BLOOD CULTURE BOTTLE CHANGE FOR PEDIATRIC PATIENTS

Per the *UCMC Laboratory Handbook* located on the Intranet, the type of Blood Culture Bottles for Pediatric Patients has changed.

Neonates (≤ 30 days or <5 kg)	Peds Plus **(Pink)** bottle only (0.5 - 3mL)
Neonate to <2 yr	Peds Plus **(Pink)** bottle only (1-3 mL)
2 yrs to ≤ 10 yrs	Peds Plus **(Pink)** bottle (2-3 mL) and Lytic/10 Anaerobic **(Purple)** bottle (3-8 mL)
11 yrs and older, with or without antibiotics	Aerobic Plus **(Gray)** bottle (8-10 mL) and Lytic/10 Anaerobic **(Purple)** bottle (8-10 mL)

BLOOD REQUIRMENTS FOR GREY AND PURPLE CULTURE BOTTLES

BD BACTEC™ Plus Aerobic/F Culture Vial **(Gray)**	Optimal: 8-10 mL Minimum: 3 mL Maximum: 10 mL
BD BACTEC™ Lytic/10 Anaerobic/F Culture Vial **(Purple)**	Optimal: 8-10 mL Minimum: 3 mL Maximum: 10 mL

5/17 EM

See PGP-25 *Electrolyte Guideline for Pediatrics* and Lexicomp for more information

Calcium Chloride & Calcium Gluconate

Similarities

Side Effects

Extravasation Risk
Arrhythmias
Hypotension
Vasodilation/Flushing

Administration

IV piggyback - diluted

IV infusion given over 30-60 minutes, 60 minutes preferred

Contraindications

Do not give in same IV line as phosphorus containing fluid

Will cause precipitation

Calcium Chloride

IV Route

Central Line ONLY

[Only given in PICU/CED or on C5/6 when critical care team is present]

Administration

IV push - over 10-20 seconds during cardiac arrest ONLY

Bioavailable immediately

Indications for Use

Same Indications as Calcium Gluconate, but preferred during cardiac arrest and emergency resuscitation when liver failure is suspected

Calcium Gluconate

IV Route

Central Line preferred, Peripheral accepted

[can be given on Comer 5/6]

Administration

Never given IV push

Metabolized in the liver before it is bioavailable, takes longer to take effect

Indications for Use

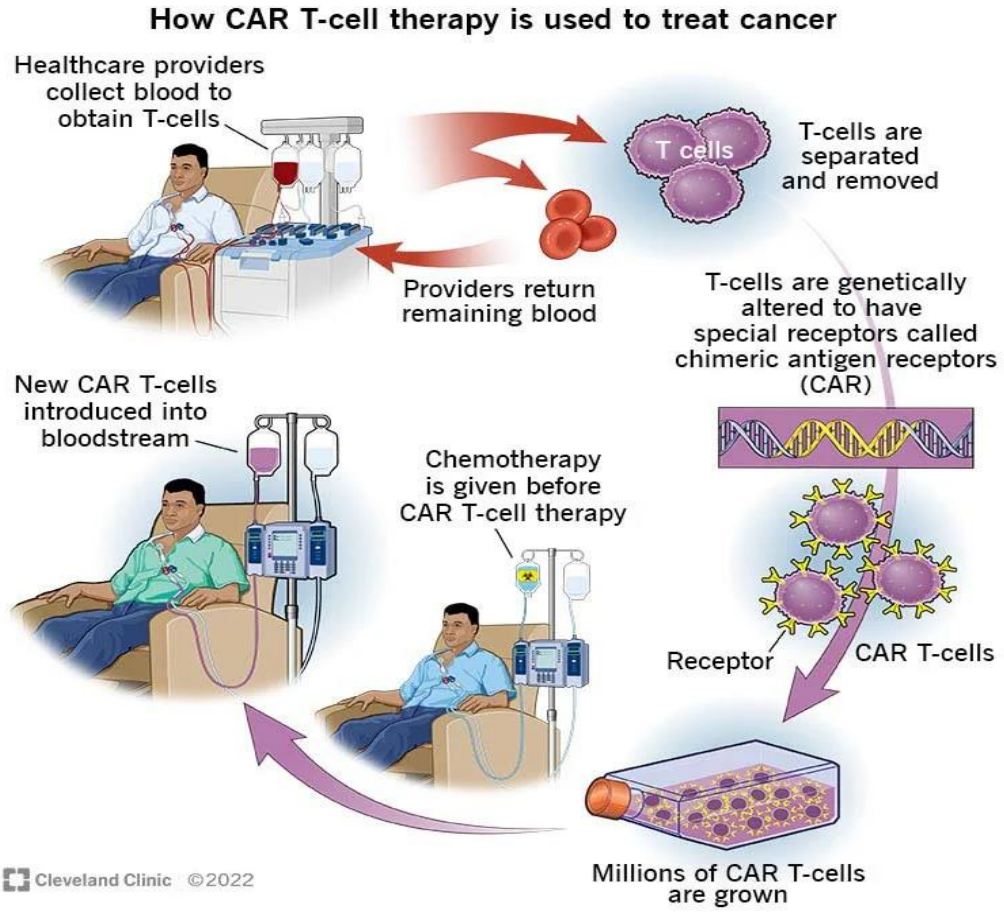
Treatment of Hyperkalemia and Hypocalcemia and conditions secondary to hypocalcemia (eg, tetany, seizures, arrhythmias)

Monitoring

- Monitor vital signs, being alert for bradycardia, dysrhythmias, and postural hypotension.
- May potentiate digitalis toxicity, so careful monitoring of patients on digoxin is advised.
- For patients with severe, symptomatic hypocalcemia, monitor serum calcium concentrations q 6 hours.
- If extravasation, stop administration of calcium and follow extravasation guidelines in UCMC formulary.

CAR T-Cell Therapy

- Chimeric Antigen Receptor Modified T-Cell
- Currently indicated for relapsed pre-B ALL which carries a CD19 protein
- The infusion of the cells elicits an immune response, which may cause the listed side effects (cytokine release syndrome and neurotoxicity).



CAR T-Cell Infusion:

- Verify the following:
  - 2 doses of tocilizumab are available (pharmacy role)
  - Verify order, central line access, type and screen
- Pre-medications:
  - 30-60 minutes before the infusion (Tylenol, diphenhydramine)
- Emergency equipment:
  - Suction, ambu bag, nasal cannula/non-rebreather
  - Medications: epinephrine, hydrocortisone, diphenhydramine
  - **DO NOT USE** corticosteroids expect with SCT attending approval and in the case of life-threatening emergency

- Tubing set-up:
  - Primary tubing with a Y-type adapter connected (stem cell team to bring up tubing – currently kept on Comer 6)
  - Primed with 0.9NS, NO filter
  - Connect the tubing directly to the hub of the CL (no clave) with a stopcock, check blood return
- Final preparations:
  - Make sure the patient ID band is on
  - Obtain Vital Signs and auscultate lungs
  - Confirm APN and attending physician are present
- Administration:
  - To gravity, cells must be infused in 30 minutes or less
  - Flush tubing with 0.9NS to ensure all the product is infused
  - Cells cost $500,000 (pay careful attention to the infusion process)
- Monitoring:
  - VS and lung auscultation prior to infusion
    - **Q 5min for 15 minutes**
    - **Q 15 minutes for the remainder of the infusion**
    - **Immediately after infusion**
  - Post transfusion VS and lung auscultation
    - **Q 15 minutes x 1 hour**
    - **Q 30 minutes x 1 hour**
    - **Q 1hour X 2 hours**

Infusion Reaction

Cells are cryopreserved in DMSO (dimethylsulfoxide) which can have several side effects:

- Foul breath odor
- Flushing
- Pulmonary distress (capillary leak)
- Abdominal cramps
- Hypotension
- Allergic reactions (hives, wheezing, respiratory distress, fever, rash)
- **Bradycardia**
- Arrhythmias
- Heart block

Cytokine Release Syndrome (CRS)

- When the cells are reinfused after being treated, the patient may exhibit an extreme immune response (CRS), can be potentially life threatening
- **Symptoms include fever, hypotension, tachycardia and hypoxia**
- Early recognition of symptoms and careful monitoring is essential
  - **Notify Gold team and/or SCT APN IMMEDIATELY for any fevers or vital sign changes**
- Transient and variable; graded 1-5 based on severity
- Risk period for the start of CRS: 3-7 days after infusion
- Treatment: fluids, vasopressors, PICU monitoring
- Tocilizumab – monoclonal antibody that binds to the IL6 cytokine – decreases reaction
- Corticosteroids – used as a last resort – can suppress the immune system

CRS Grading Assessment	Treatment
Grade 1: Not life threatening -Fever (defined as >/= 38.3), rigors, malaise -anorexia, nauseas -myalgias, arthalgias -vomiting, headache	-vigilant supportive care -assess for infection -treat fever and neutropenia if present, monitor fluid balance, antipyretics, analgesics as needed
Grade 2a: Require moderate intervention -Hypotension: response to fluids or one low dose vasopressor -Hypoxia: responds to <40% O2 -Organ toxicity grade 2	-transfer to PICU -as above for grade 1 **AND** -fluids/vasopressor -monitor organ function closely -monitor with continuous cardiac telemetry and pulse oximetry
Grade 2b: Requires aggressive intervention -2a symptoms in patients with extensive comorbidities (essentially a grade 3)	-as above for grade 2a **AND** -consider **tocilizumab-first choice**, corticosteroids-second choice
Grade 3: Require aggressive intervention -Hypotension: requires multiple vasopressors or high dose vasopressors -hypoxia: requires >/= 40% O2 -Organ toxicity: grade 3 or grade 4 transaminitis	-as above for grade 2 **AND** -consider **tocilizumab-first choice**, corticosteroids – second choice
Grade 4: Life-threatening symptoms -mechanical ventilation -organ toxicity: grade 4 excluding transaminitis	-as above for grade 4 -corticosteroids BID x 3 days with a rapid taper

Immune Effector Cell-Associated Neurotoxicity (ICANS):

- **Neurotoxicity can** be profound: can **start as a high fever and lethargy**
- **Symptoms include aphasia/dysphasia, confusion, tremor, somnolence, seizure, and headaches**
- Typically resolves in 1-4 weeks
- Seen 4-5 days post infusion
- Grade 1-4 based on severity
  - ***Grade I*** – mild somnolence, drowsiness, confusion, encephalopathy, dysphasia; no LOC change
  - ***Grade 2*** – moderate somnolence; limiting ADLs, confusion; dysphasia – impairing spontaneous communication; brief generalized seizure
  - ***Grade 3*** – obtunded, severely confused/ disoriented; severe dysphasia impairing ability to read, write, communicate; multiple seizures; complete bowel/bladder incontinence
  - ***Grade 4*** – life threatening; mechanical ventilation, life-threatening prolonged repetitive seizures
- **Nurse MUST perform ICE score once per shift**
- Treatment: monitoring, support, Tocilizumab, corticosteroids
- PICU transfer at the onset of neurotoxic symptoms
  - **ANY changes in neuro status notify Gold team and/or SCT APN IMMEDIATELY**

ANY CHANGES IN CLINICAL STATUS OR FEVERS PLEASE NOTIFY THE GOLD TEAM AND/OR SCT APN IMMEDIATELY!!

Comer 5 & 6 Care Guidelines

Welcome to Comer 5 & 6

Visiting guidelines

*We are currently under the following restrictions during flu season. Children under the age of 12 years are not allowed to visit any hospitalized patients. Visitors with any of the following symptoms may not visit hospitalized patients: fever, cough, sore throat, runny nose, nasal congestion.

- All visitors should use the Comer lobby entrance, stop at the lobby desk, and present photo identification (i.e. driver's license or state ID)
- Once cleared by the front desk as an approved visitor, a visitor badge will be issued. This badge should remain with the individual.
- All badges must be turned in when leaving and reissued daily at the front security desk.
- Four visitor badges will be available for each patient at one time, including the 2 yellow banded parents/legal guardians.
- Parents have 24hr access to their child. All others have 8am to 9pm visiting hours.
- Each parent and legal guardian will be provided with a yellow band to identify them as having 24hr access.
- When minor children (17yrs or younger) are visiting, they must be supervised by their parent/legal guardian at all times.

Daily Routine

Frequency of Vitals (temperature, RR, HR, B/P, SaO2) & Head to Toe Assessments

Every 2 hours

- All patients with tracheostomies (respiratory assessment + vitals)
- Asthmatics on continuous nebs (respiratory assessment + vitals)
- All patients on HFNC (respiratory assessment + vitals)
- Any patient in which a more frequent assessment or VS monitoring is ordered

Every 4 hours

- General unit guidelines

ECG Strips

- Any patient receiving continuous ECG monitoring: Print, interpret, and place the ECG strip in the patients chart every shift (q12 hours) and with ECG/status changes

Temperatures

- Every 4 hours (repeat 60 minutes post intervention if febrile).
- No rectal temps in the following patients: Hematology, oncology, stem cell transplant, immunocompromised (fever and neutropenia), bleeding disorders
- If a hematology/oncology patient becomes febrile, notify the MD immediately. Cultures must be drawn and antibiotics must be administered within 60 minutes of the onset of the fever (cultures drawn prior to starting the antibiotics).

Assessments

- IV sites and pumps are checked hourly
- Includes complete neuro check on patients with every assessment –including pupil reactivity/size

Pain Assessments

- FLACC = preferred scale for non-verbal or pre-verbal patients regardless of age (do not use N-PASS, NIPS, or Non-verbal Pain Scale)
- Wong-Baker Faces Scale
- 0-10 Numeric Scale

eCART Scoring

- Visible and accessible from the patient's storyboard
- Visible and accessible from your patient list, must wrench in eCART column
- Visible from Comer 5/6 unit tracker board
- Contact charge RN for questions, see tip sheet
- Routinely check what your patient's eCART score is and enter the pathway soon after identifying red/yellow scores.
- For all yellow and red risk patients, **every 4 hours**
- **Within 2hours** for patients that have a PET call that remain on the floor post PET with an elevated eCART score

Labs

- Peripheral AM labs M-F, 3a-11a drawn by phlebotomist Pam Doyle
- Note: Central Line lab draws are to be performed by the bedside RN

Daily Care

- Bath every day (unless contraindicated)
- Patients with central lines receive daily CHG bath unless contraindicated.
- Trach care Q shift
- Trach changes every Friday
- *Central line dressing changes every 7 days on Sunday (unless parent specifies to be done on a different day)* ***and/or*** *when the dressing becomes soiled/un-occlusive*

Documentation

PEDS specific flowsheets: make sure to change to general pediatrics so appropriate rows will populate

- Peds VS
- Peds Assess
- Peds Daily Care
- WALDO
- I & O
- Education & Care Plan
- Patients with restraints must have the restraint flow sheet completed (every 2 hrs) and a new order every 24 hours (please see restraint policy PC 27 or online module)
- eCART score and sepsis screening minimally q4 hours – more frequently based on acuity/eCART risk category

Emergencies

- Pediatric cart sheet will be at the bedside in the wall holder and in the patient's chart
- Patient in room: hit blue "code" button on wall at head of bed. Ask another staff member to call a peds Dr. Cart by dialing 1-4-7. All unit MD & RN phones will ring.
- Patient off of unit: dial 1-4-7 and inform operator of Dr. Cart, provide location and state if pediatric or adult
- Non-patient: dial 1-4-7 and inform operator of Dr. Cart, provide location and state if pediatric or Adult
- For a PET (Pediatric Early Response Team) or Sepsis Alert: dial 1-4-7 and inform operator of PET/Pediatric Sepsis alert, provide room number. PICU RN, fellow, and RT to respond.

Unit Resources

Please also refer to Elsevier Clinical Skills.

Commonly used phone numbers

- Comer 6 North and South front desk 2-0238
- Comer 5 front desk 2-6460
- Comer 6 North Charge nurse 5-7900, pager #4104
- Comer 6 South Charge nurse 4-9400, pager #92386
- Comer 5 Charge nurse 5-7886, pager #5101
- RT pager: Comer 6: #5434, Comer 5: #7827
- On Call Unit Manager Pager #7267 (24 hour coverage)
- Phlebotomy: Pam Doyle (0300-1100)
- Unit Educator:
    - Alexa Haynes 4-9184
    - Kelly Lankin 2-4497, pager #5257
    - Mary Kennedy 2-1220
- Unit Clinical Nurse Specialist:
    - Monica Gonzalez pager #4886 ext. 4-2890
- Patient Care Support RNs
    - Mary Pager #6616
    - Diane Pager #6995
- Tube station #800 (C6), #802 (C5), code: 9876

Comer Children's Hospital IV Push Medication Administration Chart

This chart applies to all patients receiving care in the Children's Hospital

If a medication is NOT on this list to be IV pushed on Comer 5, Comer 6 and ICU units then it MUST be given via a pump.

Generic Name	Trade Name	Administration Rate	Required Monitoring	Comments
acetaZOLAMIDE	Diamox	Give over 1 minute (MAX rate 500 mg/minute)		The maximum dose is 4000 mg/24 hours
ampicillin		Give over 3-5 minutes (MAX rate 10 mg/kg/minute OR 100 mg/minute)		Doses ≤ 500 mg
atropine		Give over 1 minute	Cardiac monitoring	MAX single dose 0.5 mg; MAX total dose 1 mg
bumetanide	Bumex	Give over 1-2 minutes		MAX dose 10 mg/day
cosyntropin	Cortrosyn	Give over 2 minutes		
dexamethasone	Decadron	Give over 1-5 minutes		Doses ≤ 10 mg
dextrose 50%		Give 3mL/minute		Irritating to veins; Central vein preferred
dextrose 25%		Give over 1 minute		≤ 12 years of age
diazepam	Valium	Give over ≥ 3 minutes (MAX rate 1-2 mg/minute)		
diphenhydrAMINE	Benadryl	Give over 5 minutes (MAX rate 25 mg/minute)		Seizure may be precipitated with too rapid IV administration May cause paradoxical hyperactivity
famotidine	Pepcid	Give ≤ 10 mg/minute over at least 2 minutes		
flumazenil	Romazicon	Give over 15-30 seconds		May repeat at 1-2 minute intervals (MAX 4 doses) MAX dose 0.05 mg/kg OR 1 mg
fosphenytoin	Cerebryx	1-3 mg PE/kg/min (MAX rate 150 mg PE/minute)	Blood pressure and pulse every 15 minutes for 1 hour after administration	MUST dilute to final concentration 25 mg PE/mL

Note: Intensive Care Units includes: Neonatal ICU, Pediatric ICU, CICU, Emergency Services, Post-anesthesia care unit, and Operating Room
Note: This chart addresses administration to pediatric patients by IV push administration ONLY. It does not apply to continuous infusions
Note: This chart does not apply to medications used as part of an investigational drug protocol
Note: Nurses may push certain medications that are NOT on this list in the event of an emergency and under the direction of the Pediatric Critical Care Service

Last Updated 9/23/2016 R King

Comer Children's Hospital IV Push Medication Administration Chart

This chart applies to all patients receiving care in the Children's Hospital

Generic Name	Trade Name	Administration Rate	Required Monitoring	Comments
furosemide	Lasix	Undiluted: 0.5 mg/kg/minute (MAX rate 4 mg/minute)		Rapid administration has been associated with ototoxicity
glucagon		Give Rrapid IV push over seconds ** Beta blocker/calcium channel blocker toxicity – Administer over 3-5 minutes	Blood glucose	
hydrALAZINE	Apresoline	Give over 3-5 minutes (MAX rate 5 mg/minute)	Blood pressure and heart rate for up to 60 minutes following administration	
hydrOXYzine	Visaril	Give slow IV push (MUST have central line)		ONCOLOGY patients only; ; IM preferred for all other patient populations
hydrocortisone	Solu-Cortef	Give over 30 seconds	Blood pressure	Doses < 500 mg
HYDROmorphone	Dilaudid	Give over ≥ 2-3 minutes	Respiratory rate, O2 saturation, blood pressure, heart rate	Rapid IV administration has led to respiratory depression and hypotension
ketorolac	Toradol	Give over 1-5 minutes		Do NOT exceed 5 days of therapy (↑ risk of GI bleed)
levothyroxine	Synthroid	Give over 2-3 minutes		50-75% of oral dose
LORazepam	Ativan	Give over 2-5 minutes (MAX rate 0.025 mg/kg/minute OR 2 mg/minute)	Respiratory rate, blood pressure, heart rate	Max dose for floor patients = 4mg
morphine		Give over 4-5 minutes	Respiratory rate, blood pressure, heart rate, O2 saturation	Rapid IV administration may increase adverse effects
naloxone	Narcan	Give over 30 seconds (MAX single dose 2 mg)	Respiratory rate, heart rate, blood pressure	May repeat every 2-3 minutes until desired respiratory rate Note dose difference for full opioid reversal (0.1 mg/kg) and opioid-induced depression (0.001-0.01 mg/kg)
ondansetron	Zofran	Give over 2-5 minutes		MAX dose 8 mg
PHENobarbital		MAX 1 mg/kg/minute OR 30 mg/minute	Respiratory rate, heart rate, blood pressure	MAX dose 1000 mg Rapid administration may cause respiratory depression, apnea, laryngospasm or hypotension
sodium bicarbonate		MAX 10 mEq/minute		Neonates/infants use 0.5 mEq/mL concentration

Note: Intensive Care Units includes: Neonatal ICU, Pediatric ICU, CICU, Emergency Services, Post-anesthesia care unit, and Operating Room
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Last Updated 9/23/2016 R King

Comer Children's Hospital IV Push Medication Administration Chart

This chart applies to all patients receiving care in the Children's Hospital

If a medication is NOT on this list to be IV pushed in ICU units then it MUST be given via a pump.

Generic Name	Trade Name	Administration Rate	Required Monitoring	Comments
adenosine	Adenocard	Rapid IV push over 1-2 seconds (Follow with a rapid 0.9% sodium chloride flush to ensure delivery of adenosine)		Attending physician/fellow MUST be present
cisatracurium	Nimbex	Give rapidly over 1-2 seconds	Heart rate, ventilation status, blood pressure	MUST confirm existing endotracheal tube/mechanical ventilation be preparing to place an endotracheal tube and amnesia prior to administration
digoxin	Lanoxin	Give over ≥ 5 minutes	Heart rate	Rapid administration of digoxin may cause systemic and coronary arteriolar vasoconstriction
enalaprilat	Vasotec IV	Give over ≥ 5 minutes	Blood pressure	
EPINEPHrine	Adrenaline	For each mg, give over 1 minute	EKG, heart rate, blood pressure	1:10,000 concentration
fentaNYL		Give slow IV push over at least 1-3 minutes	Blood pressure, respiratory rate, heart rate, O2 saturation	Do NOT push doses > 5 mcg/kg Rapid administration may result in respiratory paralysis/apnea due to chest wall rigidity (treated with paralytic)
insulin (regular)	Novolin	Give over ≤ 30 seconds	Blood glucose, serum potassium	For treatment of hyperkalemia, mix with dextrose-containing solution as directed prior to administration
ketamine	Ketalar	Give over ≥ 60 seconds (MAX rate 0.5 mg/kg/minute OR 2-3mg/minute)	Cardiovascular effects, heart rate, blood pressure, respiratory rate, O2 saturation	Attending physician/fellow MUST be present
labetalol	Trandate	Give over 2 minutes (MAX rate 2 mg/minute)	Blood pressure and heart rate closely (prolong duration of action; 2-4 hours)	MAX pediatric dose 1 mg/kg or 40 mg
lidocaine	Xylocaine	Give over 2 minutes (MAX rate 0.5 mg/kg/minute OR 50 mg/minute)	EKG continuously	Attending physician/fellow MUST be present

Note: Intensive Care Units includes: Neonatal ICU, Pediatric ICU, CICU, Emergency Services, Post-anesthesia care unit, and Operating Room
Note: This chart addresses administration to pediatric patients by IV push administration ONLY. It does not apply to continuous infusions
Note: This chart does not apply to medications used as part of an investigational drug protocol
Note: Nurses may push certain medications that are NOT on this list in the event of an emergency and under the direction of the Pediatric Critical Care Service

Last Updated 9/23/2016 R King

Comer Children's Hospital IV Push Medication Administration Chart

This chart applies to all patients receiving care in the Children's Hospital

midazolam	**Versed**	**Give over 2-3 minutes (neonates: over 5 minutes)**	**Respiratory rate, blood pressure, heart rate and O2 saturation**	
factor VIIa (recombinant)	**NovoSeven**	**Give over 2-5 minutes**		**Attending physician/fellow MUST be present IF flush is needed use 0.9% normal saline**
rocuronium	**Zemuron**	**Give rapidly over 1-2 seconds**	**Heart rate, ventilation status, blood pressure**	**MUST confirm existing endotracheal tube/be preparing to place an endotracheal tube and amnesia prior to administration**
verapamil	**Isoptin**	**Give over 2-3 minutes**	**EKG, blood pressure, heart rate**	

Note: Intensive Care Units includes: Neonatal ICU, Pediatric ICU, CICU, Emergency Services, Post-anesthesia care unit, and Operating Room
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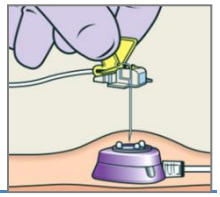
Central Line Care and Ports



Dressings

- All central line dressings must be changed every Sunday, on admission, and as needed if wet, soiled, or peeling
- Do NOT reinforce dressings. If the dressing is peeling around the edges, it must be changed

Tubing

- Minimize how often you are disconnecting and reconnecting patients from tubing. If you disconnect for any reason:
    - Must place a **green** curos cap on the end of the tubing. It is NOT acceptable to connect tubing back into itself or use any other type of cap (i.e. white caps from saline flushes).
    - Change most IV tubing Q96 hours, Change TPN/Lipid tubing Q24 hours
    - Use 'back prime' option on Baxter pump for most secondary infusions (ensure compatibility of primary fluid and secondary)
    - Secondary tubing is good for 96 hours as long as it is not disconnected from primary tubing at any point. If disconnected, secondary tubing is only good for 24 hours.

Port-a-Caths (PACs): special considerations

- Verify type of port (Power Port or Traditional) through one of three ways:
    - Patient ID card/bracelet
    - If port placed at U of C, you can look in procedure note (radiology can pull this up quickly if needed)
    - CXR-physician can view the actual film to identify port type
    - Power Ports can be used for IV contrast, Traditional ports CANNOT
- Needle Selection
    - Standard size: 1" 19 gauge works for most patients.
        - Small/Petite patients may require 0.75" 19 gauge
        - Large patient may require 1.5" 19 gauge
    - Power Port: use the Power Loc needle (purple packaging)
    - Traditional Port-use regular port needle (black & white packaging)
- Port needles are changed Q7 days, on Sundays
- If a pt has a double lumen mediport, both lumens should be accessed at the same time.
- If a patient is admitted with the port already accessed, verify it was done at UCM- either in the ER or at one of our UCM clinics (eg. 10 Central, DCAM, Orland Park IVT, Silver Cross IVT). If you cannot verify it was placed at UCM, you will need to de-cannulate and re-access the port.
- On Sundays, if you have TPN running through a Port, change the port needle/dressing when you hang the new bag of TPN
- De-accessing for hospital Discharge: Flush with 10cc saline, then instill Heparin 100u/ml 3-5ml

CYCLOSPORINE AND TACROLIMUS

1. **Administration**
    - Cyclosporine or Tacrolimus should be administered through a designated line
        - Usually the red lumen [non-Power port] of the PICC or the white lumen of the central line (if no PICC is present)
    - Tubing is changed daily, down to the clave
        - The clave is changed using sterile technique
    - The new bag of Cyclosporine or Tacrolimus must be hung AT THE SAME TIME EVERYDAY in order to maintain therapeutic levels
    - Cyclosporine or Tacrolimus should NEVER be turned off.

2. **Drug Levels**
    - Cyclosporine and Tacrolimus are administered into the non-power lumen of the PICC line. Because of drug adhesiveness to the inside of the lumen, drug levels must be drawn from the central line only to avoid potentially contaminated specimens.
        - When drawing Cyclosporine and Tacrolimus levels, be sure to stop all infusing medications/pumps to ensure accuracy of the drug level.
    - Tacrolimus and Cyclosporine levels are sent in a purple top tube.
    - Levels for continuous infusions are usually drawn with the 4am labs; however, levels for continuous infusions levels can be drawn at any time.
    - Drug levels are initially drawn every Monday and Thursday. Sometimes, the patient will require closer monitoring, in which case levels may be obtained more often
    - For oral/IV intermittent dosing, be sure to draw the level **prior** to giving the am dose of Tacrolimus or Cyclosporine. Once an intermittent dose is given, a drug level cannot be done for that day.
        - On weekdays: for 9am dosing, draw levels at 8:30 am
        - On weekends: for 9am dosing, draw levels by 7:30am – blood needs to get down to the lab by 8am on the weekend

3. **Tacrolimus and Cyclosporine Preparation from Pharmacy**
    - Cyclosporine and Tacrolimus are handled similar to chemotherapy for safety purposes
        - The Tacrolimus/Cyclosporine medication bag comes to the unit attached to the primary tubing.
            - The primary tubing is primed with diluent (0.9%NS or D5W)
            - Purge 20mL from the primary tubing, then attach the tubing to the patient. The drug will now be primed through the tubing
        - Tacrolimus/Cyclosporine may be prepared in a syringe for younger patients. In this case, the tubing is still primed with diluent and must be primed to the tip before beginning the infusion.

4. **Infusion Times**
    - Medication bags are expected to be the exact volume matching the bag size (50mL, 100mL, etc.).
        - The EPIC-calculated rate will match the intended rate
    - The contents of each the Cyclosporine and Tacrolimus bags need to be entirely infused, including the flush, within 24 hours.
    - Calculate rate as follows:
        - Amount in bag – 20mL prime + 20mL flush / 24 = rate of infusion
        - (the amount listed in the bag will include the 20mL prime)

      Examples:

      120mL – 20mL prime + 20mL flush/24 hours = 5 mL/hour

      **Set the pump for 100 mL to infuse the medication, which will alarm to remind you to hang a saline bag on the primary line for the flush

      ** Flush will infuse over 4 hours

      270mL – 20mL prime + 20mL flush / 24 hours = 11.25 mL/hour

      ** Set the pump for 250mL to infuse the medication, which will alarm to remind you to hang a saline bag on the primary line for the flush

      ** Flush will infuse over roughly 2 hours (1hour and 45min)

    - Once the drug bag is empty, you can spike either a NS or D5W bag for the flush
        - 20mL is used for the flush because the medication is being flushed through the entire primary set.

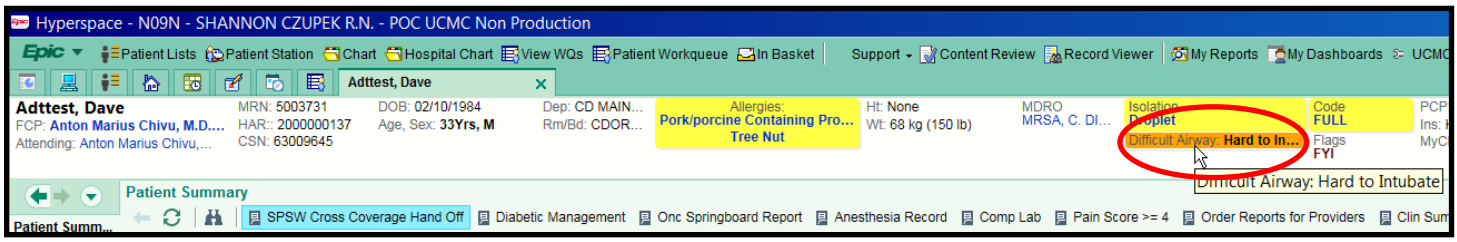
Pediatric Developmental Milestones

Age	Gross Motor	Fine Motor	Language	Social	Notes
1 month	- Equal movements - Lifts head	- Follows to midline	- Responds to bell	- Smile spontaneously - Regard face	- Can focus 8-12 inches away - Hearing is fully mature
2-3 months	- Head to 45° - Starts to bring objects to the mouth	- Follows past midline - Holds rattle, lets go*	- Vocalizes ooh/ahh - Laugh - Squeals	- Smile responsively	
4-5 months	- Head to 90° - Bear weight on legs - Roll over - Pull to sit: head steady	- Hands together - Grasp rattle - Follows 180°	- Turn to rattling noise - Turn to voice - Babbling	- Regards own hand - Regards stranger with interest	
6-7 months	- Roll over - No head lag - Sit without support	- Rakes - Passes object between hands - Helps hold bottle	- Babbling* - Imitate speech sounds - Responds to name*	- Knows familiar faces - Smiles at self	
8 months	- Stands holding on - Rolls both ways - Sits stably*	- Takes 2 cubes - Passes objects between hands	- Syllables: da, ba, ka - Responds to “no”	- Social play - Responds to other’s emotions	- Full color vision
10 months	- Pulls to stand	- Pincer grasp - Bangs 2 blocks together	- Combines syllables - Dada/mama nonspecific - Approx. names: baba/bottle	- Waves “bye-bye” - Indicate wants - Peek-a-boo	
12 months	- Stand alone 2 seconds - First steps	- Pincer grasp - Pokes with index finger	- Jargon (own language)* - One word other than mama or dada	- Begins to use objects correctly	- Anxious with strangers - Object permanence
18 months	- Walks well - Walk up stairs - Walk backwards - Runs stiffly	- Stacks 2 cubes - Turns pages of a book - Scribbles	- 6-10 words* - Two-words phrases - Points to desired object	- Uses spoon/fork - Feed doll - Remove garment	- Direct another’s attention to an object or action
24 months	- Kick ball forward - Throw overhand - Jump up - Walks backwards*	- Stacks 4-6 cubes	- Several hundred words - Combines words (at least 2) - Names 1 picture* - 6 body parts (at least 1*) - Speech 50% understandable	- Drink from a straw - Feed self	- Temper tantrums - Shyness - Pretend play - Refer to self; me/mine
3-4 years	- Balance on each foot 1-2 seconds - Hop - Up and downstairs without support	- Catches bounced ball - Copies circle (3), square(4)* - Mature crayon grasp	- Concepts of same and different - Basic grammar - 3-4 word sentences (by 3 years)*	- Draws person with 2-4 body parts - Dresses self	- Fantasy/pretend play - Envisions self as whole person

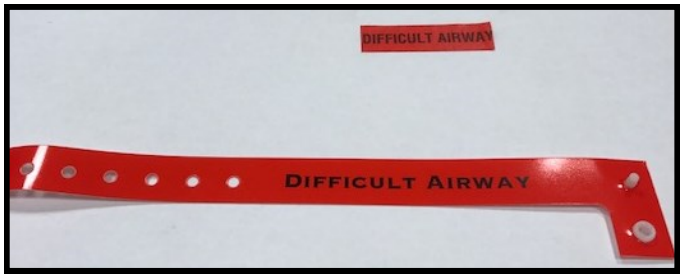
*More than 90% of children can pass this item

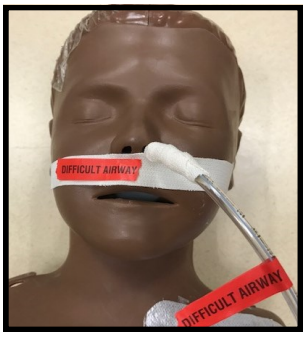
Identification of Patients with a Difficult Airway

New safety measures are being implemented to help identify a patient with a difficult airway that may need special equipment and/or personnel for assistance with intubation. Providers identify patients with a difficult airway and document this on the history and problem list. This flags the patient's EPIC header an orange color.



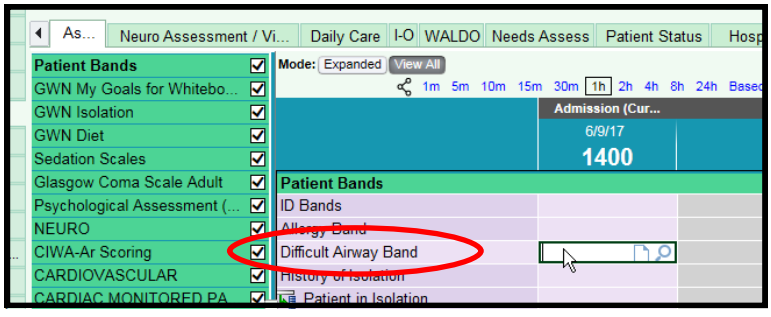
Nurses are to place a red difficult airway wristband on the <u>patients who are identified with a difficult airway</u>. If the patient has an airway appliance (endotracheal tube or tracheostomy) then a red sticker is placed on the airway securement device.

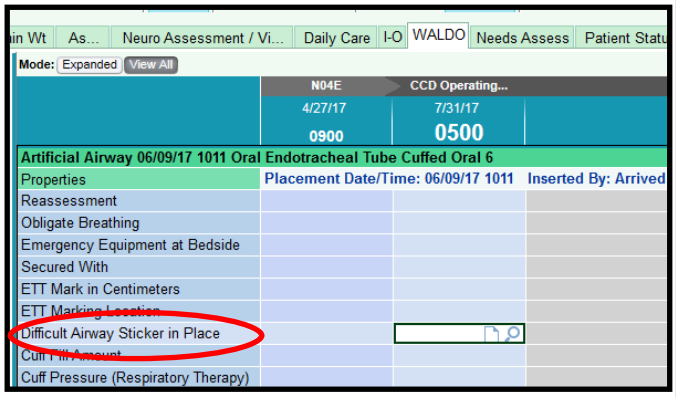




These supplies will be located at the nurses stations near where other patient bands are kept. They are also located on the anesthesia advanced airway carts. Red identification bands are to remain on the patient throughout their hospitalization **<u>OR</u>** until a provider removes this from the patient's history and problem list, which will then remove the orange EPIC header.

Rows for documenting placement of red wristband and sticker will be added into EPIC under the Patient Bands section of the **Nursing Assessment** and **WALDO** (under artificial airway, if present) flowsheets.





This process and the addition of the documentation rows in EPIC will go live on **Wednesday August 16th, 2017**. A policy for difficult airway documentation is under development.

eCART Overview

eCART, Electronic Cardiac Arrest Risk Triage, is a predictive software tool embedded inside Epic that can identify patients at risk of clinical deterioration, with the goal of facilitating care management and halting progression of a medical crisis. Read the original eCART study here.

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eCART RISK STRATIFICATION

Patients are automatically and continuously stratified using their vitals signs and laboratory values into high, moderate, and average risk. If a black **Verify (-)** appears for your patient, it indicates that one or more vital signs are outside normal physiologic ranges, and data should be corrected in the EHR.

High risk (100 - 97)

Moderate risk (96 - 93)

Average risk (<93)

eCART NURSE WORKFLOW

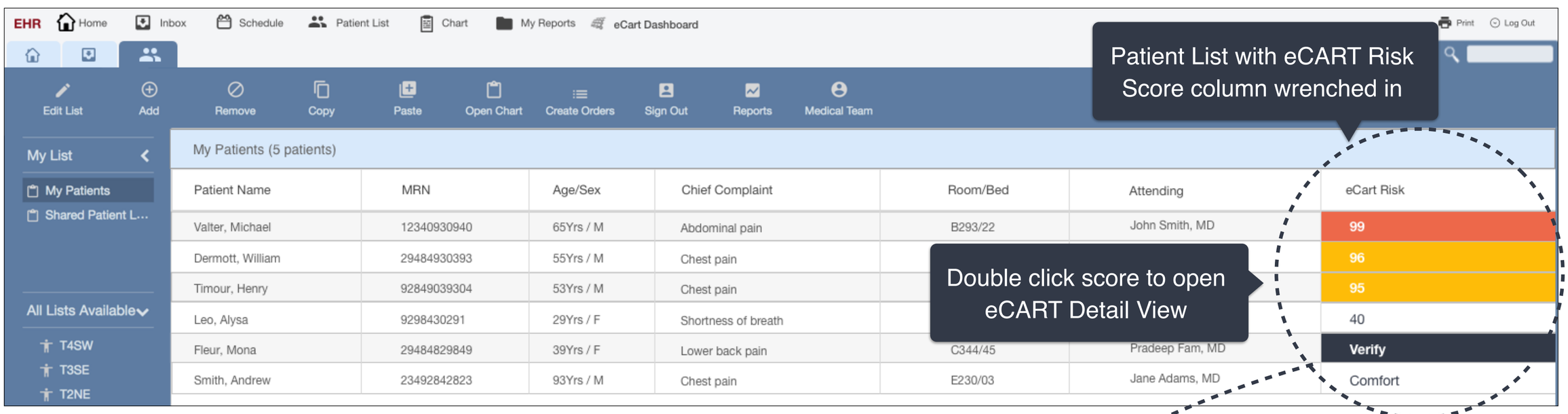
Step 1: Review Epic patient list whenever new data is available, at a minimum of every four hours during your shift*

Step 2: For all **high** or **moderate** risk patients, double click to review the eCART detail view

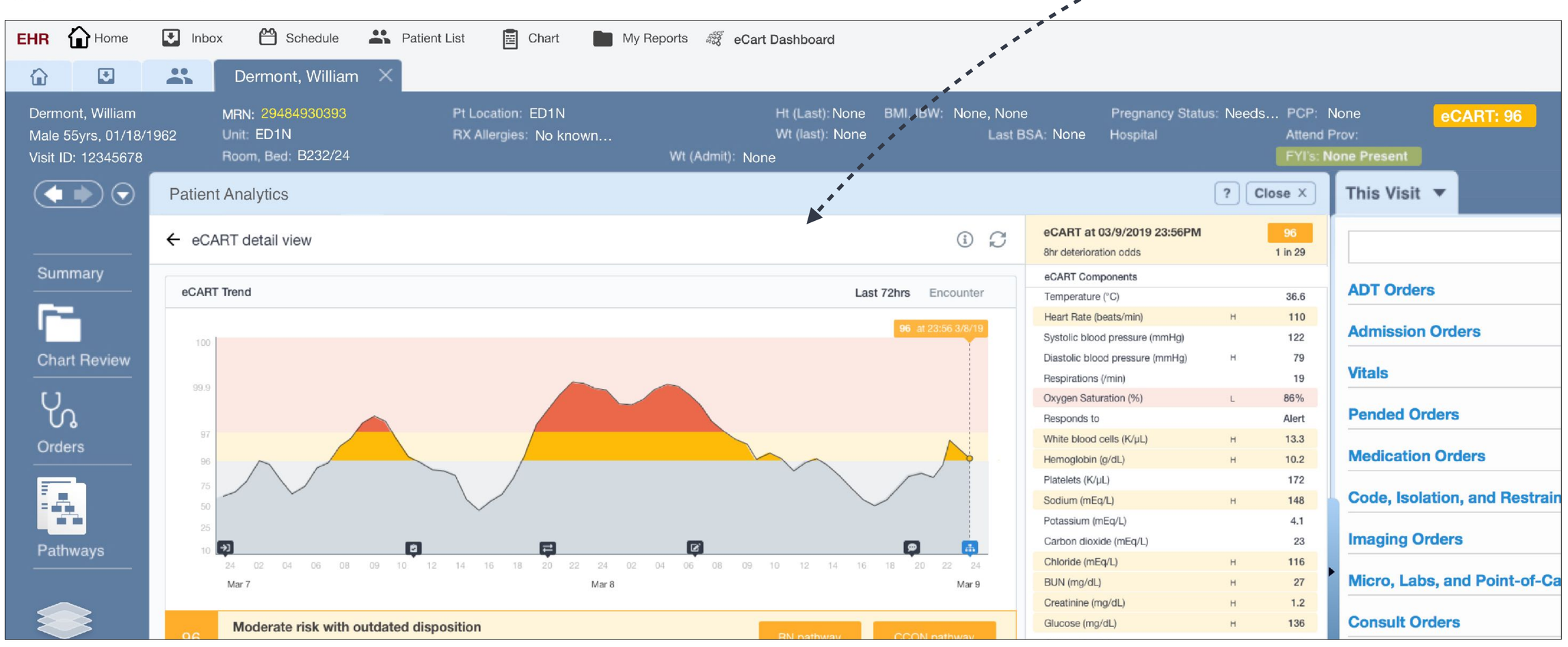
Step 3: Enter the RN pathway and follow instructions

If a **comfort care order has been officially filed, you are not required to continue management through eCART*

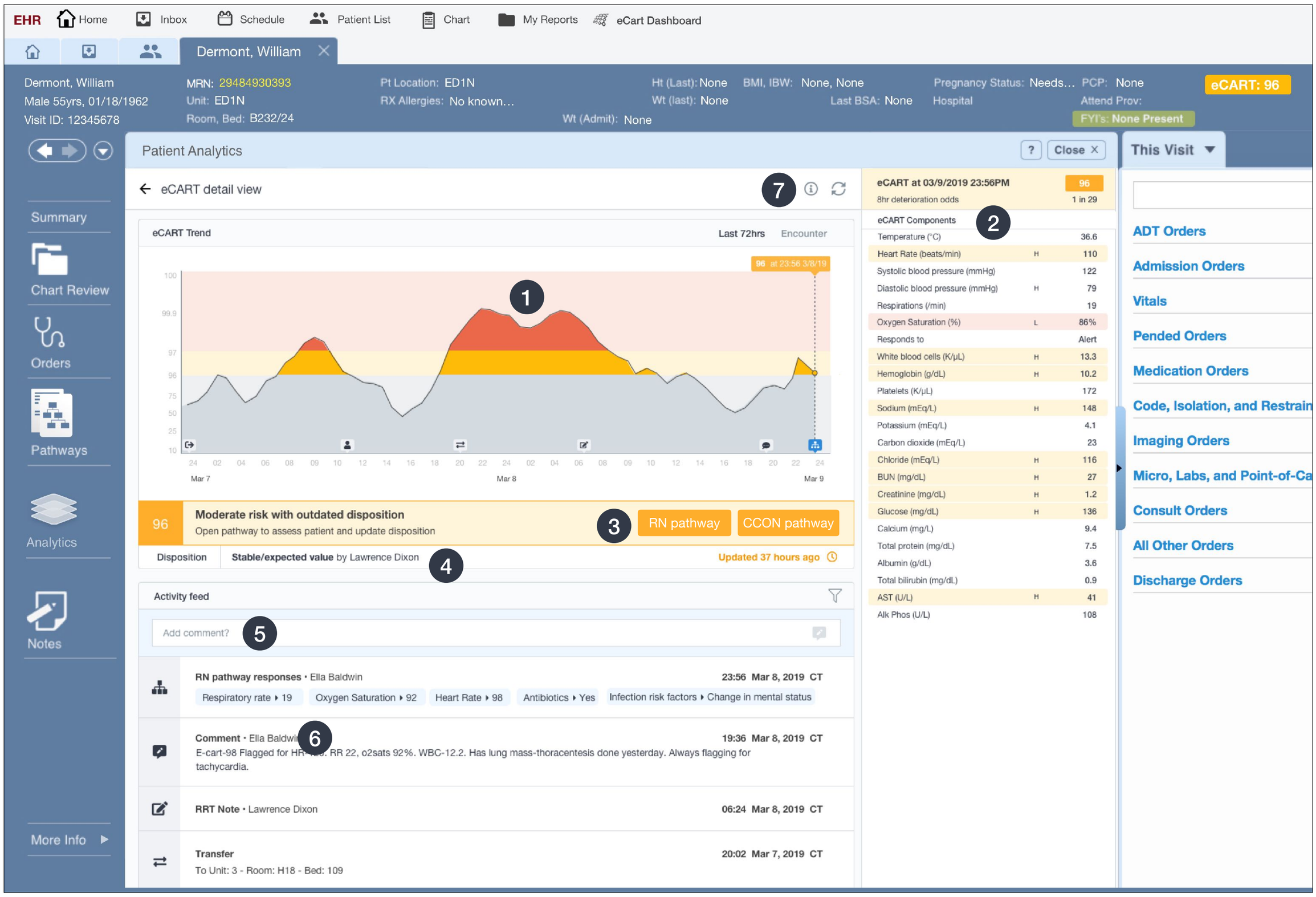
PATIENT LIST VIEW



eCART DETAIL VIEW



eCART DETAIL VIEW WALKTHROUGH



1 Hover over trend to see eCART over time

2 Review contributing vitals/labs over time

3 Select RN Pathway for assessment/management

At a minimum of every four hours, complete the RN Pathway for patients with elevated eCART scores and update the eCART disposition.

4 Disposition Status

An eCART disposition saved in the RN Pathway will display on the Detail Page. Disposition status types are defined as follows:

- **Stable/expected value** → Indicates that the patient is responding as expected to a plan that has been in place for at least 24 hours; no new workup or intervention is needed
- **Actively managing instability** → Indicates that the care team is in the process of developing or changing interventions, that it is too soon (i.e. less than 24 hours) to know if the patient is responding adequately to a treatment plan, or that the cause of the patient instability remains unknown
- **Hospice/comfort care** → Indicates that the patient is in hospice or comfort care; further management through eCART is optional

5 Comment field

Add comments to facilitate shift to shift communication and interdisciplinary care. eCART comments are NOT a part of the EHR; need for full documentation of notes and medical decision making within Epic still remains.

6 Track status updates on the activity feed

Review historical dispositions, comments, pathway responses, and transfer information in the activity feed to facilitate shift to shift communication and interdisciplinary care.

7 Reference information and troubleshooting

For information about eCART and troubleshooting resources, click the information button in the top banner.

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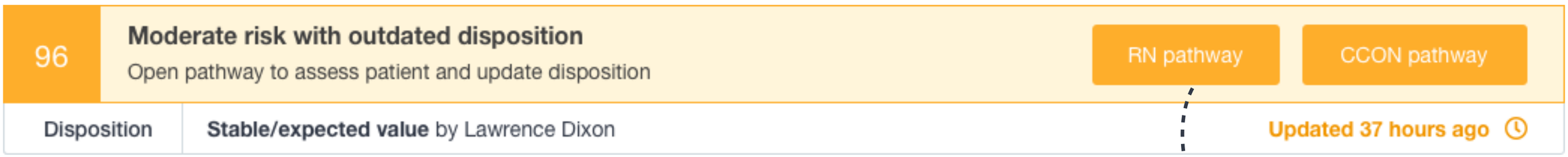
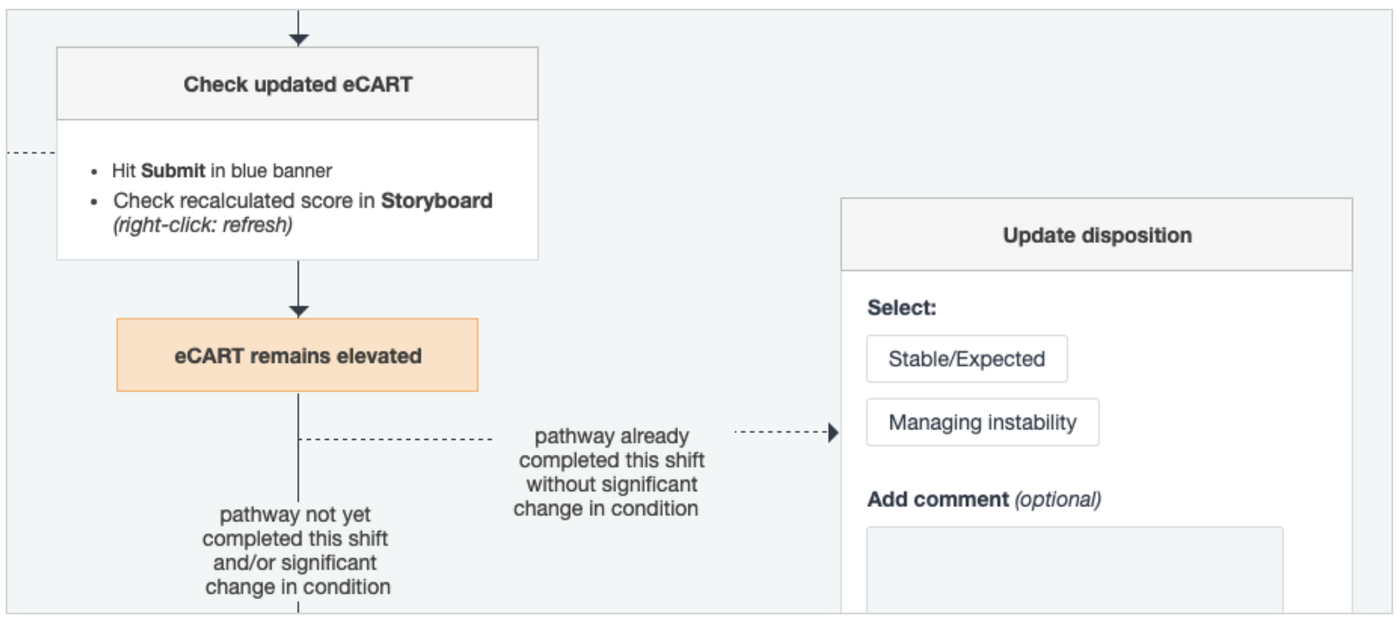
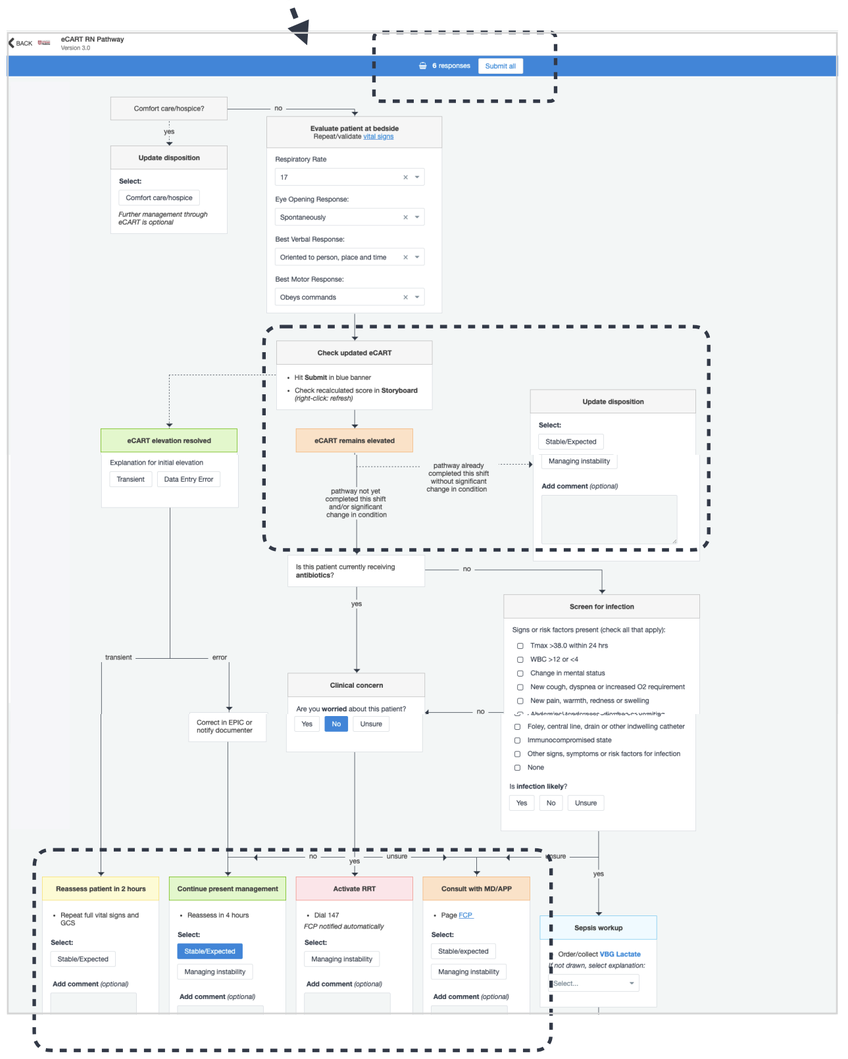
DISPOSITION WORKFLOW UPDATE: USE THE eCART RN PATHWAY

Review Epic Patient List at least every 4 hours. For all **high** or **moderate** risk patients, access the eCART Detail View page and open the RN Pathway to assess the patient and update disposition.

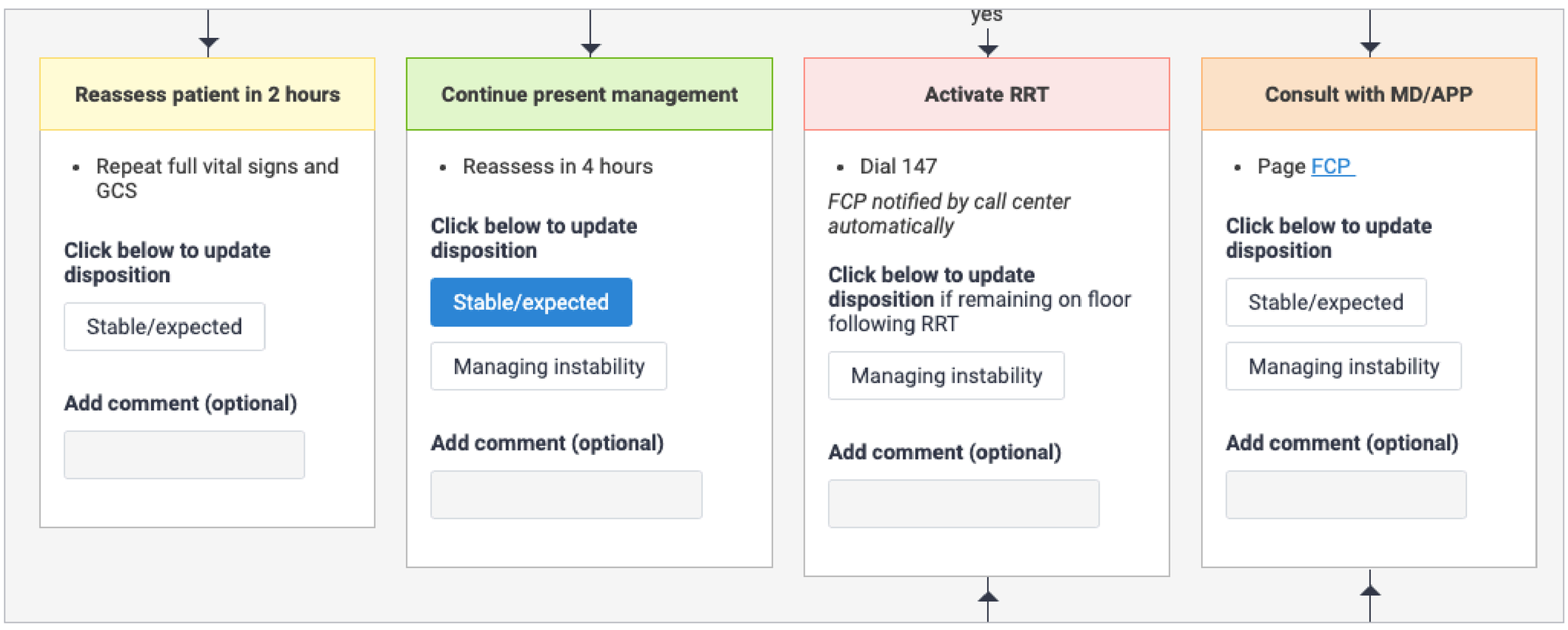


If the patient is ***known*** to you and the pathway was completed this shift without significant change in condition, evaluate the patient's vitals and update the disposition status in the pathway here:

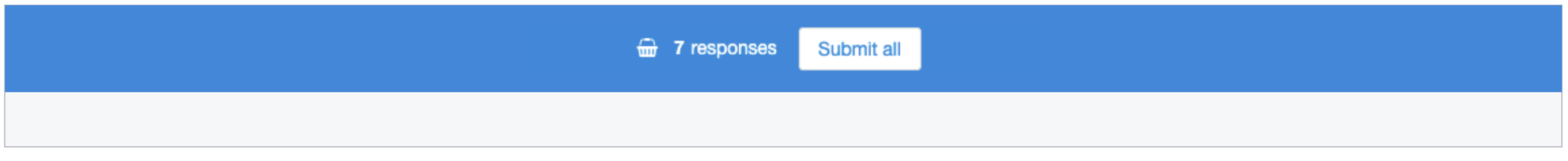




If the patient is ***new*** to you on this shift and/or has a significant in condition, follow the entire RN Pathway and document disposition in the appropriate terminal box for your patient:



When you have completed the pathway, remember to "**submit**" your responses using the blue banner. Pathway responses can be seen in the Activity feed in the Patient detail view.



AgileMD

MONITORING EMU PATIENTS OVERNIGHT

CHECK YOUR EPIC ORDER SET FOR VITAL SIGN FREQUENCY

EMU patients are not to have vitals taken overnight. However, they should be on a continuous pulse ox monitor and EKG.

ESCALATING CONCERNS

FCP is always covered by the Neuro Team, pager 30127. This pager should always be the one contacted. If there is an active seizure and you need someone at the bedside urgently, then page the gen peds provider AND neuro.

My Orders Don't Look Right

Page Neuro at 30127 to ensure your vital sign orders are appropriate BEFORE night shift. There are very few reasons the providers will want these patients woken up overnight.

EPIC ORDER SET

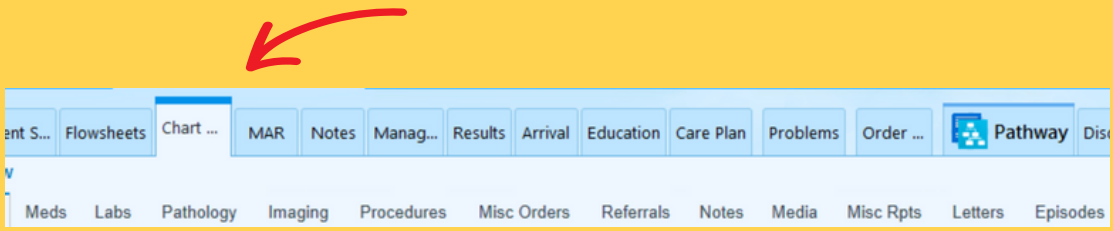
- [x] Neurological Assessment Q8H & PRN
  ROUTINE, EVERY 8 HOURS & AS NEEDED, First occurrence today at 1036
  Continue Assessment Throughout the Night: No
  Neuro assessment to be documented with vital signs and as needed DURING SEIZURE: Neuro assessment to be performed and recorded EVERY 5 minutes and as needed POST-SEIZURE Neuro assessment to be performed and recorded every 15 minutes x2 followed by every 30 minutes x2 followed by every 1 hour until returned to baseline neuro state (and as needed)
- [x] Pediatric Cardiopulmonary Monitoring Until Specified
  ROUTINE, UNTIL SPECIFIED, Starting today at 1036, Until Specified, Cardiopulmonary Monitoring with VIDEO EEG MONITORING
- [x] Pediatric Continuous Pulse Oximetry
  ROUTINE, UNTIL SPECIFIED, Starting today at 1036, Until Specified, Pulse Oximetry to be recorded with Vital Signs and PRN
- [x] Vital Signs ⓘ
  ROUTINE, EVERY 8 HOURS & AS NEEDED, First occurrence today at 1036
  Continue Vitals Throughout the Night: No
  When at neuro baseline POST-SEIZURE Vital Signs to be performed: q15 minutes x2 followed by q30 minutes x2 followed by q1hour until returned to baseline neuro state and as needed

Looking for your patient's chemo consent?

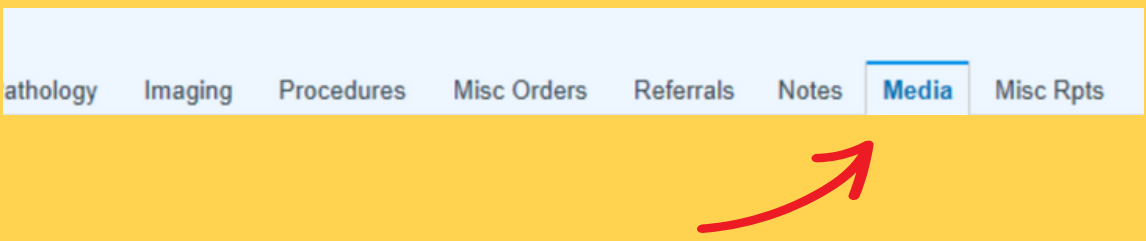
FOLLOW THESE

5 STEPS

Step #1 Navigate to "Chart Review" in EPIC

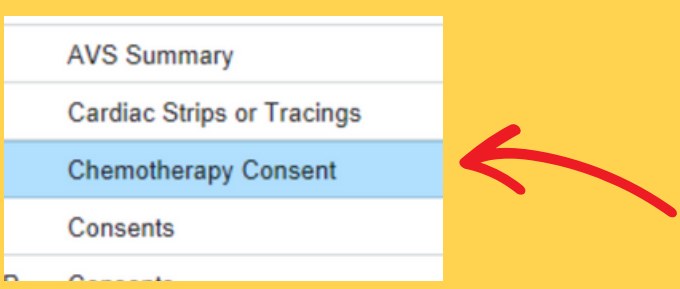


Step #2 Click on "Media" Tab



Step #3 Sort by "Document Type"

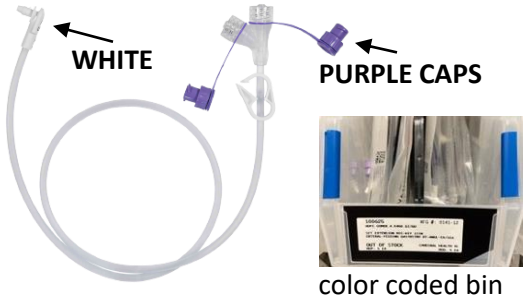
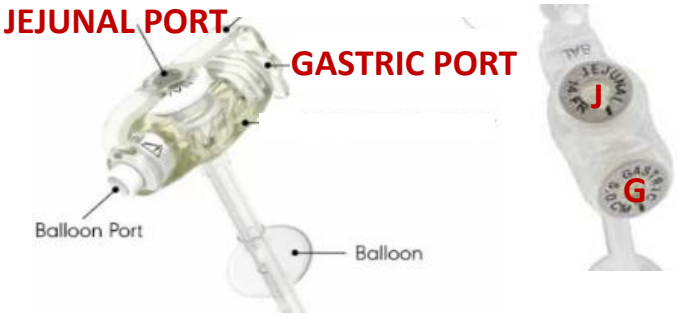
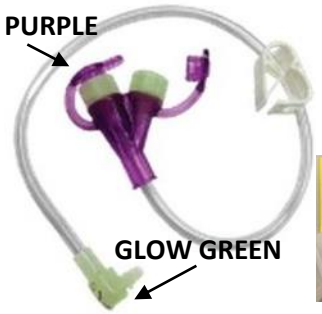
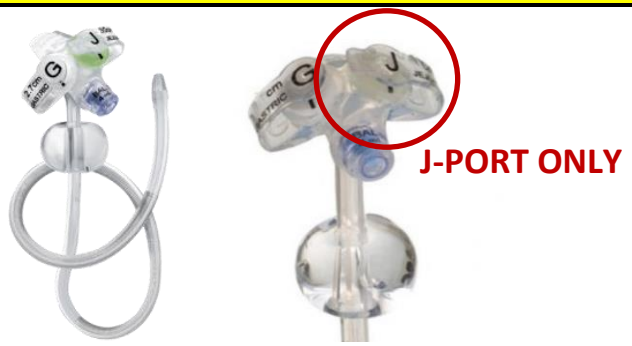
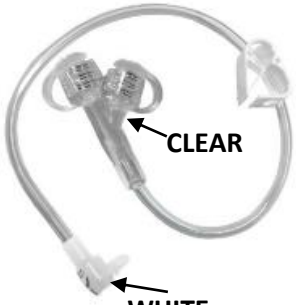
Step #4 Locate "Chemotherapy Consent"



Step #5 Visualize Chemotherapy Consent Document

You cannot **confirm** chemo consent without following these steps and visualizing the document yourself.

If you have EPIC access issues, please call the **Help Desk** & ask for your **Onbase account to be unlocked.**

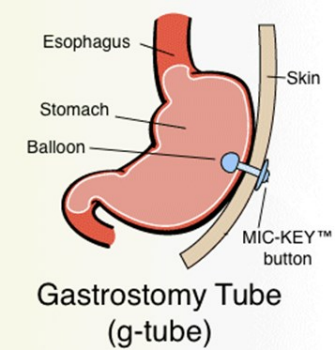
GT / GJ EXTENSION SETS	USE WITH	OR USE WITH
Oracle #100625 *manufacturer #0141-12	**MIC-KEY BUTTON G-TUBE**	**MIC-KEY G-J: Same for G & J PORTS**
 color coded bin	 *Extension set ALSO WORKS WITH AMT BUTTONS	
ORACLE #246894 *manufacturer # AMT 8-1255 ISOSAF	**AMT BUTTON G-TUBE**	**AMT G-JET: J PORT ONLY**
 color coded bin	 *Extension set ALSO WORKS WITH MIC-KEY BUTTONS	
ORACLE #248902 *Manufacturer# AMT 6-1222 ISOSAF	***AMT G-JET***	**AMT G-JET: G PORT ONLY**
 color coded bin	Different extension sets for G & J ports 	

Questions? Call Pediatric Surgery APN #4156 / 2-6169

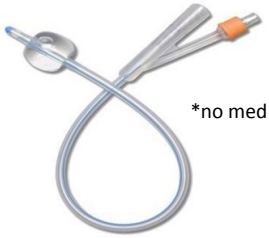
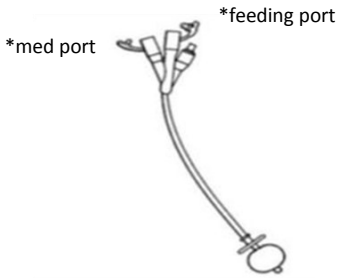
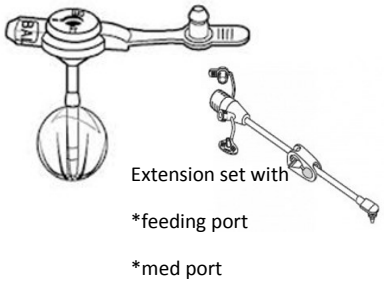
FEBRUARY 2023

AT THE FOREFRONT OF KIDS MEDICINE
UChicago Medicine
Comer Children's

G-Tube Tips from the Department of Pediatric Surgery



- **3 types of G-tubes are used-Surgeon / patient need determine type placed**
- **CALL PEDS SURG APN (#4156) whenever a G-tube comes out unexpectedly**
- **PEDS SURG APN will replace ALL G-tubes < 6wks old & *may* follow with a GT study**
- **RN's may replace G-tubes > 6wks post-op once approved by PEDS SURG**
- **Mic-G & Button G-tubes are changed Q 3 months by Peds Surgery APNs**
- **Venting via Farrell bag or syringe *may* be ordered for patients with a Nissen**
- **G-tube sites should be assessed and cleansed DAILY/PRN to avoid irritation**

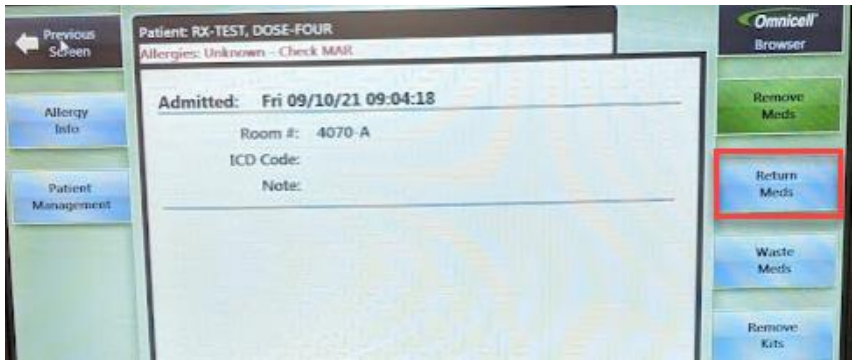
FOLEY CATHETER	MIC-G	MIC-KEY OR AMT BUTTON
		
♦ **Post-Op Plan**: -Initial surgical placement:: **8Fr** -Upsized in about **2 weeks**: **10Fr** -Upsized in about **2 weeks**: **12Fr** Mic-G or Low Profile Button ♦ **Initial Care**: Tube stabilization -Transparent film or -Hollister securement device -**Cleanse site with dressing chg** -**change dressing weekly and PRN** ♦ **Refer to care listed at right** once changed to a Mic-G or Button ♦ **Rationale for Foley Placement**: -Allows tract to gradually increase in size to accommodate G-tube -Reduces risk of leakage	♦ **Post-Op Plan**: -May keep the Mic-G OR -May change to Low Profile Button **4 weeks post-op** ♦ **Care**: -Cleanse site with water / pat dry -Position and maintain flange **snug against skin** to reduce risk of leakage -Use number markings on tube to identify position of flange -Turn /rotate button 1/4 turn QD -May use fenestrated dressing PRN ♦ **Rationale**: Exterior flange -Adjusts to individual patient size -Adjusts for sizes smaller than smallest button available (.8cm) -Accommodates for abdominal distension	♦ **Post-Op Plan**: -Extension set is necessary for administration of feeds -First Button change: **3 months** and then **Q 3 months** ♦ **Care**: -Cleanse site with water / pat dry -Turn /rotate button 1/4 turn QD -May use fenestrated dressing PRN ♦ **Rationale**: -Low profile is easily managed with children -Parents can be taught to change at home -Short length reduces risk of clogging

Pediatric Surgery APNs #4156

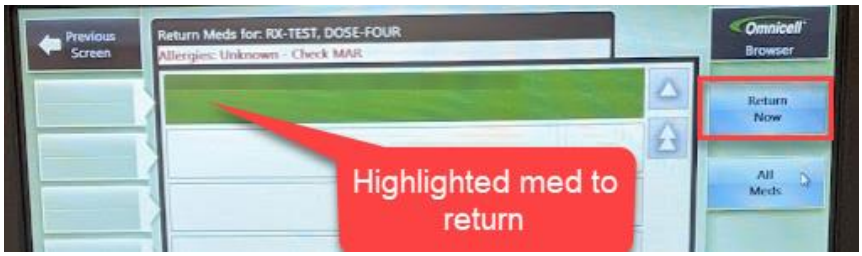
Christa Fox, APN, CPNP	**6280 / 4-5340**	**Chris Speaker, APN, FNP-BC**	**9883 / 4-9883**
Chris Baker, APN, CNS, CWOCN	**8048 / 2-9618**	**Lily Yuen, APN, CPNP**	**8379/2-9178**
Shannon Harris, APN, CPNP	**6970 /2-9880**	**Joyce Eapen, APN, CPNP**	**7172 / 2-5578**

How to Return Medications to the Omnicell

1. Log into the Omnicell and select the patient.
2. On the right side of the screen, select “Return Meds”

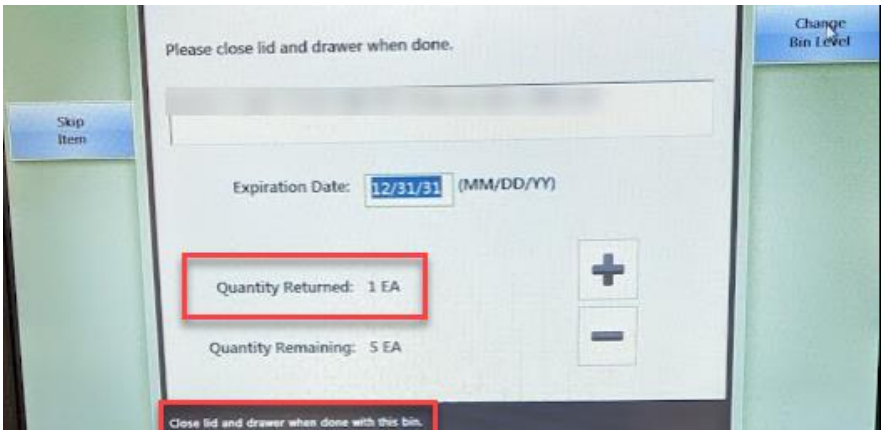


3. Highlight the medication(s) you wish to return to the Omnicell and select the button on the right that says “Return Now”



4. Input the quantity of the medication that you are returning and select “OK”
5. Confirm that the quantities are correct and select “Return Now” on the right

6. Look for the flashing lights on the Omnicell and open the indicated bin or shelf
7. Scan the barcode of the item that you are returning
8. Enter the earliest expiration date of the returned medication(s)



9. Load the medications into the Omnicell and then close the lid or door

IVIG Administration Tip Sheet

1. Remember that IVIG should be dosed based on *ideal body weight*. The calculations can be found on the Intranet:
    a. Call pharmacy to double check your calculations if necessary

Weight Equations

Ideal Body Weight (IBW) (kg)

Adults

IBW_{male} = 50 kg + 2.3 [Height (in) – 60]

IBW_{female} = 45.5 kg + 2.3 [Height (in) – 60]

Pediatrics

< 5 feet tall: [$Height^2$ (cm) x 1.65]/1000

≥5 feet tall: IBW_{male} = 39 + 2.27 [Height (in) – 60]

IBW_{female} = 42.2 + 2.27 [Height (in) – 60]

Adjusted Body Weight (AdjBW) (kg)

Use if actual body weight (ABW) > 20% over IBW

AdjBW = IBW + 0.4 (ABW-IBW)

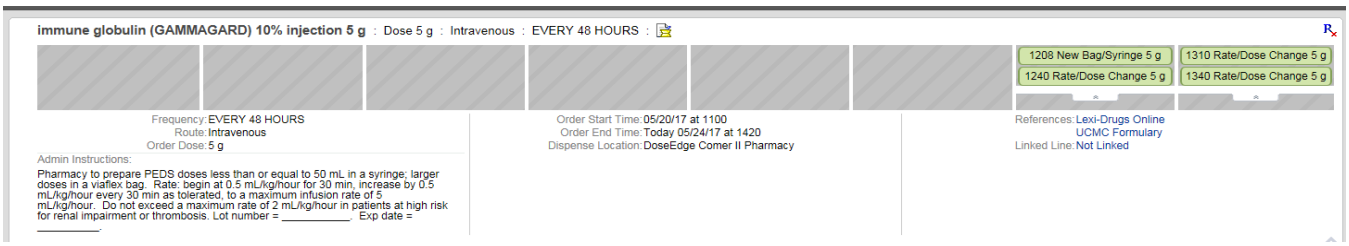
Calculating Rate:

1. 0.5ml/kg/hr for 30 minutes
2. 1.0ml/kg/hr for 30 minutes
3. 1.5ml/kg/hr for 30 minutes
4. 2.0ml/kg/hr for 30 minutes ****MAX DOSE IF RENAL ISSUES PRESENT****
5. 2.5ml/kg/hr for 30 minutes
6. 3.0ml/kg/hr for 30 minutes
7. 3.5ml/kg/hr for 30 minutes
8. 4.0ml/kg/hr for 30 minutes
9. 4.5ml/kg/hr for 30 minutes
10. 5.0ml/kg/hr for 30 minutes

*Document each rate change in your MAR/Flowsheet

2. If you infuse the IVIG on the primary line, then you can set the infusion in the multistep mode. If you do this, then you can infuse the flush on the secondary line – just try to run your fluids down to secondary infusion port to ensure that all of the IVIG has infused, then clamp the primary line to infuse your flush. I know this seems cumbersome, but these Baxter pumps are not designed to infuse the multistep mode on the secondary infusion.
    - You can use primary or secondary mode on the IV pump
3. Remember, IVIG is only compatible with D5W, so the flush solution both before and after the IVIG infusion needs to be D5W
4. Vitals should be completed with EACH RATE CHANGE q 30 min. For example, if you start the infusion at 1315, then your first rate change and set of vitals would be completed at 1345, 1415, 1445, etc. until you reach the max dose. After you reach the max dose, vitals can be charted per routine q 4 hours, unless otherwise indicated or if the patient has a reaction to IVIG.
5. CHART EACH RATE CHANGE IN MAR AND Chart COMPLETED time in EPIC!
    - NOTE: For continuous infusions, chart COMPLETED at completion. For intermittent infusions, chart FINISHED at completion.
6. Document if patient has any side effects in a nursing note or in the MAR: Fever, chills, nausea, headache, dizziness, joint pain, abdominal cramping, rash, anaphylaxis.

**Example of charting rate changes in your MAR. Make sure to chart COMPLETED once infusion is done.*



THE UNIVERSITY OF CHICAGO MEDICINE

Clinical Laboratories
Order of Draw Tube Guide

Draw order	Tube	color	Additive	Inversions *Do NOT shake*	General Use	Draw volume (mL)
1		Pink, blue, yellow	Aerobic and anaerobic	5	Microbiology blood cultures	20
2		Red		5	Microbiology AFB cultures	5
3		Light blue	0.105M Sodium Citrate (3.2%)	3-4	Coagulation testing, (eg PT, PTT)	2.7
4		Royal blue- *red stripe*	No additive	8	Trace Element serum (i.e aluminum)	6
6		Red	Clot Activator	5	Immunology (eg, HIV, Hepatitis)	6
7		Gold	Clot Activator and gel for serum separation	5	Chemistry	5
8		Mint	Lithium heparin and gel - plasma separation	8	Chemistry	4.5
9		Green	Sodium heparin	8	Various send out tests	6
10		Pink	Dry K_2EDTA	8	Blood Bank, (eg type and screen)	6
11		Lavender	Dry K_2EDTA	8	Hematology, (eg CBC), Chemistry (eg hemoglobin A1c)	4
12		Royal blue- *lavender stripe*	K_2EDTA	8	Trace Element whole blood (i.e mercury)	6
13		Gray	Potassium Oxalate / Sodium fluoride	8	Chemistry, (eg lactate, glucose tolerance)	6
14		Yellow	ACD (Acid Citrate Dextrose Solution A)	8	HLA cross matching; *Caution; look for tube with paper label*	8.5

Midline Catheters

What is it?

Peripheral IV catheter placed via ultrasound guidance.

Benefits:

- Power injectable
- Can stay in place for up to 29 days
- Can draw blood from line

Nursing Considerations:

Placement

- Placed by trained Pediatric Sedation RNs
- Can be done at the bedside without the use of sedation
- No consent needed
- Currently available in two sizes:
  - 20 gauge
  - 18 gauge
- Length of catheter and max power injection flow rate are printed and visible on the hub of the catheter
- Placed primarily in the cephalic, basilic, or brachial veins of the arm
- Contact the Pediatric Sedation Team at 5-7647 or pager #SED-8 if you think your patient may benefit from having this catheter placed!

Maintenance

- Dressing changes, done aseptically once a week and PRN. Clean insertion site with chlorhexidine (CHG) wipe, place CHG impregnated sponge placed over insertion site and cover with transparent dressing.
- Working on getting statlocks stocked separately, to replace weekly as well. For now maintain the statlock placed by sedation.
- Medication Administration: Treat as a peripheral IV **DO NOT administer medications meant for central lines through midline catheters!!**
- Flush with 10ml NS after each use and PRN
- Because the catheter length is longer than a traditional IV must observe for s/s of infiltration higher up the length of the arm

Blood Draws

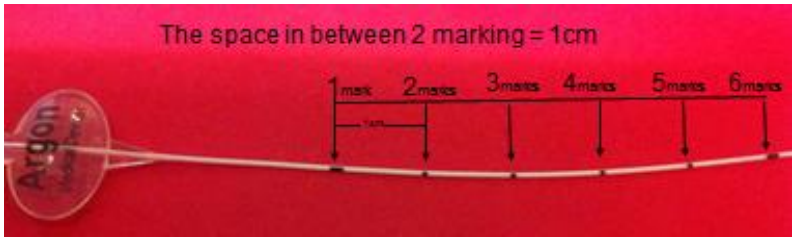
- Attempt without a tourniquet first
- If using tourniquet know that midline catheters are either 8 or 10cm long. Tourniquet must be placed high enough so as to not occlude the catheter

Removal

- Can be removed by bedside RN
- Follow same procedure that is done for removal of a PIV, note that the catheter length will be slightly longer than a PIV

PICC Lines in the Neonatal Population

1. Neonatal PICC catheters are very similar to the PICC lines that are used in pediatrics – they are percutaneously inserted into a central vein, so they can be used for all infusions (Except BLOOD products, contrast, or bicarb!!).
2. The dressing change is done only on a PRN basis, not scheduled. If the dressing needs to be changed, contact the NICU Charge Nurse, 56505. The Charge Nurse will send someone to change the dressing. (unocclusive, soiled, etc.). Documentation of the dressing change should be completed by the RN doing the dressing change.
3. There should always be fluids infusing through a neonatal PICC line. Typically, the fluid is 0.9% NS or D10W with a 0.5-1 units of heparin to keep the line open. The minimum rate of infusion is 0.5mL/hour.
4. Always use at least a 5mL syringe on all neonatal PICC lines – nothing smaller.
5. Always use a syringe pump to administer medications, flushes, etc. Manual flushing creates too much pressure and will cause the line to migrate.
6. Document the site with each assessment. At the beginning and end of the shift, you should assess and document how many marks are visible on the PICC line.



7. No blood draws!! These lines very rarely draw back due to their small size and the risk of line migration is too high, so you will have to perform a heel stick or venipuncture for blood specimens.
8. Also, the line may not be centrally located so make sure to verify that the line is central. If the line is not central, there are limits to the amount of dextrose, calcium, and potassium that can be infused through the line.

Wyckoff, M. & Sharpe,E. (2015). NANN (National Association of Neonatal Nurses) Peripherally Inserted Central Catheters Guidelines for Practice. 3rd ed. Glenview, IL: National Association of Neonatal Nurses

Updated 10.8.21 ajerman

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Normal Vitals in Children

Normal Heart Rate in Children**

Age	Awake Heart Rate (bpm)	Sleeping Heart Rate (bpm)
Neonate – 3 months	85-205	80-160
3 months – 2 years	100-190	75-160
2 years – 10 years	60 - 140	60-90
> 10 years	60-100	50-90

Normal Blood Pressures in Children**

Age	Systolic pressure (mmHg)	Diastolic pressure (mmHg)
Term Neonate	50-70	25-45
Infant	70-100	50-70
Toddler	80-110	50-70
Preschooler	80-115	50-80
School-age	85-120	55-80
Adolescent	90-130	60-88

Definition of Hypotension

Age	Systolic pressure (mmHg)
Term Neonate	< 60 mmHg
Infant (1 -12 months)	< 70 mmHg
Child (1 – 10 years)	< 70 mmHg + (age x 2)
Child (> 10 years)	< 90 mmHg

Normal Respiratory Rates in Children**

Age	Rate (breaths per minute)
Neonates & Infants	30-60
Toddlers	24-40
Preschooler	22-34
School age	18-30
Adolescents	12-16

Approximate Weight for Age

$$\text{Body Surface Area (BSA)} = \sqrt{\frac{\text{Ht(cm)} \times \text{Wt (kg)}}{3600}}$$

Newborn	5kg
6mo	7kg
1yr	10kg
2-3yr	12-14kg
4-5yr	16-18kg
6-8yr	20-26kg
8-10yr	26-32kg
10-14yr	32-50kg
14yr	50kg

01/2018 MR

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Comer 5 O2 Device Tip Sheet

Low Flow Nasal Cannula:

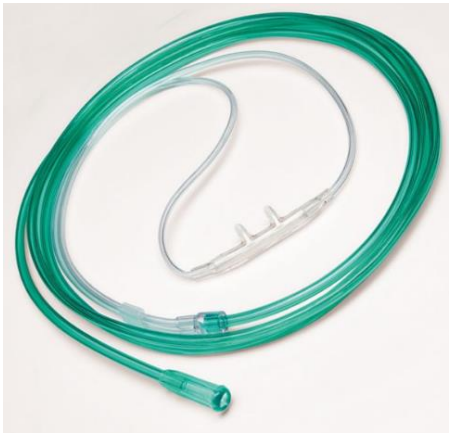
Flow Range 1-6 LPM

Apply humidification when using > 4 LPM

FiO2: 24-44%

Comer 5 Considerations: 1-6 LPM, any patient

Offered in 3 different sizes: neonatal, pediatric and adult.



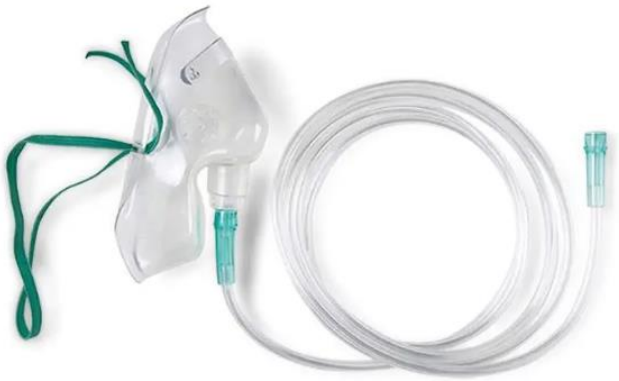
***Adult* High Flow Nasal Cannula:**

Flow Range 6-15 LPM

Apply humidification when in use. Ensure bubble humidifier used supports > 6 LPM, (there are two sizes)

FiO2: 45-80%

Comer 5 Considerations: Appropriate for pediatric patients that require an adult size O2 device and need >6 LPM. **Used very infrequently in Comer, consider another device for hypoxemia.**



Simple Mask:

Flow Range 5-10 LPM

FiO2: 35-50%

Comer 5 Considerations: Use device per IFUs. Ideal for patient who is "mouth-breathing" or can only tolerate blow-by. No less than 5 LPM due to **high** risk of rebreathing CO2. Set flow between 5-10 LPM to achieve targeted SpO2 goal.

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Comer 5 O2 Device Tip Sheet

Venturi Mask:

Flow Range 4-10 LPM

FiO2: 35-50%

Comer 5 Considerations: Use device per IFUs. Turn arrow to FiO2 that you want to deliver, then match the corresponding LPM printed above setting to achieve FiO2. If titrated always adjust **BOTH** LPM and FiO2 together. Ideal for patient who is "mouth-breathing" or can only tolerate blow-by. You can set and deliver a specific FiO2 with this mask versus just LPM (simple mask).

***MOST* frequently used with a trach collar (instead of aerosol mask) as the O2 delivery device for the transport of a stable trach patient.**

If your Comer 5 pt requires this device, set appropriate LPM for device/pt's FiO2 needs and call a PET!

Partial Rebreather Mask:

Flow Range 6-10 LPM

FiO2: 40-70%

Comer 5 Considerations: Use device per IFUs. Use if higher FiO2 is needed than max available via simple mask or Venturi mask. No less than 6 LPM due to **high** risk of rebreathing CO2. Set flow between 6-10 LPM to achieve targeted SpO2 goal.

RT will remove ONE expiration valve to allow it to become *partial rebreather mask.

***Has only a single one-way valve on interface compared to the two on a non-rebreather mask, allows for more RA entrainment.**

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Comer 5 O2 Device Tip Sheet

If your Comer 5 pt requires this device, set appropriate LPM for device/pt's FiO2 needs and call a **PET!**

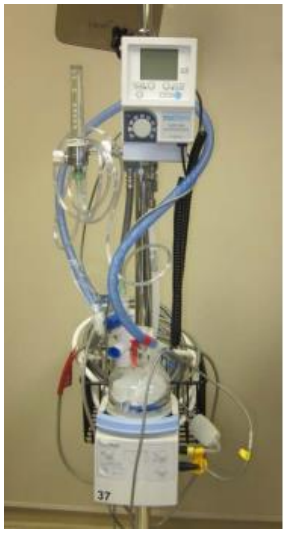
Non-Rebreather Mask:

Flow Range 10-15 LPM

FiO2: 60-100%

Comer 5 Considerations: Use device per IFUs. Use during airway emergency, short term therapy until pt transfers to PICU. **NO** less than 10 LPM due to VERY **high** risk of rebreathing CO2. Set flow between 10-15 LPM to achieve targeted SpO2 goal.

***Has one-way valve on each side of interface compared to partial-rebreather mask, allows higher FiO2 delivery.**



Heated and Humidified High Flow Nasal Cannula:

Flow Range 1-60 LPM (depending on interface used, see attachment A for specifics.

FiO2: 21-100%

Comer 5 Considerations: **If any patent requires >15 LPM and 50% FiO2 *on this specific device* they must be admitted to PICU.**

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Comer 5 O2 Device Tip Sheet

1

2

3

(1) Aerosol mask- can be cool or heated aerosol.
(2) Face tent- use with cool aerosol (upper airway/facial swelling)
(3) Trach collar- use with heated aerosol for surgical airways

All devices can provide 28-90%. Select device per pt condition. Use Venturi system on LVN (large volume nebulizer) for cool or aerosol pole with blender for heated aerosol.

- **>50% FiO2 needed to maintain SpO2 goal would require a PET and transfer to PICU.**

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Comer 5 O2 Device Tip Sheet

Attachment A

F&P Optiflow™ Junior 2

Next generation care

Nasal Cannula | MR850 | SPECIFICATIONS

PRODUCT	OJR410	OJR412	OJR414	OJR416	OJR418
Nasal cannula size	XS	S	M	L	XL
Cannula weight	6.7 g	7.1 g	9.3 g	13.5 g	13.8 g
MAXIMUM FLOW RATES* (L/min)					
MR850	0.5 - 8	0.5 - 9	0.5 - 10	0.5 - 23	0.5 - 25

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Comer 5 O2 Device Tip Sheet

F&P Optiflow™ Junior 2+
Next generation care

OJR520 Nasal Cannula | SPECIFICATIONS

OJR520 XXL	MR850	AIRVO 2
COMPATIBLE ACCESSORIES		
F&P Wigglepad™ 2	WJR114	
MAXIMUM FLOW RATES* (L/min)		
	1-36	10-50

Pediatric Status Epilepticus Treatment Protocol

Background: Patients experiencing status epilepticus while in the hospital require rapid and coordinated assessment, supportive care and medication treatment. Rapid cessation of status epilepticus prevents associated complications, such as respiratory failure and need for ICU admission.

Purpose: This protocol is intended to guide evaluation, supportive care and treatment for children on the Comer inpatient services who experience unanticipated status epilepticus.

Patients Included:

- Infants and children ages 1 month old (45 weeks post-conceptional age) and older
- Patients admitted to medical and surgical services on Comer 5 and 6
- Patients experiencing **Unanticipated Status Epilepticus**: Continuous seizure activity lasting longer than 5 minutes, or frequent seizures without return to baseline between seizures.

Patients Excluded:

- The protocol is not intended for patients in the Emergency Department or Intensive Care Units
- Patients with a known history of epilepsy should have a specific acute seizure and status epilepticus plan documented in their chart. All patients with a history of epilepsy should have a 1st line anti-seizure medication (ASM) ordered. All patients at high-risk of status epilepticus should have both 1st and 2nd line ASMs ordered. These ASMs should be ordered via that “PNE: IP Peds Admission PRN Seizure Meds” orderset.
- Patients with non-convulsive seizures/status

Protocol Developed: 06/2020
Protocol Revised: 07/2020

Convulsive Status Epilepticus Protocol for Pediatric Inpatients

Status Epilepticus = seizure > 5 min or frequent seizures without return to baseline in between

Time	Supportive Care	Antiseizure Meds (ASM)	Evaluation
0 - 5 min	Airway, breathing, circulation Cardiac Monitor Pulse Ox Start timing the seizure Page 1st contact provider	Confirm any meds given in the last 12 hours[1] If hypoglycemic give dextrose 10%, 2.5 mL/kg (unless pt on ketogenic diet, refer to keto diet protocol)	Hx: fever, trauma, ingestion, prior hx of seizure/epilepsy Exam: temp, BP, signs of trauma, assess mental status by asking patient questions and giving commands Labs: POC glucose, electrolytes, Ca, Mg, CBC, tox screen, ASM levels[2]
5 - 10 min	Page Ped Neuro 7678 If cardiorespiratory compromise, call PET[3]	**1st Line** No IV Access: IntraNasal Midazolam 0.2 mg/kg (max 10mg), give 1/2 dose up each nostril +IV Access: Lorazepam, 0.1 mg/kg, (max 4mg/dose), IV push	Assess mental status Screen for seizure risk factors[4]
10 - 15 min	Place IV	**Give 2nd dose of 1st Line[1]** IN Midazolam or IV Lorazepam	Assess mental status
15 - 25 min	Monitor closely for respiratory failure and hypotension[2] Call PET and prepare for transfer to PICU	**2nd Line** - Levetiracetam 60 mg/kg IV Alternate - Fosphenytoin 20 PE/kg IV	Assess mental status If cause of seizure remains unknown: order CT head, and consider lumbar puncture
25 - 35 min	Prepare for transfer to PICU Transfer patient to PICU	**3rd Line** -Fosphenytoin 20 PE/kg IV • Alternate - Valproic acid, Lacosamide, PHenobarbital, see footnotes	Place 24hr video EEG order, and contact EMU at 43665 Assess mental status
35+ min	Monitor for complications of prolonged coma: hypotension, infection, ileus, metabolic acidosis, DVT PENTobarbital suppresses fever.	**Continuous IV Infusion** - to achieve electrographic seizure cessation • Midazolam - bolus 0.2 mg/kg, infusion 0.1 to 2 mg/kg/hr. Rebolus with each rate increase. Or • PENTobarbital - bolus 5 to 10 mg/kg, infusion 0.5 to 5 mg/kg/hr	Continuous EEG monitoring

1 If patient has received a rescue dose of benzodiazepine within the past 2 hours, then only give one dose of 1 dose benzodiazepine before moving on to 2nd line ASM.

2 Labs: It is not necessary to repeat CBC, tox screen and ASM levels if obtained within last 24h

3 If patient has respiratory failure, activate PET, intubate and skip ahead to Continuous IV Infusion with EEG monitoring

4 Seizure risk factors: prematurity, developmental delay/regression, +family history, hx of meningitis, encephalitis, head trauma or sepsis

Alternate 3rd line ASMs - Valproic Acid 30 mg/kg IV, Lacosamide 8 mg/kg IV, PHenobarbital 20 mg/kg IV

Tips

- Consider using a patient's maintenance ASM as their 2nd line agent, e.g. if a patient takes valproic acid at home, load with valproic acid 2nd line
- Fosphenytoin can exacerbate myoclonic and absence seizures
- Patients with preserved awareness and/or milder focal seizures may require a less intense treatment protocol. Discuss plan with Peds Neuro 7678
- If psychogenic non-epileptic spells are suspected
  - obtain an EEG ASAP, PNES can often be diagnosed with a limited set of EEG electrodes
  - Choose non-sedated ASMs (e.g. levetiracetam, fosphenytoin)

Ordering ASMs:

For patients with *unanticipated seizures*, the following ASMs are available in the Omnicell for bedside preparation: levetiracetam, fosphenytoin and phenobarbital.

Patients with a history of epilepsy should have their 1st and 2nd line ASMs ordered, using the "Pediatric Status Epilepticus" orderset at the time of admission, in which case these ASMs will be available as PRNs in the patient's individual bin in the Omnicell

Pediatric Status Epilepticus
MEDICATION ORDER

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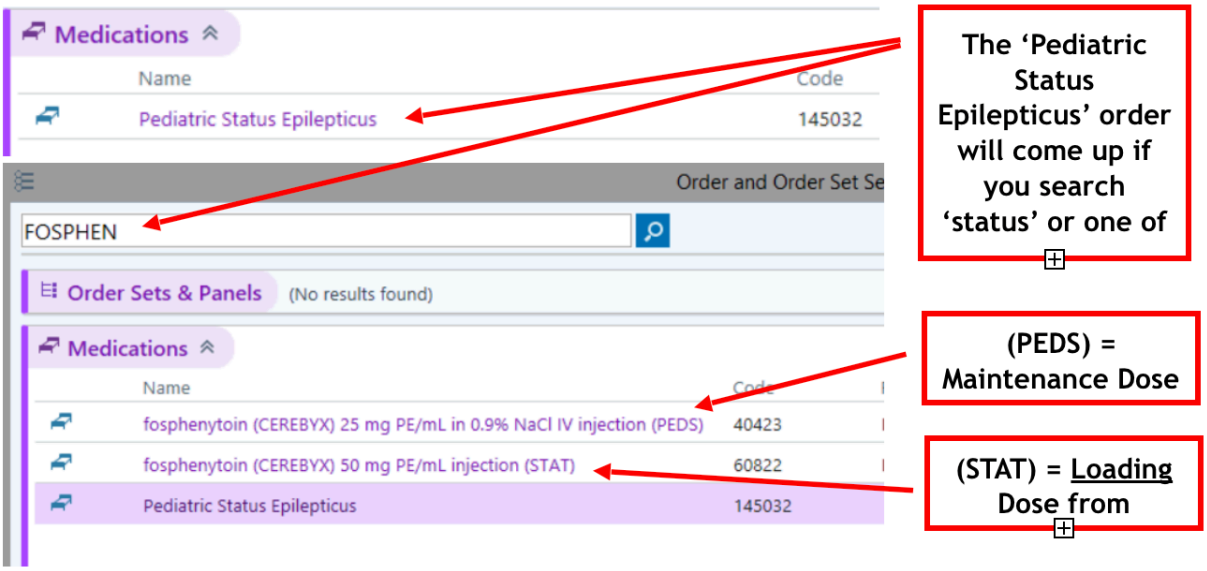
When to Use

This order set should be used for patients who have an unanticipated status epilepticus event and need a loading dose of fosphenytoin, levetiracetam, or phenobarbital immediately.

How To Order

These STAT doses can be ordered via the Pediatric Status Epilepticus medication order OR from the (STAT) IV medication order for the respective drugs. Do NOT order emergent doses via the (PEDS) option – these orders are for maintenance doses only.

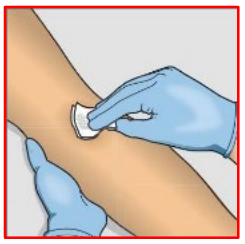


TIP SHEET: Obtaining Blood Cultures

The standard for blood culture contamination (false-positive results) as established by the American Society for Microbiology (ASM) is considered to be ≤3%. Under filling of blood culture bottles decreases the sensitivity of the culture. Blood culture contamination and under filling have real implications for patients.

Goal: Accurately identify patients with possible infections by reducing blood culture contamination and proper fill volumes.

#1 Tip: Site Preparation



- Either 70% isopropyl alcohol or chlorhexidine may be used for peripheral venipuncture. Chlorhexidine (CHG) must be used to prepare sites prior to blood cultures and allowed to dry for 30 seconds. (pc 172) [Note: alcohol=start in middle, work outwardly; CHG=side to side ↔, up down ↕]
- Once the site is prepped, do not touch site; if you need to touch the site, clean again with CHG.
- Each blood culture set should be drawn from a different site.

#2 Tip: Bottle/Vial Preparation

- Verify expiration dates
- Mark the bottles at the desired fill levels (**8-10 mL**)
- Remove caps, wipe top of the bottles with alcohol and let dry.
- Patients 11 years or older: Inoculate Aerobic Plus bottle (gray) and then Lytic/10 Anaerobic/F bottle (purple).

#3 Tip: Blood Collection

- **DO NOT** draw immediately above an existing IV infusion site. (pc 172)
- Blood cultures should be the first samples obtained. (pc 172)
- **10 mL is the optimal fill volume!** [Note: exception is pediatric bottles]
- Label and identify each set of bottles with the site, date/time, initials of phlebotomist drawing lab
- **DO NOT** cover the bar codes on the bottles

1. UCMC. (2021). PC 172 Phlebotomy Practices. https://services.uchospitals.edu/sites/PoliciesAndProcedures/Patient%20Care/PC%20172%20Phlebotomy%20Practices%20track%20changes%20accepted.pdf#search=phlebotomy.
2. Elsevier Skills. (2021). Blood Specimen Collection: Blood Cultures – CE. https://point-of-care.elsevierperformancemanager.com/skills/699/videos?skillId=GN_43_11C#scrollToTop.
3. BD BACTEC™ Blood Culture System Blood collection instructions. (2018). https://www.bd.com/en-us

PICC Line Updates – How do I know how to flush my patient's PICC line?

Any PICC line with EXTERNAL CLAMPS should be heparin-locked

- External clamps indicate that there is NO internal valve in the line – the clamps act as the valve
- Flush with 2mL, 10 units/mL (conc) – q12 hours or more frequently after medication/fluid infusion
- These lines should always have heparin when not in use (not infusing fluids)
- Use a 10 mL syringe or greater when flushing and pulsatile flush when heparin-locking

Any PICC line WITHOUT external clamps has an internal valve and does not require heparin, regardless of the catheter size

- Flush with 3-5 mL of saline q12 hours or more frequently after medication/fluid infusion
- Use a 10 mL syringe or greater when flushing, and pulsatile flush when saline-locking

Plasmapheresis In The Pediatric Patient Population

Plasmapheresis: Also known as therapeutic plasma exchange (TPE)

- Involves the removal of a patient's plasma alone, replacing it with either:
  - 5% Albumin **OR** plasma from donors
- Plasma components contain immune complexes, antibodies, inflammatory mediators, lipoproteins, protein-bound toxins and platelet aggregating factors that can contribute to inflammation and disease progression.
- Removal of a patient's plasma and therefore the offending antibody, decreasing the amount circulating in the blood stream that may be aggravating symptoms of disease.
- Mostly used for antibody removal in a variety of diseases including:
  - Guillain-Barré syndrome
  - Myasthenia Gravis
  - Neuromyelitis optica
  - Antibody mediated rejection of solid organ transplants
  - Thrombotic thrombocytopenic purpura (TTP)

Procedure:

- Patient first needs to have a large bore, double lumen apheresis catheter placed
- Depending on age of patient, clinical indications, and adequacy of veins, may be able to perform using peripheral access.
- Apheresis machine will remove appropriate blood component, depending on procedure, and then replace with the indicated fluid.
- Length of procedure depend on type:
  - TPE and RBC exchange approximately 1-1.5 hrs
  - WBC depletion and stem cell collection take longer (3-6 hrs)

Nursing Responsibilities

- Bedside RN should ensure the following:
  1. Ensure that patient has current blood bands.
  2. Obtain patient's weight and height prior to start of plasmapheresis.
  3. Ensure patient is on monitor with blood pressure set to cycle every 15 minutes.
  4. Ensure patient is on bed rest during the procedure and for **at least** 15 minutes after the completion **OR** until vital signs are stable.
  5. Administer or hold any medications as ordered.
  6. Draw and send any scheduled labs as ordered.
- May be asked to check blood products with Apheresis staff.

References/Resources:
UCM Patient Care Policy PC 83: Blood Products Procurement, and Administration
UCM Patient Care Policy PC 84: Therapeutic Apheresis
UCM Patient Care Policy PC 118: Intravenous Therapy and Vascular Access
UpToDate: Therapeutic plasma exchange: indications and complications.

Apheresis Staff Responsibilities

- **Bring apheresis machine and needed supplies including blood products to the bedside.** (Apheresis can also be done in donor room located in DCAM 5G)
- Accessing catheter and running the apheresis machine.
- Monitoring patient's vital signs throughout procedure and documenting these in EPIC every 15 minutes.
- Notifying bedside nurse of any concerns or issues during the procedure.
- Ensuring catheter is flushed with heparin/saline post procedure.

Pediatric Considerations:

- IV access: Not always easy to obtain in pediatric patients, but a large bore, double lumen apheresis catheter is necessary in order to perform therapeutic apheresis procedures.
  (NOTE: Under special circumstances this could be done via a peripheral IV).
- Volume/Fluid Shifts:
  - Fluid balance at end is even but with removal of plasma or RBC's from patient's circulation, there are fluid shifts.
  - To minimize ensure patient is hydrated and has had a meal before or at start of procedure.

Most Common Adverse Reactions:

- Note that the likelihood of complications is dependent upon
  - Patient's overall condition
  - Number and length of plasma exchanges
  - Replacement fluid (plasma vs. albumin)
- **NOTE: Adverse reactions are seen more frequently with plasma rather than with albumin replacement**
- **Citrate induced hypocalcemia:** Citrate is an anti-coagulant utilized to prevent clotting of the machine. It binds to ionized calcium forming soluble calcium citrate, lowering the ionized but not the total serum calcium level. This is why Calcium levels should be monitored and why Calcium Gluconate/Carbonate is often administered prior to plasmapheresis. Signs & Symptoms can include:
  - Tingling in hands, feet, lips
  - Muscle spasms, weakness, shaking
  - Prolonged QT syndrome or other arrhythmias (later signs)
- **Allergic Reaction**: Urticaria and/or pruritis (most common)

What to do in an Emergency:

- Follow steps outlined in **PC 84 Therapeutic Apheresis**:
  1. The withdrawal procedure should be stopped.
  2. The patient's physician should be called to examine the patient and the Blood Bank physician should be notified.
  3. The IV line should be kept open with normal saline.
  4. An EKG should be taken if deemed necessary.
  5. The patient's physician will be notified. The Blood Bank physician, in conjunction with the clinical team will determine whether or not to continue the procedure.

Potential Complication	Nursing Intervention
Air embolism	• Monitor connection tubing for any air in line • Ensure line is clamped and has cap/Clave on end when not in use • Pheresis line to be accessed only by clinically competent staff per UCM Policy **PC 118**

Citrate toxicity	• Monitor for s/s of toxicity
	  ○ Numbness & tingling around the mouth
	  ○ Pheresis staff may decrease rate of infusion on the pheresis machine

Hypocalcemia	• Monitor and treat low levels of ionized calcium before, during, & after treatment
Hypotension	• Monitor blood pressure before, during, and post treatment • Have IV fluids readily available on unit if needed to treat hypotension
Hypothermia	• Monitor body temperature • Blood warmer utilized on pheresis machine

Potential Complication	Nursing Intervention

Infection	• Follow infection control practices & UCM Policies
	  ○ Hand washing
	  ○ Isolation precautions
	  ○ CL dressing changes
	  ○ CL accessing

Bleeding	• Monitor coags before and after procedure • Ensure current blood bands in place • Transfuse as ordered

Transfusion reaction	• Monitor for transfusion reaction
	  ○ Follow transfusion reaction protocol as outlined in UCM Policy **PC 83**
	  ○ Use leukodepleted, irradiated blood products if indicated
	  ○ Consider pre-medication if high risk of reaction likely

Thrombus formation	• Monitor coags before and after procedure • Clinically competent staff to flush lines with saline/heparin as ordered per UCM Policy **PC 118**

References:

Hazinski, M. F. (2013). Nursing Care of the Critically Ill Child, 3rd Ed., Elsevier St. Louis: Missouri.
McLeod, B.C. (2012). Plasma and plasma derivatives in therapeutic plasmapheresis. *Transfusion, 52*, 38S-44S.

Comer 5 & 6: General Pediatrics, Multispecialty, Neurology/Neurosurgery, Hematology/Oncology/SCT

Pocket Buddy©

"If you find it in your heart to care for somebody else, you will have succeeded." -Maya Angelou

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IMPORTANT PHONE NUMBERS	
Admitting (Comer): 2-6234	Pharmacy: Comer Satellite 5-0093 Central Pharmacy 5-0091
Bed Access: 4 -BEDS (4-2337)	Plant Department: 2-6295
Blood Bank: 2-6827	Playroom: 2-6481
Clinical Engineering: 2-6744	Radiology:
Comer Front Desk: 2-5420	Comer CT 2-3225 Comer MRI 2-2757 Comer Xray 2-3455
Dr. Cart: 1-4-7	Mitchell Radiology 5-5544
Fire: 1-2-3	Ronald McDonald House: 324-KIDS (4-5437)
General Stores: 2-1888	Sedation 5-7647
Get Well Network: 1-888-GWN-DESK	Security (Routine): 2-6262
Gift of Hope: 1-800-545-GIFT	Staffing Office: 2-3525
Help Desk: 2-3456	Transportation: 5-5537
Lab Receiving: 2-1316	UCAN: 2-3222

Unit Phone Numbers

PICU Charge 5-7979
PICU Attending on-call 5-7959
PICU Fellow on-call 5-7949

Comer 5: 2-6460
Comer 6: 2-0238
Comer ER: 2-6249
CICU: 2-9090

PICU: 2-6494
NICU: 2-6681
Comer OR: 2-6589
PACU: 4-4460

Important Pagers*

Admitting (Comer) 7336
AOC: 7500
Chaplain: 7008
EVS: 5700

Linen: 1500
Narcotic Tech: 8369
Neurosurgery on-call: 6876
Neurosurg Peds NP: 6875

Peds ENT: 3687
Pharmacist: 6777, ph-50093, IV-24252
PICU on-call: 7428

To access pager system, dial 188, enter pager number followed by the # key, when prompted dial your return phone number. From home dial (773) 753-1880

Welcome!

AT THE FOREFRONT OF KIDS' MEDICINE®

UChicago Medicine

Comer Children's

This handbook was designed to assist you in providing safe nursing care to acutely ill children. Every effort has been made to provide you with accurate and accessible information.

This book is only to be used as a reference. As new research broadens our knowledge about medical and drug therapies, the reader is advised to check all new product information.

We hope you find this book helpful
to your daily nursing practice.

"Wisdom is not a product of schooling but of the lifelong attempt to acquire it." - Albert Einstein

We would like to thank the dedicated nurses of Comer Children's Hospital. The motivation to put together this resource came from your continuous quest to assure that the highest quality of care is delivered to the children in Comer. This resource grew out of a combination of many people and ideas. Whether it was a helpful suggestion or time spent editing, we would like to acknowledge the people who made contributions.

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Table of Contents

Tool Box

Pediatric Norms

Normal Vitals in Children

Normal Heart Rates in Children**

Age	Awake Heart Rate (bpm)	Sleeping Heart Rate (bpm)
Neonate – 3 months	85-205	80-160
3 months – 2 years	100-190	75-160
2 years – 10 years	60 - 140	60-90
> 10 years	60-100	50-90

Normal Blood Pressures in Children**

Age	Systolic pressure (mmHg)	Diastolic pressure (mmHg)
Term Neonate	50-70	25-45
Infant	70-100	50-70
Toddler	80-110	50-70
Preschooler	80-115	50-80
School-age	85-120	55-80
Adolescent	90-130	60-88

Definition of Hypotension

Age	Systolic pressure (mmHg)
Term Neonate	< 60 mmHg
Infant (1 -12 months)	< 70 mmHg
Child (1 – 10 years)	< 70 mmHg + (age x 2)
Child (> 10 years)	< 90 mmHg

Normal Respiratory Rates in Children**

Age	Rate (breaths per minute)
Neonates & Infants	30-60
Toddlers	24-40
Preschooler	22-34
School age	18-30
Adolescents	12-16

**** Always consider child's normal range and clinical condition. Respiratory rate is expected to increase in the presence of fever or stress.**

Approximate Weight for Age

Newborn	5kg
6mo	7kg
1yr	10kg
2-3yr	12-14kg
4-5yr	16-18kg
6-8yr	20-26kg
8-10yr	26-32kg
10-14yr	32-50kg
14yr	50kg

Formula for Body Surface Area (BSA) = **√((cm*kg)/3600)**

Fluid/Nutrition Requirements in Children

Maintenance Fluid Requirements in Children

Body weight DAILY maintenance formula

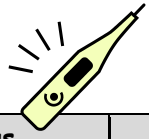
0-10 kg.	100 ml/kg.
11-20 kg.	1000 ml for 1st 10 kg. + 50 ml/kg. For kg. 11-20
21-30 kg.	1500 ml for 1st 20 kg. + 25 ml/kg for kg 21-30

Body weight hourly maintenance formula

0-10 kg.	4 ml/kg./hr
11-20 kg.	40 ml/hr for 1st 10 kg. 2 ml/kg/hr for kg. 11-20
> 20 kg.	60 ml/hr for first 20 kg. 1 ml/kg./hr for kg. Above 20.

Calculation of Circulating Blood Volume in Children

Age of the child	Blood volume (ml/kg.)
Neonates	85-90
Infants	75-80
Children	70-75
Adults	65-70



Temperature Conversion

Celsius	Fahrenheit	Celsius	Fahrenheit
34.2	93.6	38.6	101.5
34.6	94.3	39.0	102.2
35.0	95.0	39.4	102.9
35.4	95.7	39.8	103.6
35.8	96.4	40.2	104.4
36.2	97.2	40.6	105.1
36.6	97.9	41.0	105.8
37.0	98.6	41.4	106.5
37.4	99.3	41.8	107.2
37.8	100.0	42.2	108.0
38.2	100.8	42.6	108.7

Temperature

- One rectal temperature per shift should be assessed if the patient is < 1 year old or receiving thermoregulation interventions ***unless medically contraindicated***
  - ✓ *Avoid rectal temps with every set of vitals due to potential for tissue damage / stress to child.*
  - ✓ *NO RECTAL TEMPS in HEME/ONC* patients, rectal trauma, rectal bleeding
- If an axillary temperature is <35 or > 37.5 °C and was not previously outside of normal parameters, it should be verified with another method.
- If patient is febrile > 38.0°C oral or rectal, notify the physician and check the patient's temperature 1-hour post intervention (i.e. Tylenol, ibuprofen, cool packs, light clothing/ sheets). If child remains febrile, continue to check temperature every one to two hours until afebrile. Check temperature more frequently if clinically indicated.

Isolation Policies

The Infection Control:

- Indication for Isolation
- Infection/Condition
- Isolation Category
- Minimum room requirements
- Mask requirements
- Gown requirements
- Glove requirements
- Infective material
- Duration of precautions
- Additional information that may be useful to the staff

Common Reasons for Isolation

Contact Isolation:

- Clostridium difficile – until diarrhea stops, soap & water (no hand sanitizer)
- Hepatitis A
- HSV (neonatal, disseminated) – duration of illness
- Lice (Pediculosis) – 24 hours after treatment (change all linens, all personal belongings should be bagged and sent home to be washed in hot water)
- Parainfluenza
- RSV –duration of illness or negative x2
- Rotavirus – until diarrhea stops or negative x 2
- Tinea –until lesions disappear
- Drug-resistant organisms (MRSA/VRE)
- ALL CHILDREN < 5 WITH WHEEZING

Respiratory (droplet):

- Influenza
- Parvovirus
- Pertussis

Special Situations:

- Tuberculosis –Airborne isolation (negative pressure isolation room)
- Respiratory Enterovirus- droplet and contact, soap and water (no hand sanitizer)
- Varicella:
  - Exposed patients: respiratory isolation
  - Neonates exposed to mother with varicella - strict isolation (with neg pressure room)
  - Active chicken pox or shingles – strict isolation with negative pressure room

Protective Isolation:

- Immunocompromised patients such as:
  - Solid Organ Transplants
  - Stem Cell Transplants
  - Recent Chemotherapy recipients' (depending upon ANC)

Quick Reference Guide to Pediatric Emergency Equipment

	Oral Airway	ETT	Laryngoscopes= straight c = curved	Suction Catheter (French)	Bag-Valve Device	Chest Tube (French)	IV catheter gauge	NG Tube (French)	Foley Catheter (French)
Neonate	Infant/ Small	3.0 - 3.5	1s	6	Infant	12-18	22-24	5	5-8 feeding tube
6 months	Small	3.5 - 4.0	1s	6	Infant	14-20	22-24	8	8
1 year	Small	4.0 - 4.5	1s	8	Ped.	14-24	20-22	8	10
2 years	Small	4.0 - 4.5	1s	8	Ped.	14-24	20-22	10	10
3 years	Small	4.0 - 4.5	13	8	Ped.	14-24	20-22	10	10
4 years	Medium	5.0 - 5.5	2 s/c	10	Ped.	20-32	20-22	10	10-12
5 years	Medium	5.0 - 5.5	2 s/c	10	Ped.	20-32	18-22	10	10-12
6 years	Medium	5.5 - 6.0	2 s/c	10	Ped.	20-32	18-20	10	10-12
7 years	Medium/ Large	5.5 - 6.0	2 s/c	10	Ped.	20-32	18-20	12	10-12
8 years	Medium/ Large	6.0 - 6.5	2-3 s/c	10	Adult	28-38	16-20	12	12
9 years	Medium/ Large	6.0 - 6.5	2-3 s/c	10	Adult	28-38	16-20	12	12
10 years	Medium/ Large	6.0 - 6.5	2-3 s/c	10	Adult	28-38	16-20	12	12
11-18 years	Large	7.0 - 8.0	3 s/c	12	Adult	28-38	14-18	14-16	12-18

Admission and Emergency Procedures

"Sometimes, superheroes reside in the hearts of small children fighting big battles"

General Pediatrics Bedside Equipment:

- Patient Cart Sheet displayed in patient's room with 2 RN signatures
- Appropriate size resuscitation bag and mask for the patient.
- Oxygen flow meter, nasal cannula, and bubbler (oxygen setup) – if applicable
- Suction canister and tubing set up and operational
- Suction Catheters/Yankauer
- Cardiac/Respiratory monitors on and set with appropriate limits as ordered
- Nurse call light within reach of patient/family

It is your responsibility to ensure your patients are being appropriately monitored at all times.

This includes:

- Ensuring your monitor alarms are set appropriately for your patient's age, diagnosis, and current vital signs
- Ensuring your phone is programmed for your bed-spaces
- Keeping your phone with you at all times when on the unit
- Handing off your patient and phone to another nurse when leaving the unit
- Remote monitoring your patient from another bed-space when in another patient's room for a prolonged period of time
- **Reporting monitoring devices which are malfunctioning**

PHYSICAL ASSESMENT

Children should have a full physical assessment, including vital signs completed, minimally every four hours, unless condition changes ***and/or*** are a 3:1 status then vital signs and the affected system should be assessed ***at least*** q 2 hours.

SKIN: Assessments, Management & Charts

- Full head to toe patient assessments (including assessment of skin condition) are conducted by each registered nurse at the point of entry into the Medical Center, at points of transfer of care and at the beginning of each shift
- Assess the Skin Integrity upon Admission and/or Q-shift by using and document findings
    - Modified Braden Q Risk Assessment Scale(>3 weeks but <8 years of age) or
    - Braden Risk Assessment Scale will be used to document pressure ulcer risk (≥8yrs of age)

Safety

SECOND OPINION – NON -EMERGENT

- If you ever question the status of your patient, or you'd like a second set of eyes, please call the **Pediatric Emergency Team (PET)** . This is our Rapid Response Team (RRT) for Comer.
- The PICU Charge nurse and a PICU attending/Fellow and a PICU RT will respond and come to the unit to assess the patient.
- **To request the PET team, dial 1-4-7.**

CLINICAL EMERGENCIES

If an emergency occurs with your patient:

- Hit the "staff assist" or the "code" emergency buttons at bed space
- For "code" emergencies also dial 1-4-7 on the telephone to call a Dr. CART
  - For adult emergencies in Comer, call an "Adult Dr. CART"
- There are two carts and defibrillators on each unit (Comer 5 & Comer 6)
- The PICU Team/Code Team will respond to all "code" emergencies

TRANSPORT

- For the most part, the child will be accompanied and transported by a Patient Support Assistant (PSA); parents are welcomed to join
- If the child is critically ill or has a Trach, the RN MUST go on transport. The following equipment must also be taken:
  - Transport monitor
  - Resuscitation bag with mask and a full O2 tank
  - Portable Suction
  - Emergency Trach Bag with supplies

eCART Overview

AgileMD

eCART, Electronic Cardiac Arrest Risk Triage, is a predictive software tool embedded inside Epic that can identify patients at risk of clinical deterioration, with the goal of facilitating care management and halting progression of a medical crisis. Read the original eCART study here.

eCART RISK STRATIFICATION

Patients are automatically and continuously stratified using their vitals signs and laboratory values into high, moderate, and average risk. If a black **Verify (-)** appears for your patient, it indicates that one or more vital signs are outside normal physiologic ranges, and data should be corrected in the EHR.

- High risk (100 - 97)
- Moderate risk (96 - 93)
- Average risk (<93)

eCART NURSE WORKFLOW

Step 1: Review Epic patient list whenever new data is available, at a minimum of every four hours during your shift*

Step 2: For all high or moderate risk patients, double click to review the eCART detail view

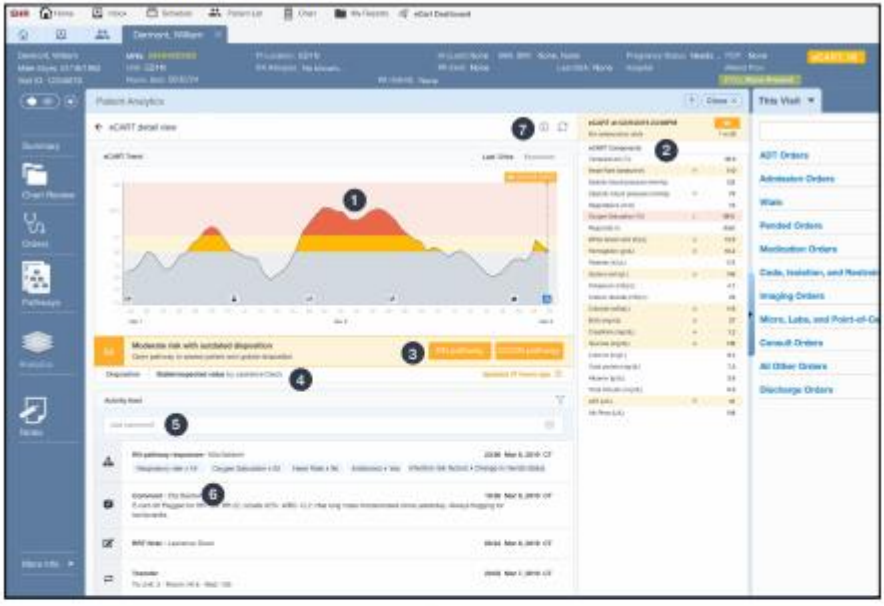
Step 3: Enter the RN pathway and follow instructions

If a **comfort care order has been officially filed, you are not required to continue management through eCART*

PATIENT LIST VIEW

eCART DETAIL VIEW

eCART DETAIL VIEW WALKTHROUGH



1 Hover over trend to see eCART over time

2 Review contributing vitals/labs over time

3 Select RN Pathway for assessment/management

At a minimum of every four hours, complete the RN Pathway for patients with elevated eCART scores and update the eCART disposition.

4 Disposition Status

An eCART disposition saved in the RN Pathway will display on the Detail Page. Disposition status types are defined as follows:

- **Stable/expected value** → Indicates that the patient is responding as expected to a plan that has been in place for at least 24 hours; no new workup or intervention is needed
- **Actively managing instability** → Indicates that the care team is in the process of developing or changing interventions, that it is too soon (i.e. less than 24 hours) to know if the patient is responding adequately to a treatment plan, or that the cause of the patient instability remains unknown
- **Hospice/comfort care** → Indicates that the patient is in hospice or comfort care; further management through eCART is optional

5 Comment field

Add comments to facilitate shift to shift communication and interdisciplinary care. eCART comments are NOT a part of the EHR; need for full documentation of notes and medical decision making within Epic still remains.

6 Track status updates on the activity feed

Review historical dispositions, comments, pathway responses, and transfer information in the activity feed to facilitate shift to shift communication and interdisciplinary care.

7 Reference information and troubleshooting

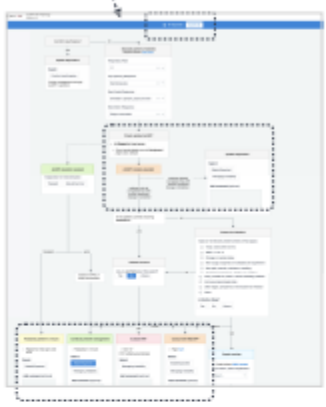
For information about eCART and troubleshooting resources, click the information button in the top banner.

AgileMD

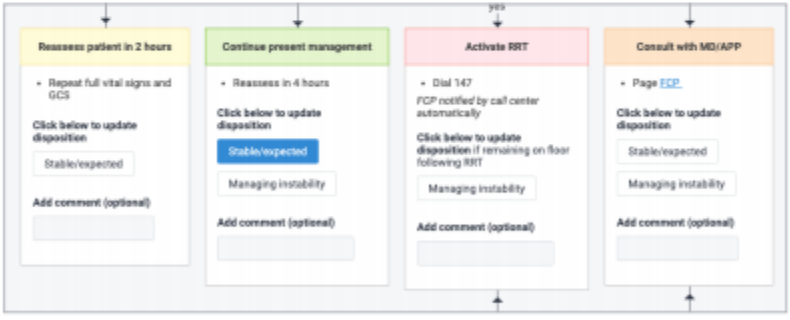
DISPOSITION WORKFLOW UPDATE: USE THE eCART RN PATHWAY

Review Epic Patient List at least every 4 hours. For all **high** or **moderate** risk patients, access the eCART Detail View page and open the RN Pathway to assess the patient and update disposition.

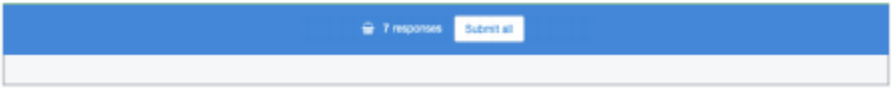
If the patient is ***known*** to you and the pathway was completed this shift without significant change in condition, evaluate the patient's vitals and update the disposition status in the pathway here:



If the patient is ***new*** to you on this shift and/or has a significant in condition, follow the entire RN Pathway and document disposition in the appropriate terminal box for your patient:



When you have completed the pathway, remember to "**submit**" your responses using the blue banner. Pathway responses can be seen in the Activity feed in the Patient detail view.



Primary Assessment

Assessments Findings	Potential Interventions
A= Airway	
• Vocalization • Tongue Obstruction • Loose teeth or foreign objects • Vomitus or other secretions • Edema • Preferred posture • Drooling • Dysphagia • Abnormal airway sounds (stridor or snoring)	• Position the patient • Open the airway with jaw thrust or chin lift • Suction or remove foreign objects • Insert an oropharyngeal/nasopharyngeal airway • Prepare for endotracheal intubation (Rapid Sequence Intubation) • Prepare for needle or surgical cricothyroidotomy
B= Breathing	
• Level of Consciousness (LOC) • Spontaneous respirations • Rate and depth of respirations • Symmetric chest rise and fall • Presence and quality of breath sounds • Work of breathing: - nasal flaring & retractions - head bobbing - expiratory grunting - Accessory muscle use • Jugular vein distension & tracheal position	• Maintain a position of comfort • Provide supplemental oxygen • Provide bag-valve-mask (BVM) ventilation • Prepare for endotracheal intubation (Rapid Sequence Intubation) • Insert gastric tube to reduce abdominal distension • Prepare for needle thoracentesis
C= Circulation	
• Rate and quality of pulses - central - peripheral • Skin color and temperature • Capillary Refill	• Control any uncontrolled bleeding • Obtain IV with largest gauge catheter possible or IO access • Administer 20 ml/kg fluid bolus of isotonic crystalloid solution • Administer blood or blood products • Administer medications • Prepare for defibrillation/synchronized cardioversion

D=Disability

• Level of Consciousness (LOC) using AVPU
  • A: Awake and alert
  • V: Responsive only to verbal stimuli
  • P: Responsive only to painful stimuli
  • U: Completely unresponsive
• Pupils
	• Perform further investigation during secondary assessment to identify cause
	• Administer pharmacologic therapy
	• Consider need for intubation to maintain airway

E= Exposure and Environmental Control

• Obvious underlying injuries • Additional symptoms of illness • Sources of heat loss • Inspect posterior surfaces	• Apply warm blankets • Provide overhead warming light • Provide radiant warmer or approved warming device • Maintain ambient environment • Increase room temperature as needed • Administer warm IV fluids • Administer warm humidified oxygen

Secondary Assessment

Assessments Findings	Potential Interventions
F= Full Set of Vitals	

• Rate, rhythm, and depth of respirations
• Compare rate and quality of pulses
  - central
  - peripheral
• Blood pressure
• Temperature
• Weight (kg)
• Pulse Oximetry
• Pain Score
	• Place on cardiorespiratory monitors as appropriate
	• Trend vital signs
	• Estimate weight
	• Lower normal limit for BP (mmHg):
	  • 70 + (2X age in years)
	• Use age specific pain scale

F= Family Presence	
• Identification of family members and their relationship to the child • Needs of the family • Need for additional support and desire to be in the resuscitation room	• Assign a staff member to provide family support • Assess needs of the family-consider cultural differences • Facilitate and support family involvement

G= Give Comfort Measures

• Presence and level of pain	• Facilitate family presence for support of the child • Use age-appropriate nonpharmacologic methods to facilitate coping • Administer analgesics and other appropriate medications • Initiate physical measures (splints, dressing, ice)

H= Head-to-Toe Assessment

• Head-to-toe assessment using inspection, palpation, and auscultation techniques • Reassessment of A-B-C-D-E once head-to-toe assessment is completed	• Initiate appropriate interventions based on findings • Reassess identified injuries

H= History

• Complete history (**SAMPLE**: signs/symptoms, allergies, medications, past illnesses, last oral intake, events leading up to present illness/injury) **or** (**CIAMPEDS**: Complaint, Immunizations/Isolations, Allergies, Medications, Past Medical History, Parent's impression of child's condition, Events surrounding illness/injury, Diet & Diapers, Symptoms Associated with Illness/Injury) • Specialized , Social, and Family	• Initiate social service consult as needed

Emergency Nurses Association (2013). Emergency Nursing Pediatric Course Provider Manual, 4th Edition. ENA: Des Plaines, IL

Sepsis Protocol

Table 1. High Risk Conditions
• Malignancy • Asplenia (including Sickle Cell Disease) • Bone marrow transplant • Central or indwelling line/catheter • Solid organ transplant • Severe mental retardation/Cerebral palsy • Immunodeficiency, immunocompromised or immunosuppression

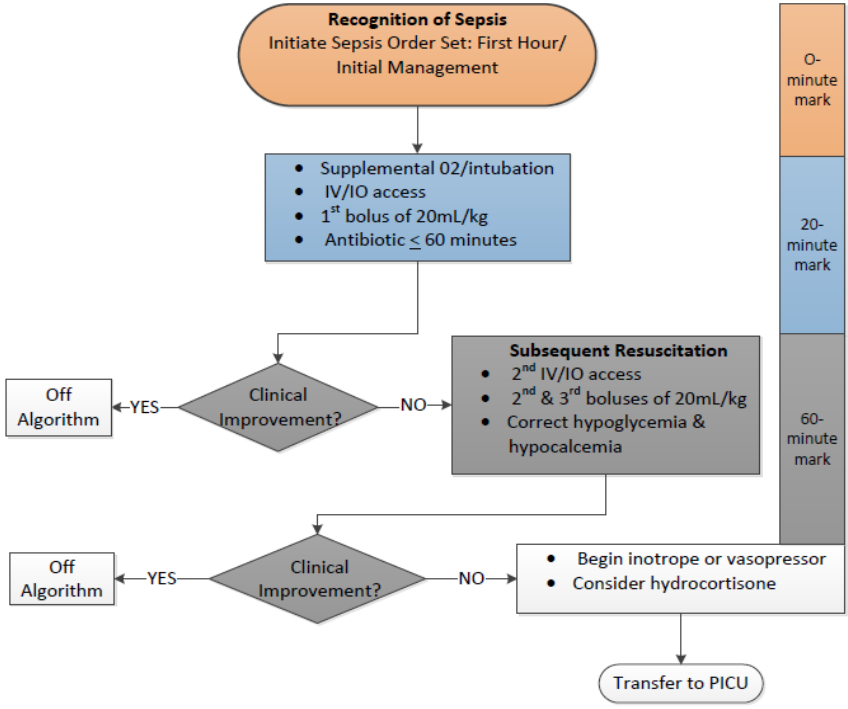
High Risk Conditions

Table 2. Vital Signs (PALS)				
Age	Heart Rate	Resp Rate	Systolic BP	Temp (^{O}C)
0 d – 1 m	> 205	> 60	< 60	< 36 or > 38
≥ 1m – 3m	> 205	> 60	< 70	< 36 or > 38
≥ 3m -1y	> 190	> 60	< 70	< 36 or > 38.5
≥ 1y - 2y	> 190	> 40	< 70 + (age in yr x 2)	< 36 or > 38.5
≥ 2y - 4y	> 140	> 40	< 70 + (age in yr x 2)	< 36 or > 38.5
≥ 4y - 6y	> 140	> 34	< 70 + (age in yr x 2)	< 36 or > 38.5
≥ 6y - 10y	> 140	> 30	< 70 + (age in yr x 2)	< 36 or > 38.5
≥ 10y -13y	> 110	> 30	< 90	< 36 or > 38.5
> 13y	>110	> 20	< 90	< 36 or > 38.5

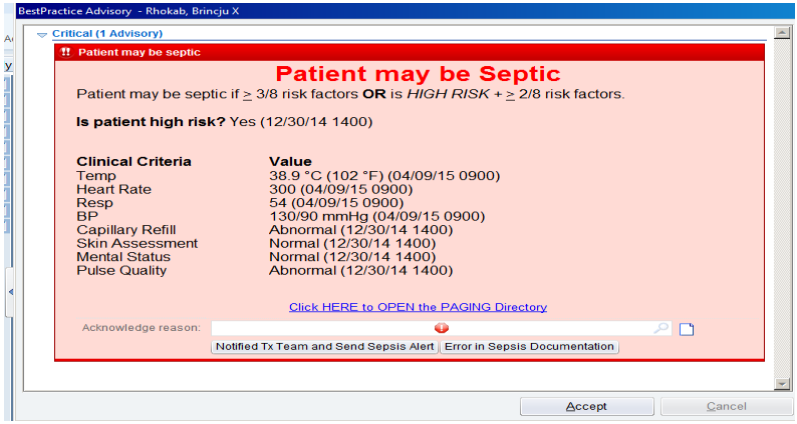
Vital Signs

Table 3. Exam Abnormalities			
	Cold Shock	**Warm Shock**	**Non- Specific**
Pulses	Decreased or weak	Bounding	
Capillary refill	≥ 3 sec	Flash (< 1 sec)	
Skin	Mottled, cool	Flushed, ruddy, erythroderma (other than face)	Petechiae below the nipple, any purpura
Mental Status			Decreased, irritability, confusion, inappropriate crying or drowsiness, poor interaction with parents, lethargy, diminished arousability, obtunded

Signs of Perfusion



- ALL patients who are admitted to PICU, CICU, Comer 5, and Comer 6 will be screened by the RN for sepsis **every 4 hours**
- If the patient screens positive for sepsis, a BPA alert fires alerting you that the patient may be septic.
- If the patient screens positive, notify the primary provider and anticipate orders based upon the "Inpatient Sepsis Treatment" in AgileMD Pathway
- If the patient is deteriorating, call 147 and activate a PET or Dr. Cart



Septic Shock:

- Compensated shock:
  - Systolic blood pressure within normal range with signs and symptoms of inadequate perfusion
  - Children more often present in compensated shock
- Decompensated shock:
  - Signs of shock associated with systolic hypotension
  - **Hypotension is a late, ominous sign in children**
- Cold Shock:
  - Cold extremities
  - Capillary refill ≥ 3 sec
  - Myocardial Dysfunction
  - Sick heart with significant vasoconstriction to maintain perfusion to organs
- Warm Shock:
  - Warm extremities
  - Flash capillary refill
  - Hyperdynamic heart with vasodilation

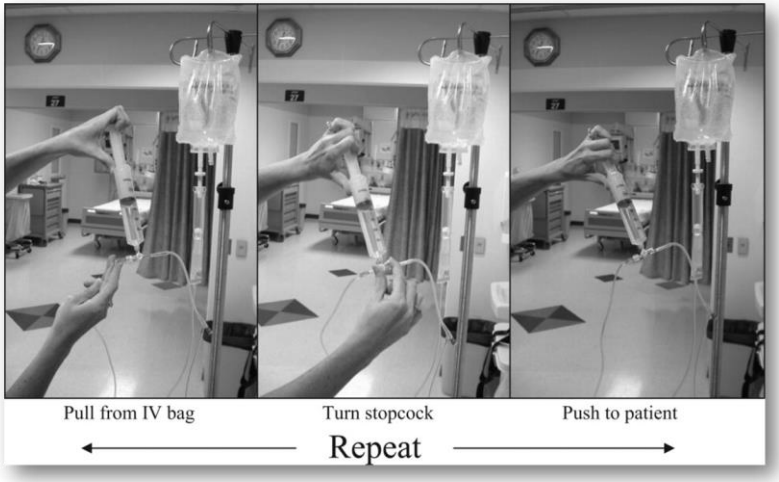
20 Minute Mark:

- Place all Children on Oxygen
- Consider early intubation for respiratory distress

- Obtain IV access and draw labs
- Obtain intraosseous line if IV unsuccessful
- Order Antibiotics – begin within 60min
- 20mL/kg of normal saline bolus - within 20 minutes

Push/Pull Method for Fluid Administration:

- Administer 1st bolus of 20 mL/kg NS via push-pull, rapid infuser, or pressure bag within 20 minutes – Call PET if not in a critical care area to receive PICU assistance



Subsequent Resuscitation:

- Always reassess after each intervention
- If the patient has not improved, begin the second round of resuscitation
- Consider establishing a 2nd IV
- Administer 2nd and 3rd boluses of 20mL/kg of isotonic saline (via push-pull, rapid infuser, or pressure bag) or colloid up to and over 60mL/kg until perfusion improves or unless rales or hepatomegaly develop
- Correct hypoglycemia and hypocalcemia

Fluid Refractory Shock

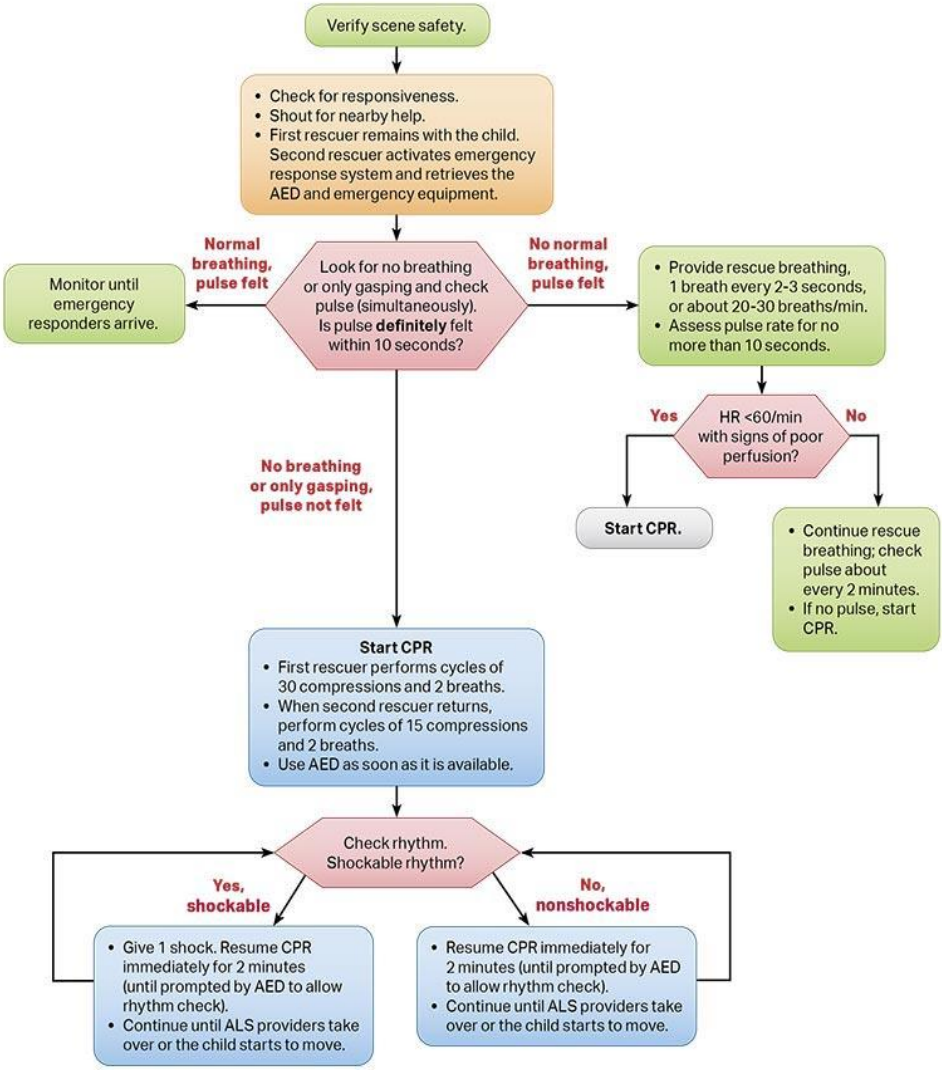
- After receiving 60 mL/kg of fluid, if the patient is still in shock it is called fluid refractory shock and additional medications need to be used. These may be started earlier in the course depending on the patient's clinical status.
- Cold shock
    - Titrate dopamine up to 10 mcg/kg/minute
    - If resistant, titrate epinephrine up to 0.05 mcg/kg/minute
- Warm shock
    - Titrate norepinephrine (0.1 to 2 mcg/kg/minute)

Catecholamine Resistant Shock

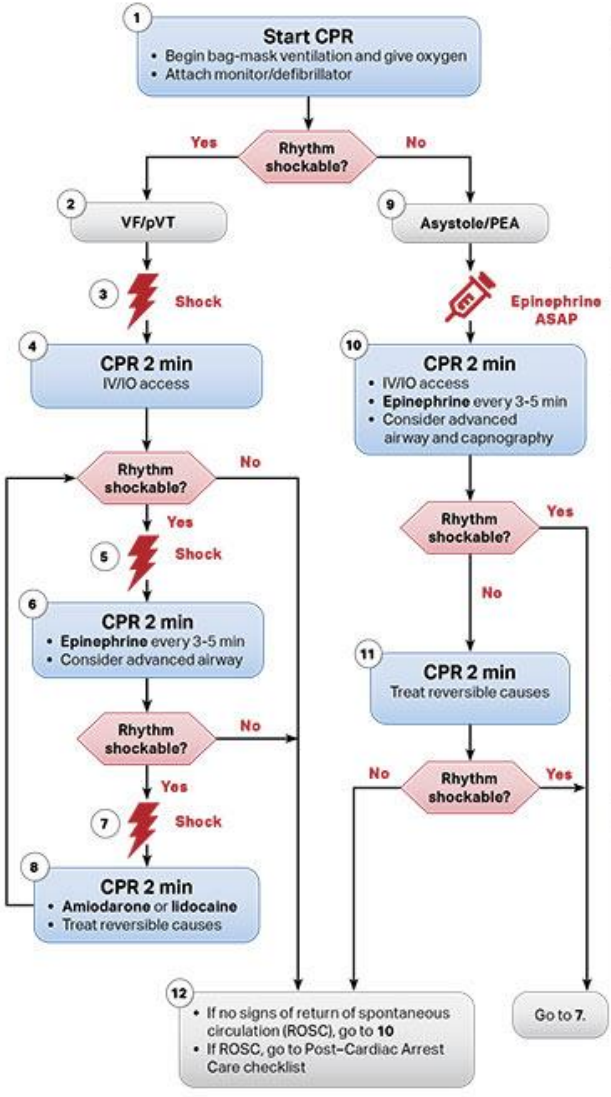
- If the patient is not responsive to inotropes and vasopressors (epinephrine, norephinephrine, dopamine), then the patient may be exhibiting catecholamine resistant shock
- If this is the case, begin hydrocortisone 2 mg/kg IV bolus (max 100 mg)

Pediatric Emergency Algorithms

Pediatric Basic Life Support Algorithm for Healthcare Providers—2 or More Rescuers



Pediatric Cardiac Arrest Algorithm



CPR Quality

- Push hard (≥⅓ of anteroposterior diameter of chest) and fast (100-120/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Change compressor every 2 minutes, or sooner if fatigued
- If no advanced airway, 15:2 compression-ventilation ratio
- If advanced airway, provide continuous compressions and give a breath every 2-3 seconds

Shock Energy for Defibrillation

- First shock 2 J/kg
- Second shock 4 J/kg
- Subsequent shocks ≥4 J/kg, maximum 10 J/kg or adult dose

Drug Therapy

- **Epinephrine IV/IO dose:** 0.01 mg/kg (0.1 mL/kg of the 0.1 mg/mL concentration). Max dose 1 mg. Repeat every 3-5 minutes. If no IV/IO access, may give endotracheal dose: 0.1 mg/kg (0.1 mL/kg of the 1 mg/mL concentration).
- **Amiodarone IV/IO dose:** 5 mg/kg bolus during cardiac arrest. May repeat up to 3 total doses for refractory VF/pulseless VT
  or
  Lidocaine IV/IO dose: Initial: 1 mg/kg loading dose

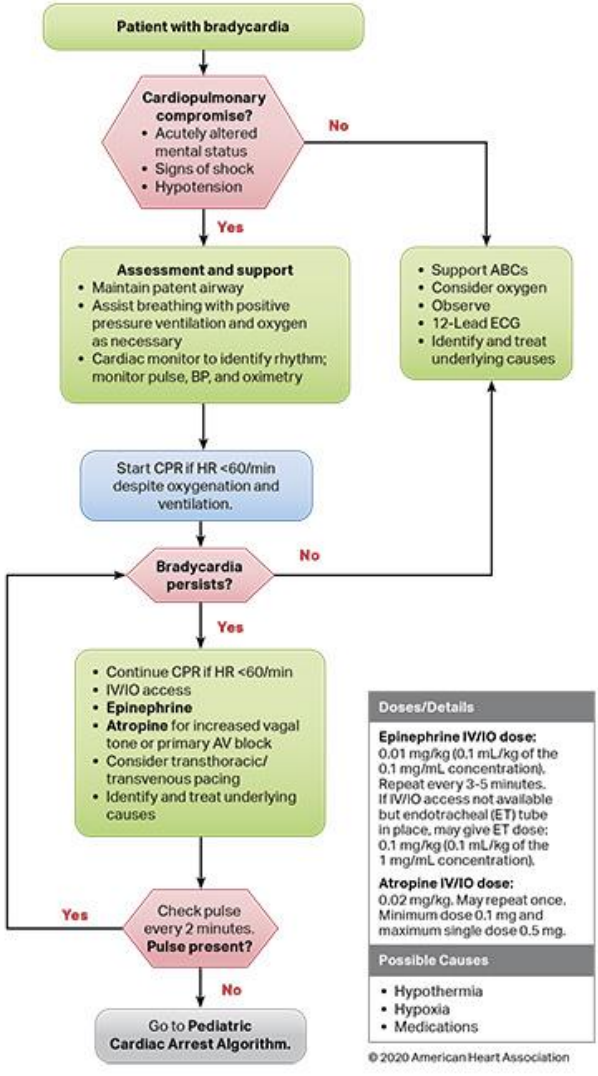
Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement

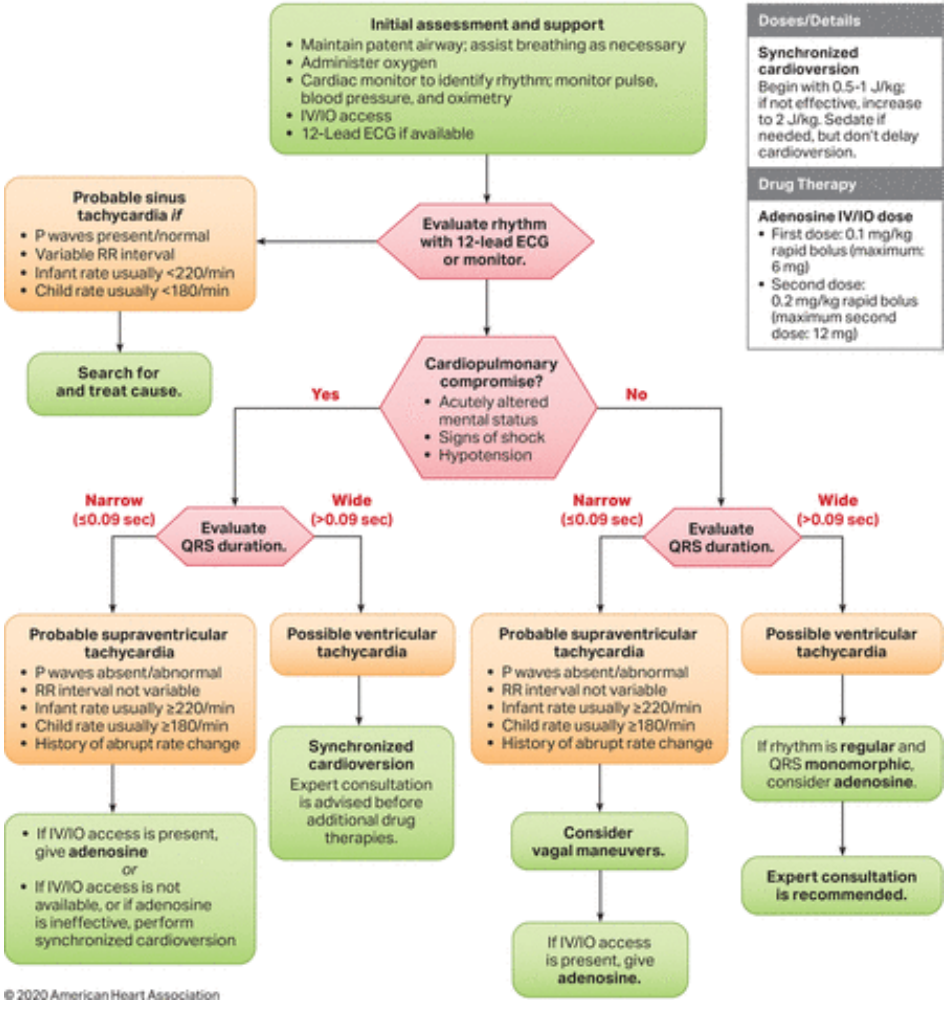
Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypoglycemia
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

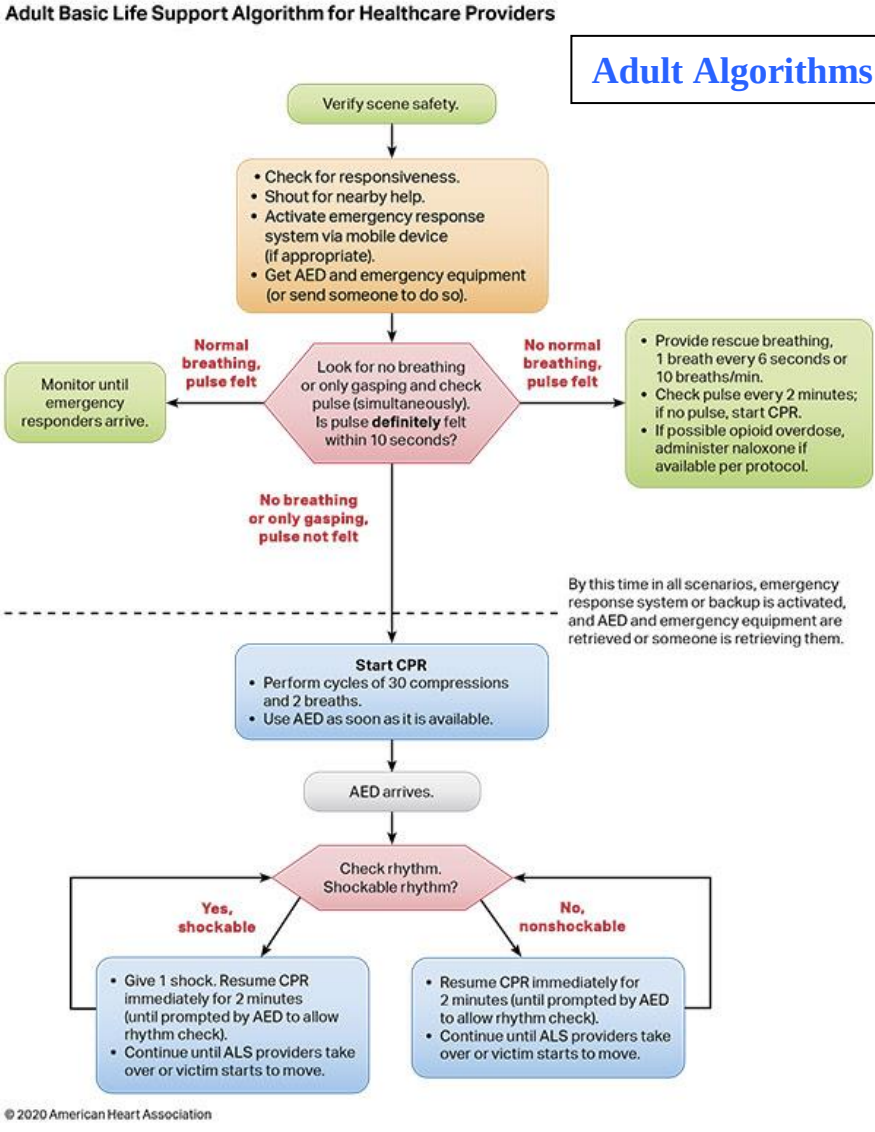
Pediatric Bradycardia With a Pulse Algorithm



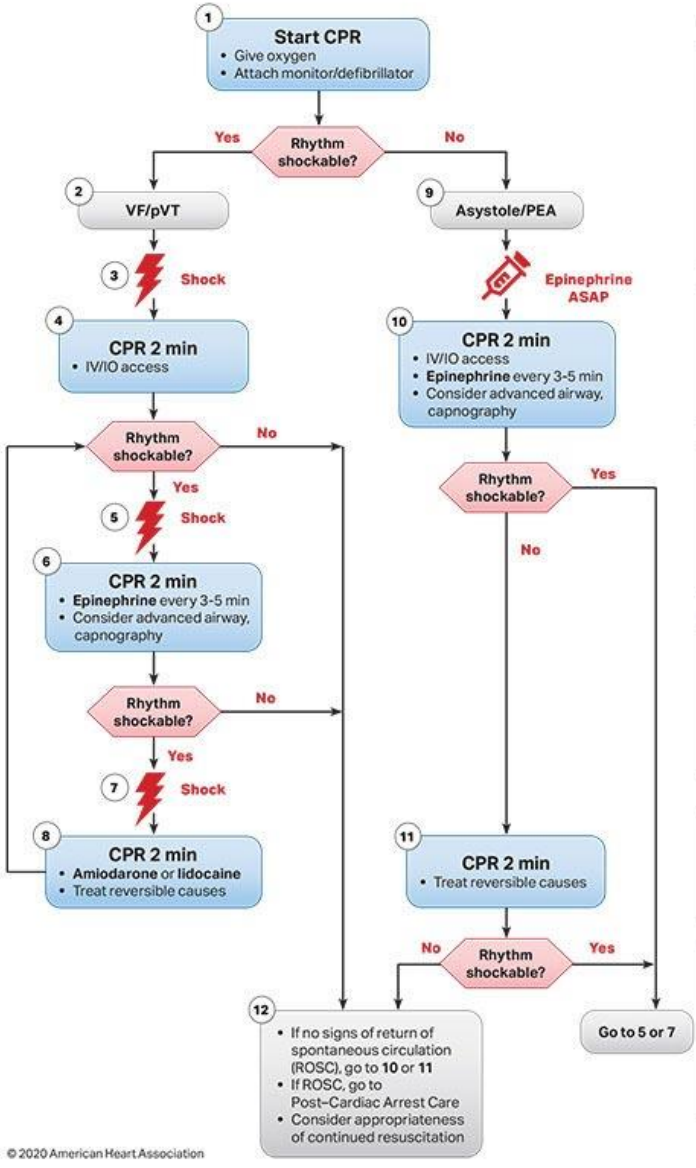
Pediatric Tachycardia With a Pulse Algorithm



Adult Algorithms



Adult Cardiac Arrest Algorithm (VF/pVT/Asystole/PEA)



CPR Quality

- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Change compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If $P_{ET}CO_2$ is low or decreasing, reassess CPR quality.

Shock Energy for Defibrillation

- **Biphasic**: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic**: 360 J

Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.
  or
  Lidocaine IV/IO dose: First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

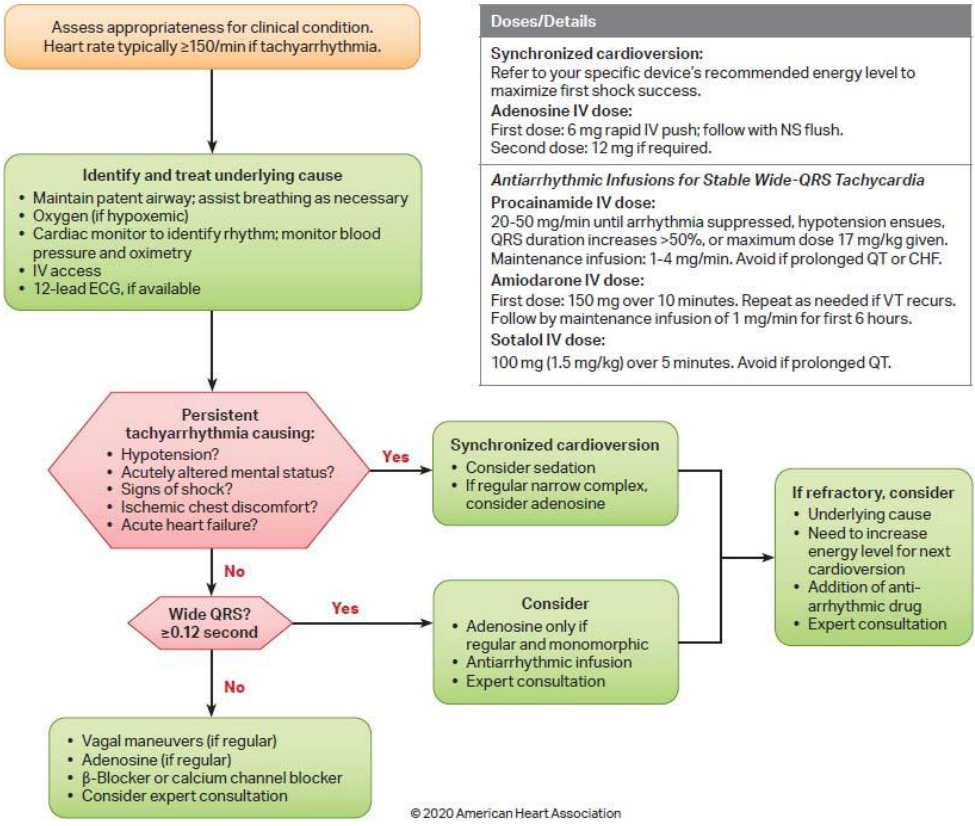
Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in $P_{ET}CO_2$ (typically ≥40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

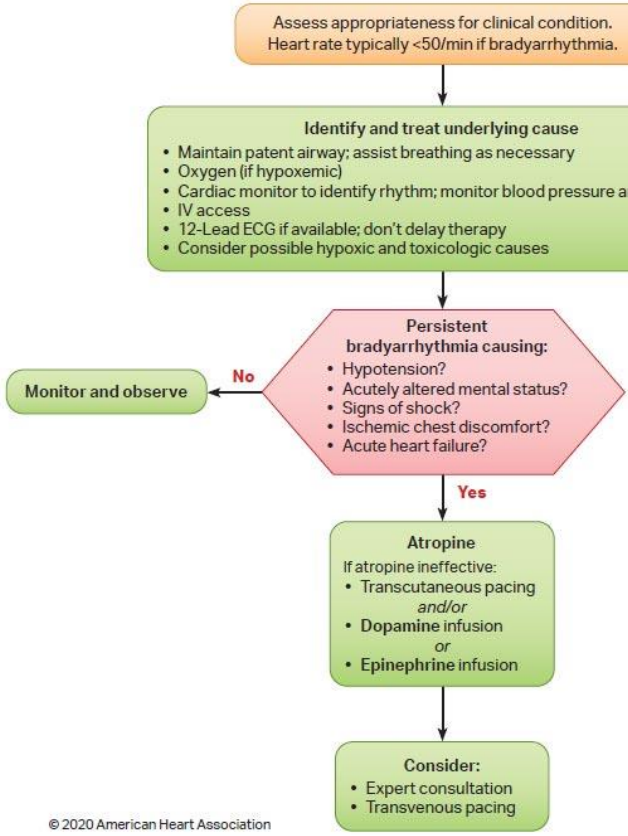
Reversible Causes

- **H**ypovolemia
- **H**ypoxia
- **H**ydrogen ion (acidosis)
- **H**ypo-/hyperkalemia
- **H**ypothermia
- **T**ension pneumothorax
- **T**amponade, cardiac
- **T**oxins
- **T**hrombosis, pulmonary
- **T**hrombosis, coronary

Adult Tachycardia With a Pulse Algorithm



Adult Bradycardia Algorithm



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Pediatric Cardiac Arrest Medications

Cardiac Meds:	Dose/Amount	Max Dose
Adenosine (3 mg/mL)	**Dose:** 0.1 mg/kg - 0.2 mg/kg **Amount: 0.033 -0.067 mL/kg**	**Max:** 6 mg (first dose) 12 mg (second dose)
Amiodarone HCl ** Add 150 mg = 3 mL amiodarone to 100 mL D5W Excel bag to make 1.5 mg/mL**	**Refractory Pulseless VT/VF:** 5 mg/kg rapid push over 1 min **Perfusing Tachyarrhythmias:** 5 mg/kg over 20-60 minutes **1.5 mg/mL volume** = 3.33 mL/kg	**Max:** 15 mg/kg/day OR 300 mg/dose for 1st dose & 150 mg/dose for 2nd dose
Atropine (0.1 mg/mL)	**Dose:** 0.02 mg/kg **Amount: 0.2 mL/kg**	**Max:** 5 mL
Calcium Chloride (100 mg/mL)	**Dose:** 20 mg/kg **Amount: 0.2 mL/kg**	**Max:** 10 mL
Epinephrine 0.1 mg/mL **"Code IV/IO Dose"** **May need to dilute 1 mg/mL concentration during shortage**	**Dose:** 0.01 mg/kg IV **Amount: 0.1 mL/kg IV** **Dilution instructions: Combine 1 mL of 1 mg/mL epinephrine with 9 mL of saline to make 0.1 mg/mL.**	**Max:** 10 mL IV/IO
Epinephrine 1 mg/mL **"Code ETT Dose"**	**Dose:** 0.1 mg/kg ETT **Amount: 0.1 mL/kg ETT**	**Max**: 2.5 mL ETT
Epinephrine 1 mg/mL **"Anaphylaxis IM Dose"**	**Dose:** 0.01 mg/kg IM **Amount: 0.01 mL/kg IM**	**Max**: 0.5 mL IM
Lidocaine 2% (20 mg/mL)	**Dose:** 1 mg/kg IV/IO/ETT **Amount: 0.05 mL/kg**	**Max**: 5 mL ETT or 10 mL IV/IO
Magnesium sulfate (40 mg/mL)	**Dose:** 50 mg/kg **Amount: 1.25 mL/kg**	**Max:** 50 mL

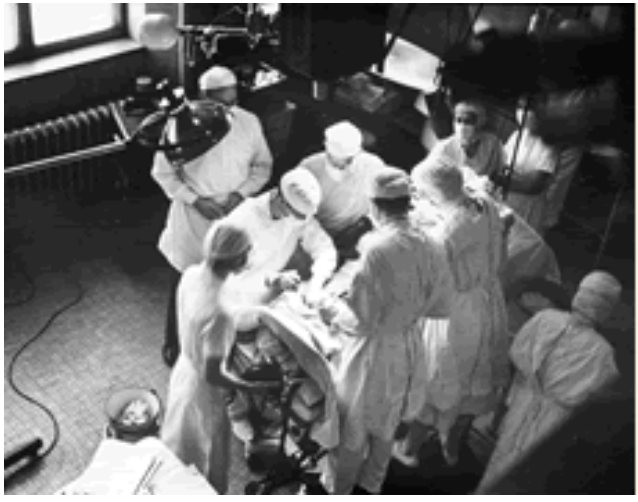
Naloxone (Narcan) (0.4 mg/mL) **Obtain from Omnicell**	**Dose:** 0.1 mg/kg **Amount: 0.25 mL/kg**	**Max:** 5 mL
Sodium Bicarbonate 8.4% (1 meq/mL)	**Dose:** 1-2 meq/kg/dose **Amount: 1-2 mL/kg**	**Max:** 50 mL
****Infant**** **Sodium Bicarbonate 4.2%** (0.5 meq/mL)	**Dose:** 1-2 meq/kg/dose **Amount: 2-4 mL/kg**	**Max:** 100 mL

Pediatric Emergency Team Dosing Recommendations

	Drug	Location	Dose
Anaphylaxis	Albuterol	Omnicell	Neb: 2.5 mg nebulized q 20 minutes prn or 15 mg/hr continuous neb
	Diphenhydramine	Omnicell	IV/IO/IM: 1-1.25 mg/kg (max 50 mg)
	IM Epinephrine (1 mg/mL)	Omnicell	**IM anterolateral thigh:** 0.01 mg/kg (max 0.3 mg) q 15 min prn
	Famotidine	Pharmacy	IV: 0.5 mg/kg (max 20mg)
	Methylprednisolone	Pharmacy	IV/IO/IM: 1-2 mg/kg (typical max 60 mg). [Can use hydrocortisone 1-2 mg/kg (max 100mg)]
Asthma	Albuterol	Omnicell	Neb: 2.5 mg nebulized q 20 minutes prn or 15 mg/hr continuous neb
	Racemic Epinephrine (2.25% nebulizer)	Omnicell	**Neb:** 0.05-0.1 mL/kg (max 0.5 mL). May repeat every 20 minutes
	SubQ Epinephrine (1 mg/mL)	Omnicell	**SubQ:** 0.01 mg/kg (max 0.3 mg) q 15 min prn
	Ipratropium	Omnicell	Neb: 250-500 mcg q 20 min prn for 3 doses
	Magnesium Sulfate	Pharmacy	IV/IO: 25-50 mg/kg (max 2 g) over 15-30 minutes
	Methylprednisolone	Pharmacy	IV/IO/IM: 1-2 mg/kg (typical max 60 mg)
Croup	Dexamethasone	Pharmacy	IV/IM/PO: 0.6 mg/kg (max 10 mg)
	Racemic Epinephrine (2.25% nebulizer)	Omnicell	**Neb:** 0.05-0.1 mL/kg (max 0.5 mL). May repeat every 20 minutes
Hyperkalemia	Albuterol	Omnicell	Neb: 2.5 mg nebulized q 20 minutes prn or 15 mg/hr continuous neb
	Calcium Gluconate	Cart	IV/IO: 50 mg/kg (max 2g) over 15-20 minutes
	Furosemide	Pharmacy	IV/IM: 1 mg/kg (typical max 20 mg)
	Insulin/Dextrose **Only to be ordered by PICU Fellow or Attending and given with supervision of PICU RN**	Omnicell	IV < 3 months and < 5 kg: Mix 0.1 units/kg of regular insulin with 5 mL/kg of D10W and administer over 30 minutes. Check blood sugar q 15 minutes x 4 IV ≥ 3 months and ≥ 5 kg: Mix 10 units of regular insulin in 50 mL D50W. Give 1 mL/kg (max 50 mL) over 30 minutes through central line (preferably). Check blood sugar q 15 minutes x 4
	Kayexalate (Sodium Polystyrene)	Pharmacy	PO: 1 g/kg/dose (max 15 g) PR: 1 g/kg/dose (max 50 g)
Hypo glycemia	Dextrose	D10: Storage room D50: Cart	IV/IO D10: Neonate: 1-2 mL/kg 1-6 months: 2.5-5 mL/kg ≥ 6 months: 5-10 mL/kg (max 250mL) IV (central)/IO D25: Mix D50 1:1 with NS and give 1-6 months: 1-2 mL/kg ≥ 6 months: 2-4 mL/kg (max 100mL)
	Glucagon	Omnicell	IV/IM/SubQ: ≤ 20 kg: 0.02-0.03 mg/kg or 0.5 mg >20kg: 1 mg
Opioid Reversal	Naloxone (Partial reversal)	Omnicell	IV/IO/IM/SubQ: 1-5 mcg/kg based on response 40 mcg/mL dilution: Mix 1 mL of 0.4 mg/mL vial in 9 mL saline 4 mcg/mL dilution: Follow above directions. Mix 1mL of 40 mcg/mL dilution with NaCl 9 mL
	Naloxone (Total reversal)	Omnicell	IV/IO/IM/SubQ: 0.1 mg/kg (max 2 mg)
Seizures	Lorazepam	Omnicell	IV/IM: 0.05-0.1 mg/kg (typical max 4 mg) over 2-5 minutes
	Fosphenytoin	Omnicell	IV/IM: Load 15-20 mg PE/kg (max 1g). MUST BE DILUTED. IV max concentration 25 mg/mL Administer at a rate of 3 mg PE/kg/min (max 150 mg PE/min)
	Phenobarbital	Omnicell	IV: Load 15-20 mg/kg (max 1g)

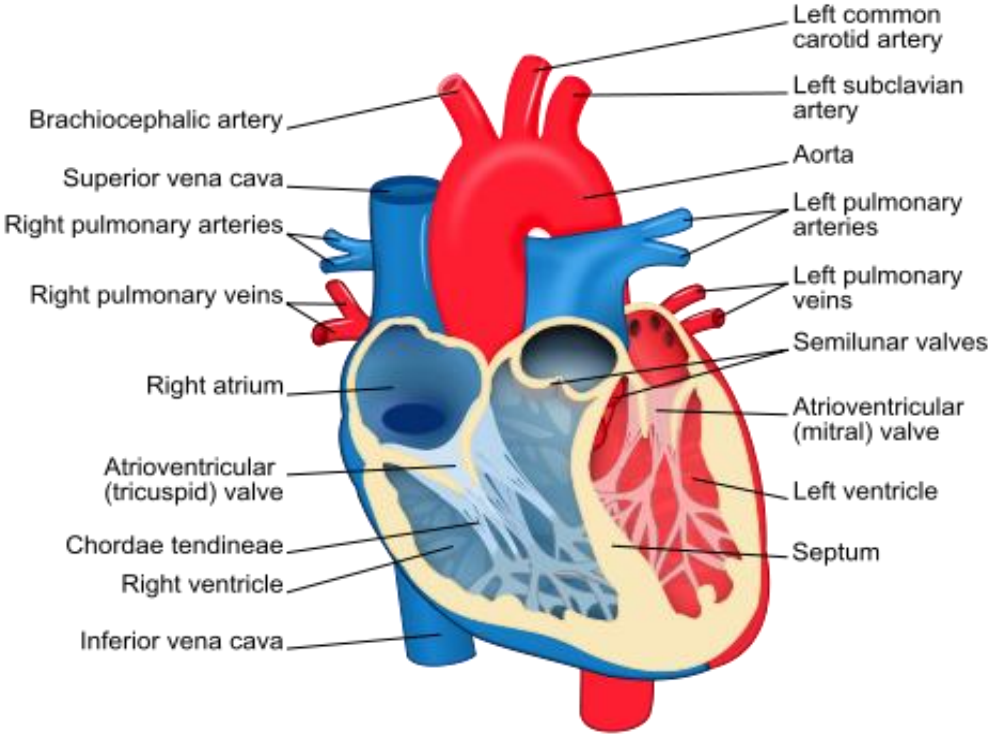
Emergency Contact Numbers & Pagers					
PET	Call 147	PICU Fellow	Call 57949	PICU Charge Nurse	Call 57979
Pediatric code	Call 147	Peds ENT	Page 3687	Pharmacist on call	Page 4230
Adult code	Call 147	Anesthesia	Page 7000		

Cardiovascular System



"At first people refuse to believe that a strange new thing can be done, then they see it can be done- then it is done and all the world wonders why it wasn't done centuries ago."
-*The Secret Garden,* Frances Hodgson Burnett, 1911

Normal Heart Anatomy



ZooFari (2010). Retrieved August 31, 2010 from http://en.wikipedia.org/wiki/File:Heart_diagram-en.svg

Cardiovascular Assessment

Inspection

- Observe the overall appearance of the child: state of alertness, activity level
- Color (central and peripheral)
- Oral mucosa
- Chest (size, shape, and symmetry)
- Respiratory (rate, rhythm, work of breathing)
- Presence of edema
- Clubbing

Palpation

- Skin temperature, turgor
- Fontanels in infants
- Peripheral pulses (location, rate, rhythm, strength)
- Blood pressure (LAST vital sign to indicate a child is in trouble)
- Capillary refill—normal < 2 seconds
- Chest (thrills, point of maximal impulse)

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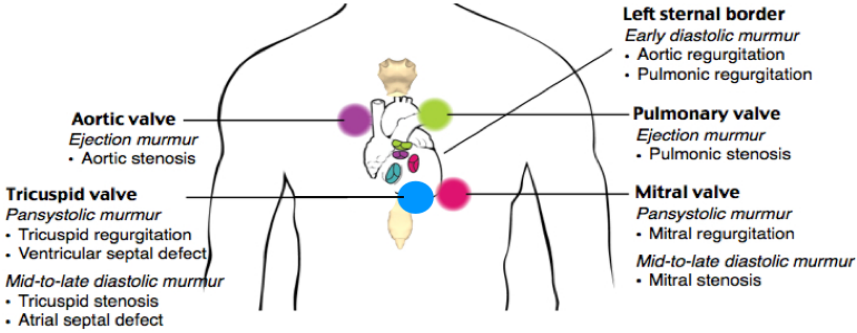
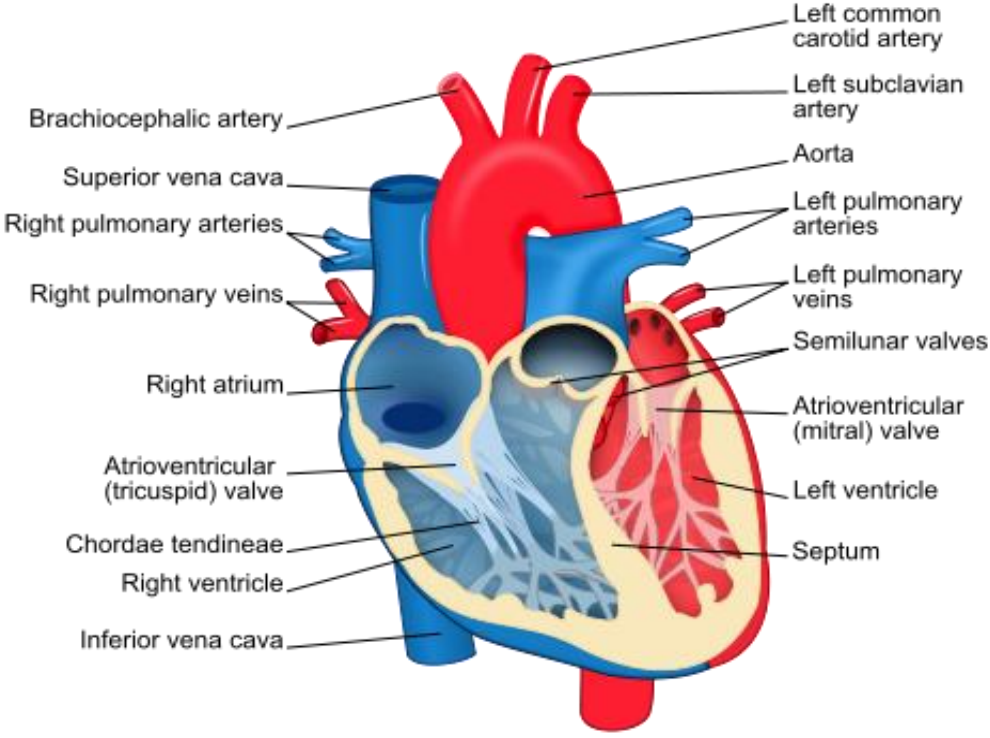
Cardiac Murmurs



Valve	Side Best Auscultated	Location
Aortic valve	Right	2nd intercostal space, just lateral to the sternum
Pulmonic valve	Left	2nd intercostal space, just lateral to the sternum
Tricuspid valve	Left	4th-5th intercostal space, over left sternal border
Mitral valve	Left	5th intercostal space, midclavicular line (Apex)

Normal Heart Anatomy



ZooFari (2010). Retrieved August 31, 2010 from http://en.wikipedia.org/wiki/File:Heart_diagram-en.svg

Congenital Heart Defects

Aortic Stenosis (AS)- Narrowing of the aortic valve;

- Palliation is by balloon valvuloplasty in infancy
- Repair is often done first but replacement with a mechanical valve or with a Ross procedure (the pulmonary valve is moved to the aortic position and an RV-PA conduit is placed in the native pulmonary position) often indicated in later years.

Atrial Septal Defect (ASD)- Hole in the atrial septal wall which allows blood to move from left atrium (high pressure) to right atrium (low pressure)

- Certain types can be closed by transcatheter placement of an occluding device.
- Surgical closure is commonly with a stitch or a pericardial patch.

Atrioventricular Canal Defect (AV Canal)- Hole in both atrial and ventricular septal walls that allows blood to move from left side of heart (high pressure) to right side of heart (low pressure);

- *A partial AVC* is an ASD and a cleft in the mitral valve
- *A transitional AVC* is an ASD, a mitral cleft, and a small VSD
- *A complete AVC* is an ASD and a large VSD with a very abnormal common AV valve
  - Repair is done by closing the septal defects and suturing together the cleft in the mitral valve.

Coarctation of the Aorta (CoA) - The aorta is pinched or constricted obstructing blood flow from the heart to the rest of the body;

- Repair is usually through a thoracotomy with excision of the narrow area and reconnection of the aorta.

Hypoplastic Left Heart Syndrome (HLHS) - The left side of the heart- including the aorta, aortic valve, left ventricle, and mitral valve- is underdeveloped; survival depends on a PDA and a PFO/ASD;

- Total repair involves 3 stages, the Norwood (or Sano), the bidirectional Glenn, and the Fontan
- The Norwood, done in the neonatal period, consists of aortic reconstruction, removal of the atrial septum, and placement of a Blalock Taussig (BT) shunt. This procedure is called a Sano if an RV to PA conduit is used instead of a BT shunt.
- The bidirectional Glenn involves connecting the superior vena cave with the pulmonary arteries. The BT shunt is taken down here.
- The Fontan procedure involves connecting the inferior vena cava to the pulmonary arteries.

Patent Ductus Arteriosus (PDA)- Connection between the pulmonary artery and the aorta in which oxygenated blood moves from aorta (high pressure) to pulmonary artery (low pressure);

- This often closes spontaneously in infancy but can be ligated through a thoracotomy or an occluding device can be placed through a catheter.

Pulmonary Atresia- Absent pulmonary valve makes it impossible for blood to flow from the right ventricle into the pulmonary artery (PA) and into the lungs; the right ventricle is typically small; survival depends on a PFO/ASD and a PDA; and another route for blood to get to the lungs (PDA or aortopulmonary collaterals APCs). In certain circumstances, a 'plate-like' obstruction between the RV and the PAs can be perforated in the cath lab.

- Correction depends on the size of the right ventricle – if small, the patient may undergo a 3-stage correction with a BT shunt, a bidirectional Glenn, and a Fontan (see hypoplastic left heart syndrome repair). If the RV is adequate, an RV-to-PA conduit can connect the RV to the PAs.

Pulmonary Stenosis (PS)- Narrowing of the pulmonary valve;

- This defect can be palliated with balloon valvuloplasty
- Correction is by repair of the valve or replacement with a mechanical or tissue valve

Tetralogy of Fallot (TOF)- Consists of four defects 1) ventricular septal defect 2) pulmonary stenosis 3) right ventricular hypertrophy 4) overriding aorta.

- Repair consists of VSD closure with a patch, and reconstruction of the RV outflow track obstruction.

Tetralogy of Fallot/Pulmonary Atresia (TOF/PA)- similar to TOF with pulmonary stenosis but the pulmonary valve is absent. There are 4 types ranging from less (a main PA is present) to more severe forms (there are no native pulmonary arteries). Pulmonary blood flow is provided by a PDA or APCs (see pulmonary atresia).

Total Anomalous Pulmonary Venous Connection- The pulmonary veins that return blood from the lungs aren't connected to the left atrium, instead the pulmonary veins drain through abnormal connections to the right atrium; survival dependent on presence of ASD/PFO;

- Repair is variable depending on the abnormal connections.

Transposition of the Great Arteries (TGA)- The great vessels are reversed so the aorta is connected to the right ventricle (carrying unoxygenated blood to the body) and the pulmonary artery is connected to the left ventricle (carrying oxygenated blood back to the lungs); Parallel circulation, survival depends on ASD/PFO, or PDA to provide mixing of oxygenated and unoxygenated blood;

- Repair is done by switching the great vessels so that are connected to the appropriate ventricle.

Tricuspid Atresia- Absent tricuspid valve makes it impossible for blood to pass from the right atrium to right ventricle, associated with a small right ventricle; survival depends on presence of PFO/ASD and PDA (VSD is also often present);

- Correction consists of a BT shunt, followed by the bidirectional Glenn, and the Fontan operation (see hypoplastic left heart syndrome repair).

Truncus Arteriosus- Malformation in which one artery arises from the heart and forms the aorta and pulmonary artery, defect also includes a large VSD;

- Repair consists of closing the VSD with a patch, connecting the single great vessel to the left ventricle, and placing an RV-to-PA conduit.

Ventricular Septal Defect (VSD)- Hole in ventricular septal wall which allows blood to move from left ventricle (high pressure) to the right ventricle (low pressure);

- Repair consists of patch closure of the defect.

Cardiopulmonary Bypass Terms

Aortic Cross-clamp (AoX) or Cross-clamp time (CCT): Time from application of clamp on aorta to removal of clamp off of aorta. Required in order to stop the heart.

Beating Heart Bypass: Partial bypass, heart partially full (volume) and electrically active.

Cardioplegia: In Latin *cardio* means heart and *plegia* means paralysis.

Cardioplegic solution: is a high potassium solution that paralyzes the heart. The solution is mixed with blood and infused into the coronary circulation to cause asystole. This is reversed over time by normal metabolic mechanisms present within the cell.

Cardiopulmonary Bypass (CPB) time: The time from going on heart-lung machine to coming off heart-lung machine

Deep Hypothermic Circulatory Arrest (DHCA) The use of profound systemic hypothermia to preserve organ function during cessation of the circulation

Deep Hypothermic Circulatory Arrest (DHCA) time: Time from cessation of total body perfusion (heart not beating, heart-lung machine off) to reinstitution of total body perfusion.

Near-infrared Spectroscopy (NIRS): Used to monitor regional oxygen saturation of brain and/or kidneys before, during, and after cardiopulmonary bypass.
Normal values:

- Cerebral = 30% lower than arterial oxygen saturation (70% if sat 100%)
- Renal = 10% lower than arterial oxygen saturation (90% if sat 100%)

Abnormal values:

- Any decline of 20% or greater from baseline (cerebral & renal)
- Cerebral = any value <40% is a critical level, needs immediate intervention
- Renal = Any value <60% merits immediate intervention

Regional low-flow perfusion (RLFP)/Selective Antegrade Cerebral Perfusion time: Time from the start of brain selective perfusion (but no other body perfusion) to resumption of total body perfusion

Common Cardiac Surgical Procedures

- **Arterial Switch**- An anastamosis of the Ao and the PA to the proper ventricle. The coronary arteries are reimplanted; used as a corrective procedure to create the proper relationship between ventricles and great arteries in transposition of the great arteries.
- **Arterioplasty**- Any reconstruction of an artery. Reconstruction of a pulmonary artery would be a pulmonary arterioplasty that involving the aorta would be an aortoplasty.

Common Cardiac Surgical Procedures

- **Central Shunt** – A gortex tube connection from the inominant artery or aorta to the PA to palliate low pulmonary blood flow lesions
- **Damus-Kaye-Stanzel (DKS)** - A PA end-side anastamosis to Ao, used as a corrective surgery to increase flow to Ao where there is aortic stenosis
- **Fontan**- An anastamosis or conduit between the RA/IVC/SVC and PA, used as a corrective surgery to establish separate pulmonary blood flow in cases of single ventricle anatomy/physiology. This is the final stage of a single ventricle repair and is usually done at about 2 years-of-age.
- **Glenn**- An anastamosis of the SVC to PA, used as a palliative procedure to increase pulmonary blood flow in cases of single ventricle anatomy/physiology . This is an intermediate step leading to the final Fontan operation and is usually done at 3 to 6 months-of age.
- **Hybrid**– Bilateral PA bands and PDA stent, an alternative to the Norwood or Sano procedure for hypoplastic left heart (HLHS)
- **Konno**- The replacement of the Aortic Valve (AV) with AV annular enlargement, used as a corrective procedure to alleviate subaortic obstruction and replace abnormal AV
- **Modified Blalock-Taussig (BT) Shunt**- A Gortex tube connection from the subclavian artery to the PA, used as a palliative surgery to increase pulmonary blood flow
- **Norwood**- Reconstruction of the aorta using the PA, removal of the atrial septum, and placement of a BT shunt. A first stage palliative procedure in hypoplastic left heart syndrome.
- **Patch**- The surgical closure of a hole or surgical incision
- **PA Band**- Constrictive band placed around pulmonary artery, palliative surgery to restrict blood flow to the lungs
- **PDA Ligation**- Ties off PDA, used as a corrective procedure to close this shunt
- **Rastelli**- A valved conduit from RV to PA, used as a corrective procedure to increase pulmonary blood flow, may establish proper sequence of flow to Ao and PA
- **Ross**- Replacement of the aortic valve and valve root with the patient's own pulmonary valve; also know as a pulmonary autograft procedure.
- **Sano** - Reconstruction of the aorta using the PA, removal of the atrial septum, and placement of an RV-to-PA conduit. A first stage palliative procedure in hypoplastic left heart syndrome.
- **Unifocalization**- Involves bringing together APCs that arise from the descending aorta and connecting them to a BT shunt or an RV-to-PA conduit. Generally done as a first stage palliation in certain severe forms of TOF/PA.
- **Valve Replacement**- Replaces any valve, used as a corrective procedure to relieve obstruction or regurgitation
- **Valvuloplasty**- repair of any valve used to correct regurgitation

Medtronic Pacemaker Cheat Sheet Continued

Most common modes are: **DDD**, **AAI**, & **VVI**

Pacemaker settings the nurse needs to know:

- Lower rate (found on display)
- Output (found on display)
- * Mode (found in menu 1)
- * Upper Rate Limit (found in menu 2)

Safety:

- **Extra battery** (9-Volt) should be at bedside when pacemaker is in use.
- Check upper left-hand corner of **pacemaker with every patient assessment for low battery indicator.** (Pacer will function for approximately 24 hours once the low battery indicator is lit, varying with set rate and outputs).
- If low battery indicated, the battery must be changed. To change the battery, press the battery release drawer until battery drawer opens. Remove old battery and replace with new 9-Volt battery. ****Make sure the drawer clicks shut -pacing is maintained for 15 seconds without battery.**
- Battery must be changed every 3 days with MD present.
- The **lock indicator** should appear in the upper right-hand corner of the pacemaker. (This safety feature indicates parameters are locked and cannot be changed accidentally by the patient.) To change settings, press the lock button. This will allow settings to be changed. When finished, press lock again to re-lock pacemaker.
- If the physicians want to view the patient's intrinsic rhythm, the **pause** key may be pressed and held. **CAUTION: Use the pause with care, since the patient is without pacing support when pause is pressed and held!**
- The physician should check threshold every day since it may increase during external cardiac pacing.
- Patient may have external pacing pads on or at the bedside (remember external pacing pads must be changed every 24 hours or more often if used)
- Familiarize yourself with the defibrillator pacing mode in case you would have to externally pace
- Have a backup pacemaker at your bedside. When turned on, the pacemaker will default to a DDD mode, lower rate limit of 80, and 10 miliamps for both atrial and ventricular outputs

Nursing Responsibilities:

- Monitor patient's rhythm and watch for changes. Run a strip at the beginning of your shift so you can compare it to the child's rhythm throughout the day.
- Monitor vital signs, perfusion, and pulses.
- **Remember, a rhythm does not equal cardiac output! It is the electrical activity!!**

Be prepared for an emergency, especially when your patient is totally dependent on the pacemaker!

AT THE FOREFRONT OF KIDS MEDICINE
UChicago Medicine
Comer Children's

PICU Cardiac Surgery

Pacemaker Information

THINGS TO REMEMBER:

- Always have a back-up pacemaker in the room
- Always have at least two AA batteries in the room
- Pacemaker must be checked with every assessment for low battery
- Battery must be changed whenever **two bars** remain on the battery life indicator
- Label pacemaker with the date of battery change
- Blue cable/connection =**ATRIAL** wire
- White cable/connection =**VENTRICULAR** wire
- **Green** light indicates pacing, **Blue** light indicates sensing
- Patients with pacing wires **cannot have an MRI**

RN RESPONSIBILITIES:

- Monitor patient's rhythm and watch for changes
- Ensure EKG monitor is setup on pacing mode when pacemaker is in use
- Print, evaluate, & document an EKG strip every shift & PRN
- Monitor vital signs, perfusion, and pulses
- Ensure that an updated order for pacemaker settings is placed when changes are made
- Document pacemaker settings in the patient's chart
- Ensure pacemaker screen is locked while in use

CHANGING THE BATTERY:

1. Make sure an MD is at the bedside
2. Set-up the extra pacemaker with a new battery to the current ordered settings.
3. Have another MD or RN double check settings.
4. Change out the battery from the pacemaker currently pacing the patient. Once batteries are removed you have **30 seconds** before the pacemaker powers OFF.
5. In the event the current pacemaker stops pacing/loses power, switch over cables from current pacemaker to back-up pacemaker.
6. Make sure to label the pacing pacemaker with date of new battery.
7. Chart battery replacement in EPIC and a note describing the event if needed.

Last Revised by M.G. 3/15/19

ECG INTERPRETATION CHEAT SHEET

Maximum PR Intervals for Age & Heart Rate						
Age	<71	71-90	91-110	111-120	131-150	>150
<1 month			0.11	0.11	0.11	0.11
1-9 months			0.14	0.13	0.12	0.11
10-24 mo			0.15	0.14	0.14	0.10
3-5 years		0.16	0.16	0.13		
6-13 years	0.18	0.18	0.16	0.16		
>13 years	0.20	0.20	0.20			

Normal QRS Durations For Age	
Age	QRS Duration (seconds)
NB-2 years	0.03-0.08
3-10 years	0.04-0.09
>10 years	0.04-0.10

Measurement	Seconds
One little box	0.04 seconds
One big box (5 little boxes)	0.2 seconds

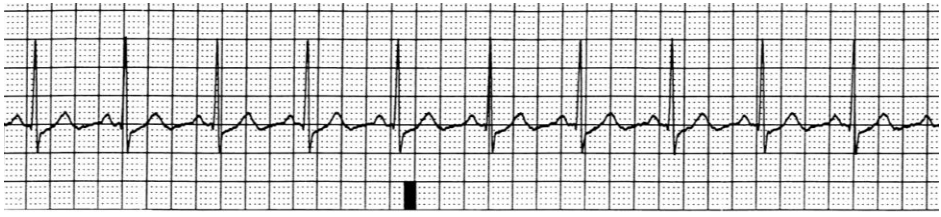
Normal QT Intervals for Heart Rate	
Heart Rate (BPM)	QT Interval (Seconds)
40 50 60	0.38-0.50 0.36-0.48 0.34-0.46
70	0.32-0.43
80	0.29-0.40
90	0.27-0.37
100	0.26-0.35
120	0.24-0.32
150	0.21-0.28
180	0.19-0.27
200	0.18-0.25

From: Duszynski, S. (2003). Pediatric ECG Interpretation 3rd Ed. Milwaukee, Wis; Maxishare.

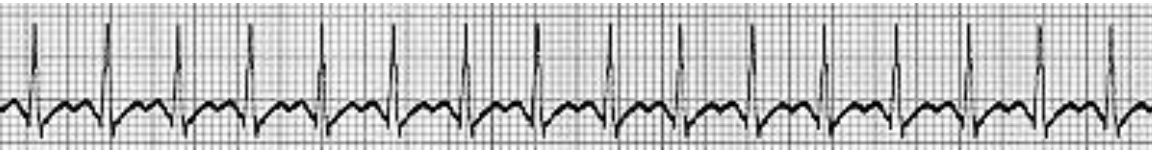
ECG Interpretation

Normal Electrocardiogram
P wave – represents depolarization of both atria
PR interval – represents the time it takes for the stimuli to spread through the atria and pass through the AV junction (this physiologic delay allows the ventricle to fill fully before ventricular depolarization occurs)
QRS complex – represents depolarization of the ventricles
ST segment – represents the beginning of ventricular repolarization, usually not elevated or depressed more than 1 mm from the isoelectric line (PR segment)
T wave – represents repolarization of the ventricles
QT interval – represents ventricular depolarization and repolarization
U wave – may represent depolarization of the Purkinje system

Sinus Rhythm

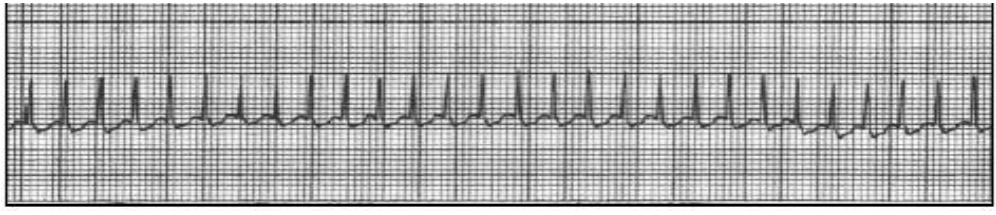


SinusTachycardia



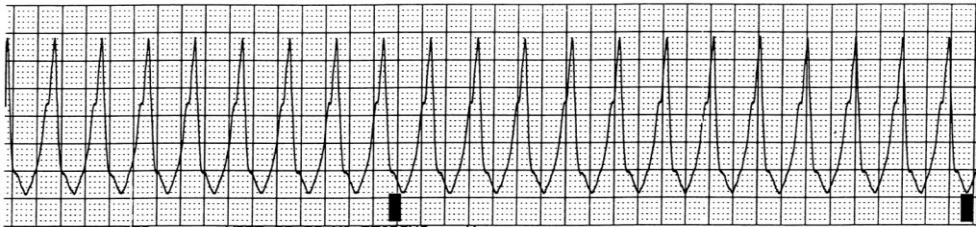
Definition: Sinus node discharge higher than normal for age
Etiology: Nonspecific clinical sign rather than an dysrhythmia resulting from anxiety, pain, fever, blood loss, dehydration, sepsis, or shock
Clinical significance: Typically develops in response to a need for increased cardiac output or oxygen delivery
Treatment: Treat underlying cause; because tachycardia is a symptom, attempts to decrease rate are inappropriate

Supraventricular Tachycardia



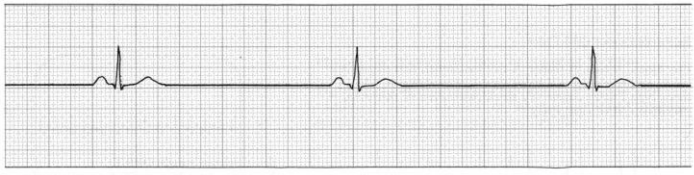
Definition: A rapid, regular rhythm commonly caused by a reentry mechanism that involves an accessory pathway and/or the AV conduction system.
EKG characteristics: Heart rate usually > 180 bpm in children & > 220 bpm in infants. P waves may be difficult to identify, especially when the ventricular rate is high.
Clinical significance: If prolonged, decreased filling time can lead to decreased CO
Treatment: Synchronized cardioversion or adenosine -consider vagal maneuvers. See PALS algorithm for tachycardia with/without adequate perfusion.

Ventricular Tachycardia



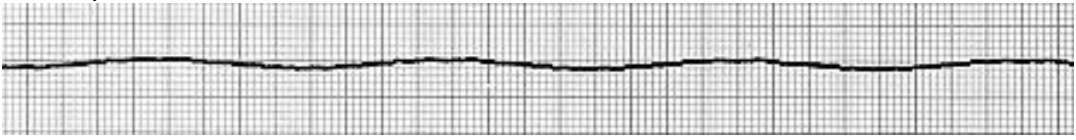
Definition: An irritable ventricular focus fires regularly at a rate faster than the SA node, atria, or AV node causing it to override them. The rate is regular, and the ventricular rate is 150-250bpm. Atrial rate is undeterminable. QRS complexes are wide & bizarre.
Etiology: Uncommon in pediatrics. Potential causes could include: acute hypoxemia, acidosis prolonged QT syndrome, underlying structural heart disease, electrolyte imbalance, drug toxicity (tricyclic antidepressants), and poisons
Clinical significance: Compromised stroke volume & CO may degenerate into vfib
Treatment: may include synchronized cardioversion, defibrillation, amiodarone, lidocaine or procainamide. See PALS algorithms for tachycardia and pulseless arrest

Sinus Bradycardia



Definition: Slow conduction through normal pathways, rate is slower than normal for age
Etiology: Usually a result of hypoxemia, hypotension, hypothermia, or acidosis resulting in an interference with the normal function of the sinus node and AV node
Clinical significance: Associated with poor systemic perfusion and should be treated in any infant or child even if B/P is normal
Treatment: Consider underlying cause; see PALS bradycardia algorithm

Asystole



Definition: A form of pulseless arrest associated with absent cardiac electrical activity; clinical confirmation (check for pulse, spontaneous respirations) is required since a straight line can also be caused by a loose lead.

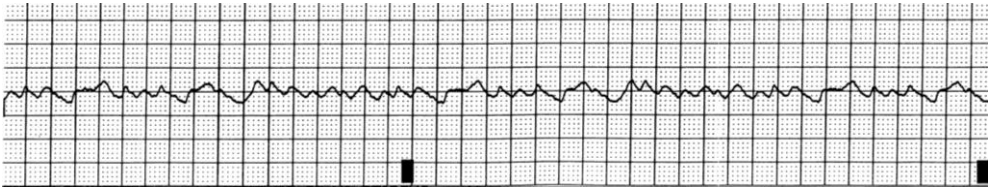
Asystole cont'd

Etiology: untreated bradycardia, hypoxia, acidosis, hypothermia, Digoxin toxicity, hypokalemia, excessive vagal stimulation, increased ICP

Clinical significance: life threatening, rarely recover without neurological sequelae

Treatment: See PALS algorithm for pulseless arrest

Ventricular Fibrillation (V-fib)



Fibrillation (V-fib)

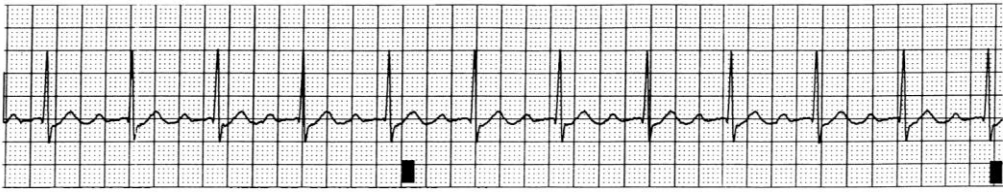
Definition: Multiple ventricular foci become irritable and generate uncoordinated chaotic impulses causing the heart to fibrillate; the rhythm is chaotic and undefinable; rate cannot be determined

Etiology: hypoxia, acidosis, hypothermia, hypokalemia, hyperkalemia, cardiomyopathies

Clinical significance: extremely life-threatening

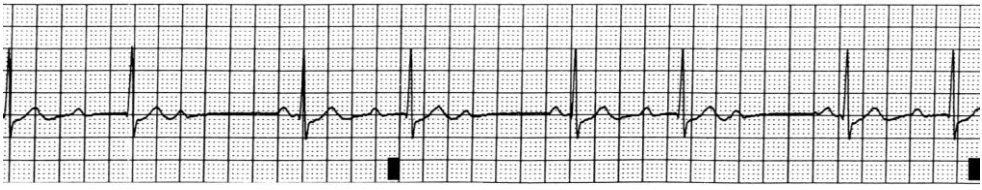
Treatment: See PALS algorithm for pulseless arrest

Heart Block –First Degree



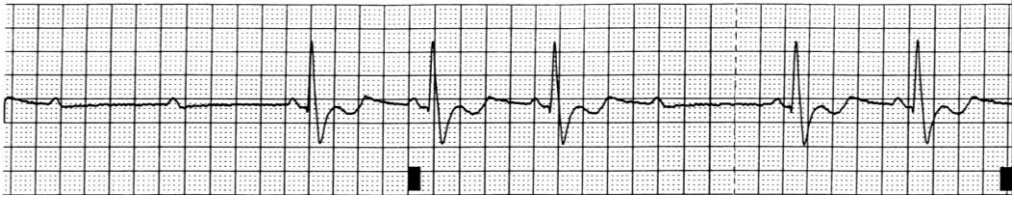
Definition: Sinus impulses are delayed in the AV node, but all are conducted to the ventricles. PR interval is longer than normal for age and heart rate.
Etiology: digoxin therapy, congenital heart disease (AV canal) or following cardiac surgery
Clinical significance: Does not compromise hemodynamic stability no specific treatment required. Close monitoring indicated to detect progression to a more severe AV block

Heart Block –Second Degree Type 1 (Mobitz I – Wenkebach)



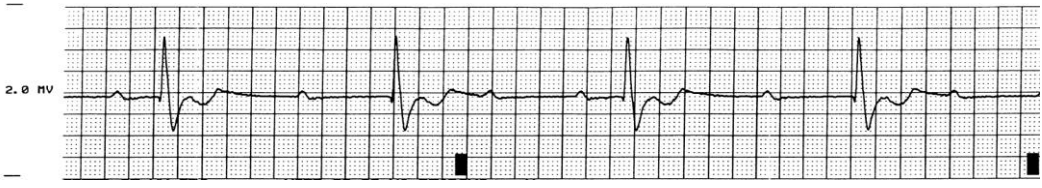
Definition: Transmission through AV node takes longer with each successive impulse until an impulse fails to be conducted to the ventricles. PR progressively lengthens from complex to complex until one p wave is not followed by a QRS.
Etiology: Ischemia or cardiovascular surgery
Clinical significance: Usually temporary and typically subsides within 72-96 hours; not likely to progress, does not require treatment

Heart Block – Second Degree Type 2 (Mobitz II)



Definition: Conduction defect below the level of the AV node where some of the sinus impulses fail to conduct to the ventricles. Atrial rate is normal, ventricular rate depends on level of conduction. PR interval is always consistent
Etiology: Ischemia or cardiovascular surgery
Clinical significance: Uncommon in children but worrisome; it often progresses to complete heart block.
Treatment – Externally pace child
****NOTE** Atropine in contraindicated. It can produce complete heart block**

Heart Block – Third Degree I (Complete Heart Block)



Definition: All sinus impulses are blocked. None of the impulses reach the ventricle.; the atria and ventricles beat independently of one another; p waves are usually regular with a rate > than QRS
Etiology: May be congenital, may follow cardiac surgery, or may be seen with inflammatory diseases of the heart
Clinical significance: Potentially lethal dysrhythmia that requires immediate intervention
Treatment – Externally pace child

Defibrillation and Cardioversion

Defibrillation - the untimed (asynchronous) depolarization of the myocardium that allows a spontaneous organized beat to be initiated

- **Indications**: ventricular fibrillation, pulseless v-tach
- **Pad placement**:
  - one pad directly over heart (pt's left nipple) and other pad on back directly behind first pad (on pt's left scapula) –Pads only
- **Energy dose**: infants and children 2 J/kg initially, then increase to 4 J/kg (max 200J with biphasic defibrillators.)

Cardioversion – the timed (synchronous) depolarization of the myocardial cells, so to avoid the vulnerable period in the cardiac cycle. The electrical stimulation coincides with the patient's R-wave

- **Indications**: stable ventricular tachycardia, SVT with cardiovascular instability, and atrial fibrillation
- **Paddle placement**: same as defibrillation

Energy dose: 0.5 – 1 J/kg initially, then increase to 2 J/kg

Safety:

1. Prepare patient (remove gown, all medication patches, ensure patient is dry)
2. Confirm all personnel are not touching patient or patient bed
3. Ensure all oxygen is removed from bedside
4. Never carry charged paddles to or from patient. Charge paddles only once pressed to patient.

"I'm clear. You're clear. Oxygen clear."

For "Quick look" to see patient's rhythm – place pads/paddles on pt's chest, turn knob to "manual on", be sure lead is set to "pad" or "paddles" NOT "lead 1", or "lead 2" etc.

****ALL DEFIBRILLATORS IN COMER ARE PADDLELESS EXCEPT ONE, WHICH IS HOUSED IN THE PICU****

Zoll R-Series Defibrillator

When are pediatric pads vs adult pads used?

- Pediatric pads are for <8 yrs of age and/or <25kg
- Adult pads are for >8 yrs and/or >25kg

How frequent are defib checks to be completed?

- Per policy Q shift in areas that function 24 hrs
- Daily on days of operation for areas not open 24 hrs

When doing a manual defibrillator test why do you charge to 30j, disarm by changing energy to 20j then charge back to 30j to then deliver the "test shock"?

- The purpose of this step is to ensure that the "disarm" feature of the defibrillator is working.

Is it ok to deliver test shock into the pads? Are the pads still good for use?

- Yes, the pads are grounded

When doing a manual test of the defibrillator ensure the following:

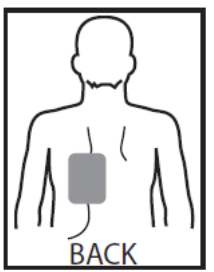
- Pads are connected and not expired
- Defibrillator is plugged into a power outlet
- Battery pack is loaded into the defibrillator

A strip will print verifying a manual defibrillator check only when the check is done in manual mode NOT in AED mode.

Defibrillator pad placement should be front/back as seen below:

Anterior-Posterior (AP)

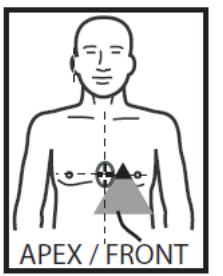
Recommended for defibrillation, noninvasive pacing, ventricular cardioversion and ECG monitoring. Optimal for noninvasive pacing because it increases patient tolerance and decreases capture thresholds.



Back (Posterior):

Grasp the Back electrode at the wire exit and peel away the plastic liner. Place to left of the spine just below the scapula at heart level.

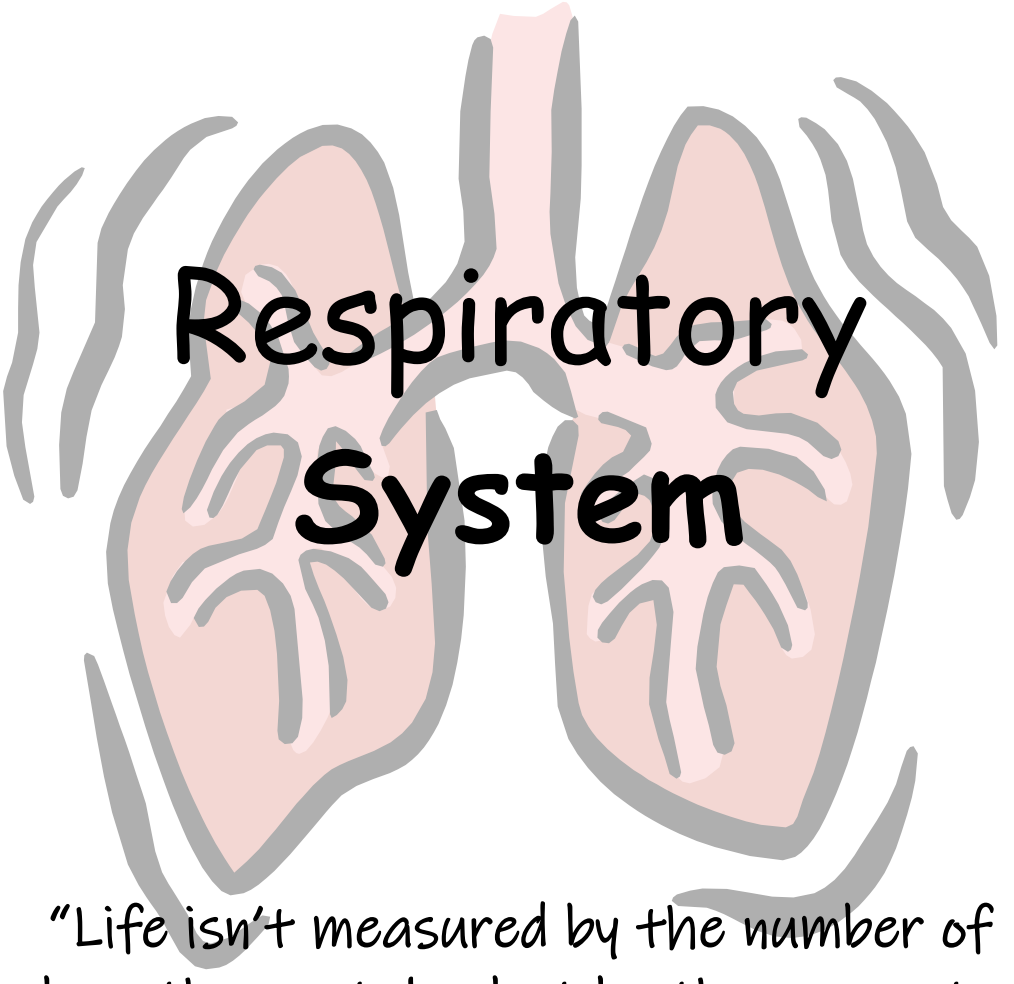
⚠ Always apply Back electrode first. If Front electrode is already in place when patient is being maneuvered for placement of the Back, the Front may become partially lifted. This could lead to arcing and skin burns.



Apex / Front (Anterior):

Grasp the Apex/Front electrode at the wire exit and peel away the plastic liner. Apply over cardiac apex between the mid line of the chest and nipple on a male patient, with the shaded "point" facing up. Position under breast on female patient.

⚠ Avoid any contact between nipple and gel treatment area. Skin of the nipple area is more susceptible to burning.



Respiratory System

"Life isn't measured by the number of breaths we take, but by the moments that take our breath away"

Assessment of Respiratory Distress*			
	MILD	**MODERATE**	**SEVERE**
Airway	• Stridor on exertion/crying	• Some stridor at rest	• Stridor at rest
Behaviour & Feeding	• Normal • Talks in sentences	• Some/intermittent irritability • Difficultly talking/crying • Difficultly feeding or eating	• Increased irritability and/or lethargy • Looks exhausted • Unable to talk or cry • Unable to feed or eat
Respiratory Rate	• Mildly increased	• Respiratory rate in orange zone	• Respiratory rate in purple zone • Increased or markedly reduced respiratory rate as the child tires
Accessory Muscle Use	• Mild intercostal and suprasternal recession	• Moderate intercostal and suprasternal recession • Nasal Flaring	• Marked intercostal, suprasternal and sternal recession
Oxygen	• No oxygen requirement	• Mild hypoxemia corrected by oxygen • Increasing oxygen requirement	• Hypoxemia may not be corrected by oxygen
Other		• May have brief apnoeas	• Gasping, grunting • Extreme pallor, cyanosis • Increasingly frequent or prolonged apnoeas

Clinical Signs of Respiratory Distress VS Respiratory Failure

Respiratory Distress	Respiratory Failure

• Tachypnea
• Increased respiratory effort
  ○ Nasal flaring
  ○ Retractions
• Inadequate respiratory effort
  ○ Stridor
  ○ Wheezing
  ○ Grunting
• Tachycardia
• Pale, cool skin
• Changes in Level of Consciousness
	• Marked Tachypnea (early sign)
	• Bradypnea (late sign)
	• Increased, decreased or NO respiratory effort
	• Poor to absent distal air movement
	• Tachycardia (early sign)
	• Bradycardia (late sign)
	• Cyanosis
	• Stupor, coma (late sign)

Blood Gas Interpretation

Anion gap = [Na – (Cl + HCO3)]

Normal anion gap = 8 –12 meq/L
Abnormal anion gap > 12 – 15 meq/L

	pH	pCO2	HCO3	PO2	Base Deficit
Normal ABG range	7.35- 7.45	35 – 45	22 – 28	80 – 100	+/- 2
Normal VBG range	7.31 – 7.41	41 –51	22 – 26	35 –40	Variable
Resp. Acidosis	Decreased	Increased	Normal or Increased	Normal or Decreased	Normal
Resp. Alkalosis	Increased	Decreased	Normal or Decreased	Normal or Decreased	Normal
Metabolic Acidosis	Decreased	Normal or Decreased	Decreased	Normal or Decreased	< -2
Metabolic Alkalosis	Increased	Normal or Increased	Increased	Normal or Decreased	> 2

Respiratory Acidosis- Pulmonary insufficiency resulting in retention of CO2, usually consequence of abrupt interference with alveolar gas exchange; fall in pH caused by hypercarbia

- Treat the cause of disturbed ventilation and restore oxygenation; may increase ventilation by increasing respiratory rate, pressure control, tidal volume, or changing the I-time
- Common Causes- airway obstruction, CNS depression, or respiratory muscle weakness

Respiratory Alkalosis- Acute reduction of plasma bicarbonate with a proportionate reduction in plasma CO2; a rise in pH resulting from hyperventilation and hypocarbia

- Treatment- Decrease ventilation; often very difficult to treat
- Common Causes- response to hypoxia or from CNS disease or injury, salicylate intoxication, or overly aggressive mechanical ventilatory support

Metabolic Acidosis- Increase in acids other than carbonic acid; any metabolic process which, if uncorrected, would lead to acidemia.

- Treatment- Administration of NaHCO3 (and occasionally THAM) while diagnosing and treating the underlying condition(s)
- Common Causes- Normal anion gap: G.I. NaHCO3 -diarrhea or a bowel fistula, Renal NaHCO3 loss due to carbonic anhydrase inhibitors or renal tubular acidosis, or miscellaneous reasons such as hyperal. with excess chloride, resuscitation with saline, or acid administration
- Increased anion gap: Uremia, lactic acidosis secondary to sepsis, cardiogenic shock, or a congenital metabolic disorder, salicylate poisonings, starvation ketosis, or DKA

Metabolic Alkalosis- Plasma NaHCO3 increased with a proportionate rise in plasma concentration of CO2.

- Treatment- Ammonium chloride, treat underlying cause
- Common Causes-Prolonged vomiting, excess NaHCO3 administration, potent diuretics, chronic hypovolemia, inadequate chloride replacement

Inhalation Therapy

- **Albuterol**- Inhaled bronchodilator that relaxes airway smooth muscle and is used to treat lower airway constriction
- **Heliox**- A mixture of helium & oxygen, generally 70% helium/30% oxygen mixture (also available as 60%/40% and 80%/20%). Since helium has a lower viscosity than oxygen or room air, it will flow readily through narrowed airways. Heliox is administered to reduce the work of breathing, lessen fatigue, and possibly prevent the need for intubation in the child with upper airway obstruction that does not require high levels of supplemental O2.
- **Racemic Epi**- Reduces airway edema and may reduce upper airway obstruction related to edema or inflammation – used most often with children presenting with Croup

Chest Tubes

Refer to: Lippincott (2011).*Pediatric Nursing Procedures;* Chest Tubes (pp 194-203)

Patient Assessment

- Vitals with Pulse ox
- Breath sounds
- Insertion site (dressing intact/remains sterile? dry? occlusive?)
- Palpate site for subcutaneous emphysema/crepitus
- Level of pain
- Length of trochar out of patient
- Sign of infection: fever, purulent drainage, redness at insertion site or purulent drainage in drainage system
- Encourage semi-sitting position, coughing and deep breathing

Drainage System Assessment

- Perform q 4 hours
- Trochar stabilized in patient
- Tubing free of kinks and patent?
- Tubing secured at all connections with banding gun?
- Appropriate level of suction (if on suction, is orange flag present)
- Set drainage system dry suction control dial to 20 cm of H2O unless otherwise ordered
- Drainage unit below chest level, secure to floor or hung at foot of bed
- Air leak present/continuous bubbling in water-seal chamber?
- If no air leak, water level in water seal chamber should rise and fall with patient's respirations, reflecting normal pressure changes in the pleural cavity
- Adequate solution in chamber? (may need to add sterile water)
- Drainage amount, color, consistency
- NEVER CLAMP A CHEST TUBE!!!! This will cause accumulation of air in the pleural cavity, which has no means of escape and can lead to the rapid development of a tension pneumothorax. (only briefly clamp when changing the drainage system)

Troubleshooting Air-leaks

- Obtain CXR. Is tube in good place?
- Start with patient and move down tube towards drainage system
  - Is dressing intact? Is one of the chest tube trochar holes outside of the patient?
  - Redress and wrap Vaseline gauze at the insertion site to prevent an air leak from site
  - Inspect tubing and drainage system for holes or loose connections
  - Clamp chest tube momentarily at chest wall. If air leak continues, problem is in tubing or system. If airleak stops, problem is at the patient. **Remember to unclamp!**

Dressings

- Sterile manner only when soiled, loose, or with medical order
- Keep chest tubes away from any other wound to prevent transmission of infection

Changing Drainage System

- Fill water seal chamber with sterile water to 2 cm line
- If patient is on wall suction, turn off the suction
- Connect suction tubing from old drainage system to the new drainage system
- Briefly clamp chest tube tubing. While maintaining sterility disconnect the chest tube tubing from old drainage system and connect it to new drainage system. ***UNCLAMP.***

Additional Emergency Equipment at the Bedside

- Xeroform petrolatum dressing, biocclusive dressing, bottle of sterile water (500ml)

Obtaining Drainage Specimen

- Clean the port on the drainage unit tubing with alcohol and then turn (luer lock) a syringe and draw back to obtain specimen

Wall Suction vs. Water Seal

- Not all patients require suction. Medical order must indicate whether the chest tube is to suction or water seal. Do not clamp the chest tube when changing from suction to water seal. Suction can be discontinued to transport a patient or to trial a patient off suction

for potential discharge in 24 hours. Water seal acts as a one way valve-allowing air to leave pleural cavity, but not return, which maintain negative pressure. If suction is discontinued, the suction tube or port should remain uncapped and free of obstructions to allow air to exit and minimize the possibility of a tension pneumothorax.

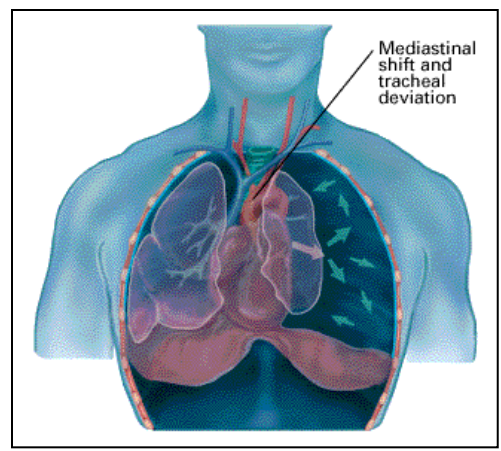
Special Consideration: Tension pneumothorax:
Life-threatening injury to the lung. Air enters into the pleural space on inspiration, but it cannot escape on expiration. Therefore intrathoracic pressure collapses the lung causing a mediastinal shift, thus compressing the heart and great vessels.

Early Signs/symptoms

- Anxiety
- Tachycardia
- Increased respiratory rate
- Worsening pain with deep breaths

Late Signs/Symptoms:

- Severe respiratory distress
- Distended neck veins
- Hypotension
- Subcutaneous emphysema
- Tracheal deviation to the unaffected side
- Cyanosis
- Muffled heart sounds
- Cardiac arrest



Patients with a Chest Tube: If an order is written by the attending physician allowing a child to go to the playroom an RN MUST accompany and stay with the child while the child

SAMPLING/ATS OPTION

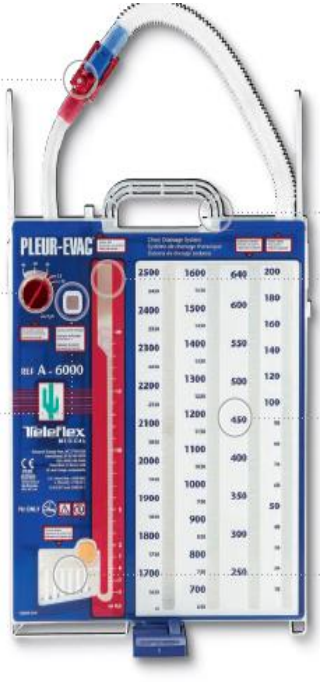
- *Self-sealing sample port for direct collection requires no needles*
- *Easily connected ATS Bag makes collection/ reinfusion simple*

ACCURATE DRY SUCTION

- *Maintains a constant suction level, variable between -10 to -40 cm.*
- *Dial clicks in place at prescribed suction level*

SUCTION CONROL

- *Orange Float appears in the window when desired suction level has been attained*
- *Operates with airflow capacity of a minimum of 16 liters per minute (LPM)*



SAFETY

- ***Positive Pressure Relief Valve*** *opens with increases in positive pressure, preventing pressure accumulation*
- ***Filtered High Negativity Relief Valve*** *provided to vent excessive negativity*
- ***High Negative Float Valve*** *prevents excessive negative pressure build up*

FOUR COLUMN COLLECTION CHAMBER

- *Provides a more accurate patient reading*
- *First chamber shows 2 cc increments up to 200 cc for accurate recording*

DIAGNOSTICS

Patient Air Leak Meter *visually quantifies the size and progress of air leak*

- *Packaged with a prefilled water bottle*

DRY SUCTION/WET SEAL – ALL MODELS LISTED BELOW CONTAIN ATS CONNECTORS AND A PATENTED AIR LEAK METER

A-6000 SERIES – ADULTS/CHILDREN

Tracheostomy Care

- Sterility must be maintained while suctioning and for tube changes, skin care and tie changes are clean procedures
- Tracheostomy tubes are changed weekly (usually Friday) by two RNs or an RN and RT
- **Remember**: The first trach change is always done by ENT

- Bedside trach bag includes:
  - **Extra tracheostomy** tube -same size and one smaller then the one currently inserted
  - **Obturator** (size of current trach)
  - **Inner cannula** (if applicable)
  - Resuscitation **bag** and appropriate sized **mask**
  - Oxygen **flow meter** with nipple adapter
  - **Scissors**
  - Trach **ties**
  - Water-based **lubricant**
  - **Syringe** (if cuffed)
    - Shiley Trach Tubes: Air
    - Bivona Trach Tubes: Sterile Water
  - Working **suction** set-up
  - 2 sterile **suction catheters** (correct size = 2 times the trach size)
    - e.g. Trach size 4.0 = 2 x 4.0 = 8 Fr suction catheter
- All children with tracheostomies must have humidification
- For routine suctioning, do not suction past the tip of the trach tube.
- Tracheostomy skin care is provided q shift and prn care involves cleaning the site and changing the inner cannula (if present).
- **Trach ties and stoma dressing** should be changed at least **q 24 hours and PRN**.
- All children with a trach must be monitored with a pulse ox & cardiac-respiratory monitor
- AN RN, RT, or guardian who is trach competent must accompany the patient when leaving the unit (bedside trach bag should accompany transport)
- Trach checklist in Epic will be completed every shift

Oxygen Devices

- Nasal Cannula 0.1L-6L/min (21% FiO2 plus 3% per liter)
- Simple Face Mask 5L-10L/min (35%-50% FiO2)
- Non- Rebreather **10**-15 L/min (60%-100% FiO2)
- High Flow device: 1-60L (Need a blender and an FiO2 MD order)

Nebulizer Treatments:

- Nebulizer treatments are given via a mask, trach collar, or mouthpiece over 7-10 minutes with 7-10 liters O2 flow
- The mouthpiece is recommended for children >6 years old
- **Blow-by is not an acceptable method of delivery**.
- The nebulizer set-up should be changed q 24 hours.
- Document vital signs, respiratory assessment, and O2 sats before and after treatments.
- Call MD if heart rate is 20 bpm higher than normal.
- Make sure the infant/child is sitting up right
- A peak flow should be done on children 4 years and up. Performed before and after each treatment while awake and standing to ensure a full inspiration. The best 1 out of 3 is the one recorded.

Patients on Continuous Nebulizer Treatments:

- Minimal 3:1 nursing care
- Document the following q *1-**2 hour*** for stable pt or q ***1 hour*** for changes in condition:
    - O2 sats
    - Auscultate all lung fields and count respiratory rate and note WOB
    - Heart Rate
    - Flow source/Amount of oxygen
- Place patient on cardiac monitor and pulse ox, HOB @ 90 degrees. Pt should be NPO.
- If after 1 hour of continuous nebs the patient has a change in LOC, increased respiratory distress, weak cry (infants), or no improvement- notify the MD immediately.

High Flow Nasal Cannula:

Procedure:

1. Patients requiring HFNC in Comer Children's Hospital may be cared for under the following settings (UCM PC48):
    - Pediatric patients should be managed in a critical care area if:
      1. Requiring **FiO2>50%** and/or
      2. If above the recommended initial flow rate for pediatric High Flow Nasal Cannula (HFNC), calculated as 1L/kg/min for the first 10kg of body weight followed by 0.5L/kg/min for each kg of body weight above 10kg, to a maximum of **15L/min**.
1. Patients in the Emergency room must be stable on the current regimen of HFNC for at least 1 hour prior to being transferred to Comer 5.
2. A Pediatric Emergency Team (PET) call should be activated if a patient on Comer 5th floor receiving HFNC requires escalation above 15L or 50% FiO2
3. Patients may have HFNC therapy initiated on Comer 5 or PICU only. Comer 6 patients can be on HFNC therapy for comfort care in end of life circumstances.
4. Patients who require Continuous Nebulized Albuterol and HFNC on Comer 5th floor, should be transferred to the PICU

Weaning HFNC

1. Patients should be transitioned to regular (low flow) nasal cannula oxygen delivery when receiving
    a. 2 L/min if pt is 2-10 kg
    b. 4 L/min if pt is >10 kg

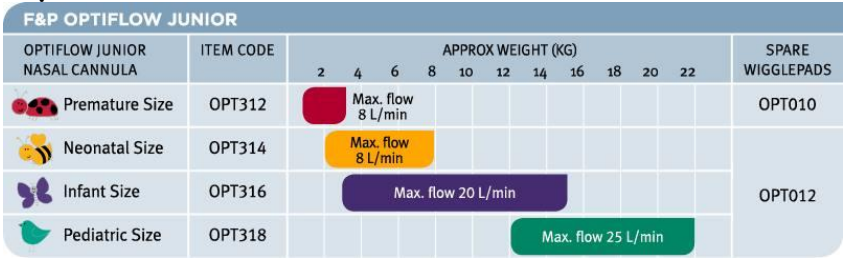
See HFNC Maintenance & Weaning Pathway in AgileMD

2. All children on HFNC should have:

- Minimally 3:1 nursing care

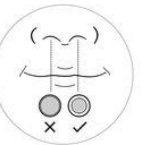
- Nursing evaluation at least q 2 hours and PRN to include: Respiratory assessment
- Vital signs q 2 hours
    - Continuous cardiorespiratory monitoring
    - Continuous pulse oximetry
    - Vascular access
- Nurse accompany on transport and notify Respiratory Care Services prior to transport
- Respiratory Care Services evaluation and full assessment q 4 hours and PRN
- Upon admission, the nurse assigned to the patient will do an immediate assessment of the patient's respiratory status and communicate that assessment to a member of the physician team caring for the patient.
- A member of the physician team caring for the patient should assess the patient within 30 min of their arrival to the floor.
- Contact and Droplet precautions on admission
- Children on HFNC may not visit the playroom

Optiflow Jr. (Max 25L)



Wider range of sizes

Recommended nare occlusion of 50% should be used to size cannula.

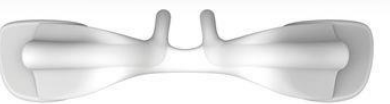


XS NEW

S

M

L



XL

Cannula images are true to scale

25.4mm = 1 inch

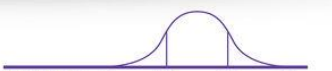
APPROXIMATE AGE AND WEIGHT

Age and weight information should only be used as a guide. Ensure clinical judgement is used when sizing.

Weight (Kg)*	0.5	1	2	2.5
Correlated age**	23 wkGA	28 wkGA	33.5 wkGA	35 wkGA

Weight (Kg)*	0.9	1	3.5	4
Correlated age**	27 wkGA	28 wkGA	40 wkGA	42.5 wkGA

Weight (Kg)*	1	1.5	8	10
Correlated age**	28 wkGA	31 wkGA	6.6 mo	15.4 mo



Weight (Kg)*	3	3.5	18	20
Correlated age**	37.5 wkGA	40 wkGA	4.9 yr	5.6 yr

Weight (Kg)*	5	7	25	30
Correlated age**	47.5 wkGA	4.7 mo	7.6 yr	12 yr

wkGA = weeks of gestation; mo = months; yr = years

* *Weight data is based on F&P product validation studies.*

** *Age data is a correlation to weight data based on a combination of Fenton, WHO and CDC growth charts.*

Optiflow (Max 60L)

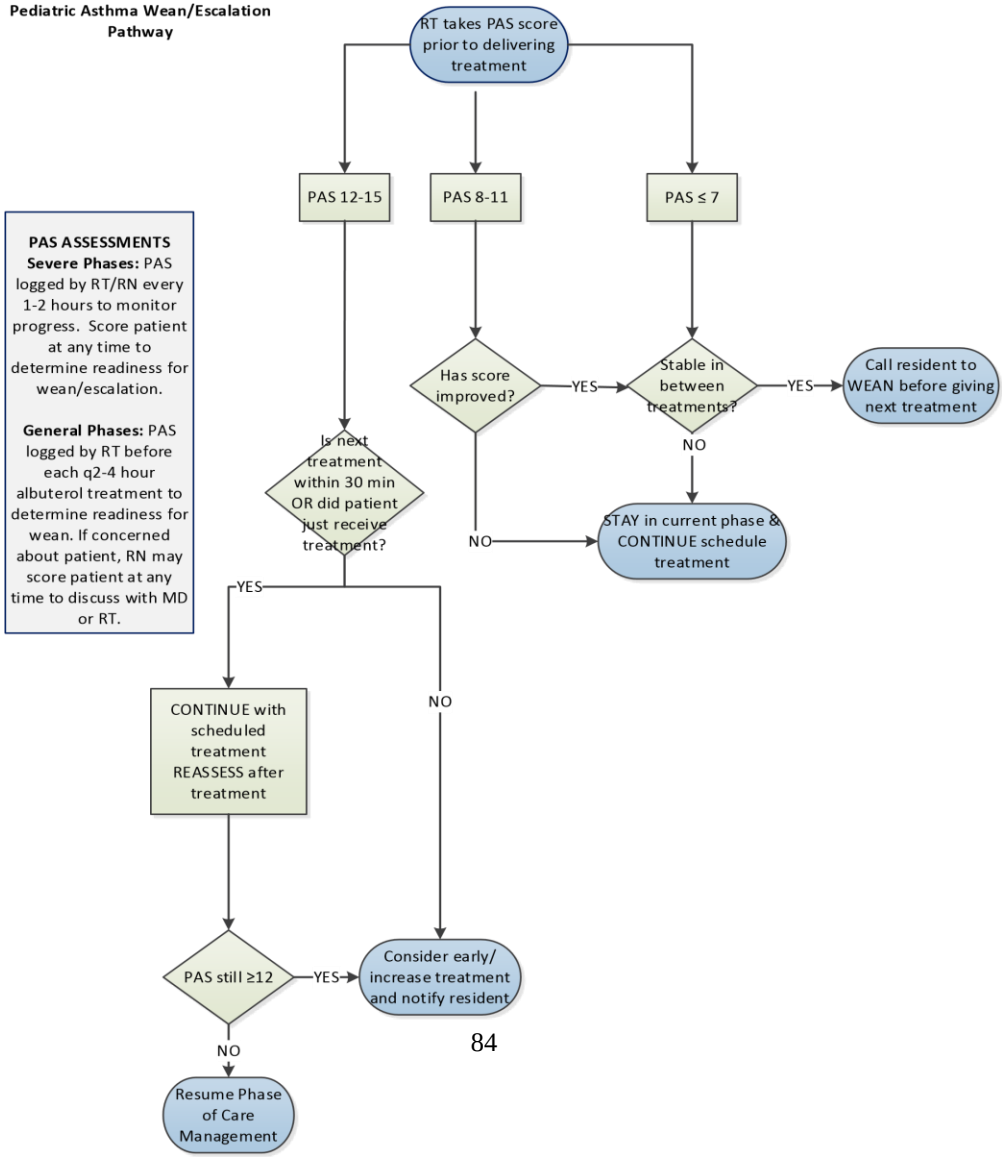
Modified Pediatric Asthma Score, amended for Comer Children's Hospital inpatient services

	1 Point	2 Points	3 Points
Respiratory Rate Age 2-3 Age 4-5 Age 6-12 Age >12	 ≤34 ≤30 ≤26 ≤23	 35-39 31-35 27-30 24-27	 ≥40 ≥36 ≥31 ≥28
O2 saturation* *PICU* *Floor*	>95% on room air *On LFNC <4L*	90-95% room air *On HFNC>4L* *>95% on O2*	<90% on room air *On BiPAP* *<95% on O2*
Auscultation	Normal to mild expiratory wheeze	Expiratory wheeze	Inspiratory and expiratory wheeze or diminished
Retractions	None or intercostal	Intercostal and substernal	Intercostal, substernal, supraclavicular
Dyspnea	Speaks in sentences, coos and babbles	Speaks in partial sentences, short cries	Speak in single words Grunts

Total Score 5-15

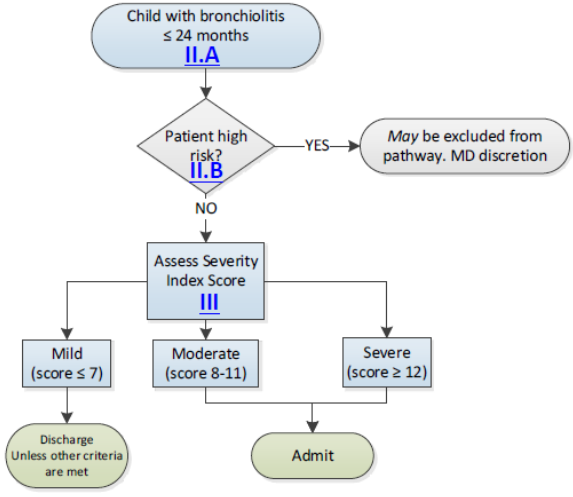
*Room air score preferred, if safe for patient to be checked on room air. If patient not safe to be removed from O2, adjust score as listed.

Pediatric Asthma Wean/Escalation Pathway



Bronchiolitic Guidelines

Admission Pathway



High-risk
<8 weeks old
Ex-premature infant
Cardiac disease
Chronic lung disease
Immunodeficiency
Other chronic illnesses

Admission Criteria:
- Hypoxia (despite nasal suctioning) and need for supplemental oxygen therapy;
- Need for ongoing hydration; presentation with apnea;
-Altered mental status;
- Other concerns that may impact care at home.

Considerations

Note:
Use the following algorithm as a just-in-time guideline for providing care. If at any point the SIS falls in a higher or lower treatment category (Mild, Moderate, Severe), follow corresponding care guideline.

Initial Assessment

- History & Physical
- If RR in severe range, consider NG feeds/ IV fluids
- Suctioning: pre-feeds & prn
- Meds not recommended
- Monitoring based on SIS

Assess SIS:

SpO2 < 90%
Signs of moderate-severe respiratory distress
Dehydration
Apnea
High-risk child
Altered mental status
Family /social

If Albuterol or HTS 3% are given:

- Score SIS
- Give treatment
- Re-score SIS after 20 min
- Responder: SIS ↓ by ≥3
- Non-responder: SIS unchanged

Discharge Criteria

1. SpO2 >89% (asleep)*
2. No apnea > 48h*
3. Feeding adequately*
4. Education completed*
5. Off O2 x 12 hours
6. Severity score ≤ 7 x 12 hrs
7. No need for suction > 4 hrs

**Required discharge criterion.*

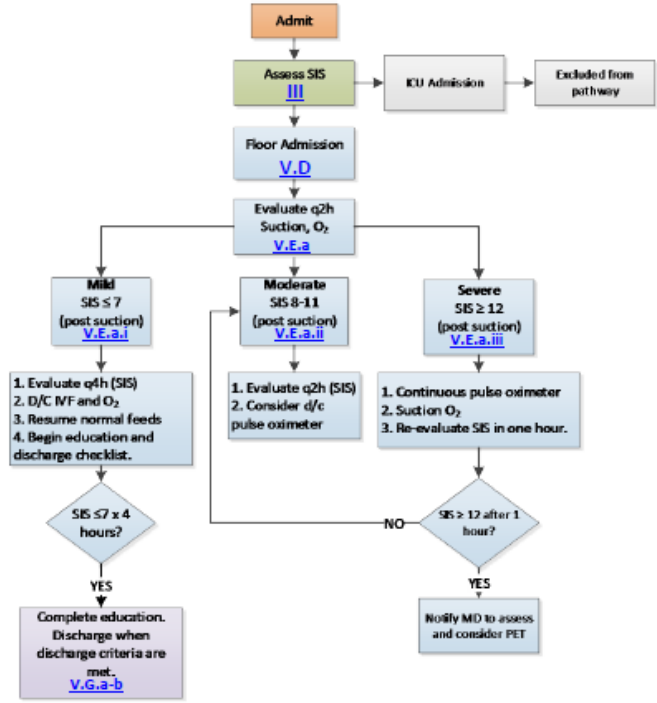


Table 1 – Severity Index Score: The initial assessment will be made at admission (Resident, nursing & RT). The highest rating will indicate the severity in which the child is placed in the care-map.

POINTS		1	2	3
RR*	< 3months	<30	30-60	>60
	3-12 months	<25	25-50	>50
	1-2 years	<20	20-40	>40
WOB		None	Intercostal retractions	Nasal flaring, head bobbing, grunting
Oxygen		>94%	90-94%	<90%
Breath sounds		Normal, mild end-expiratory wheeze	Expiratory wheeze	Inspiratory, expiratory wheeze, diminished breath sounds
Suctioning		Bulb	Bulb/wall	Wall
Mental status		Normal	Fussy, anxious	Inconsolable, lethargic

** Respiratory rate must be counted over 1 minute*

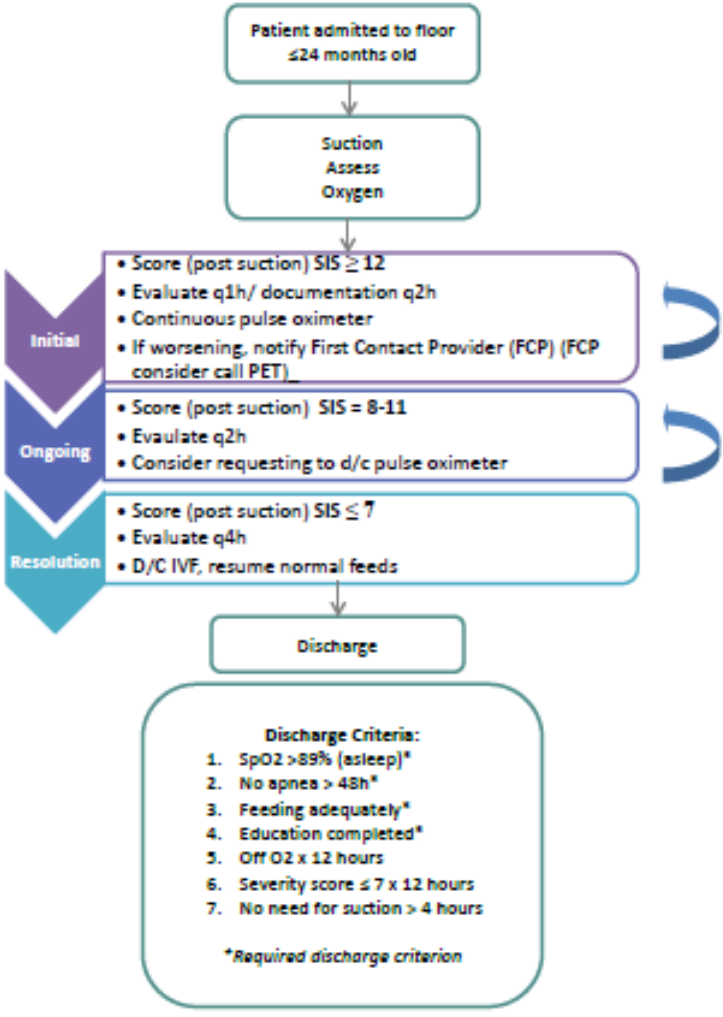
CLASSIFICATION of Bronchiolitis severity is based on the Severity of Index score:

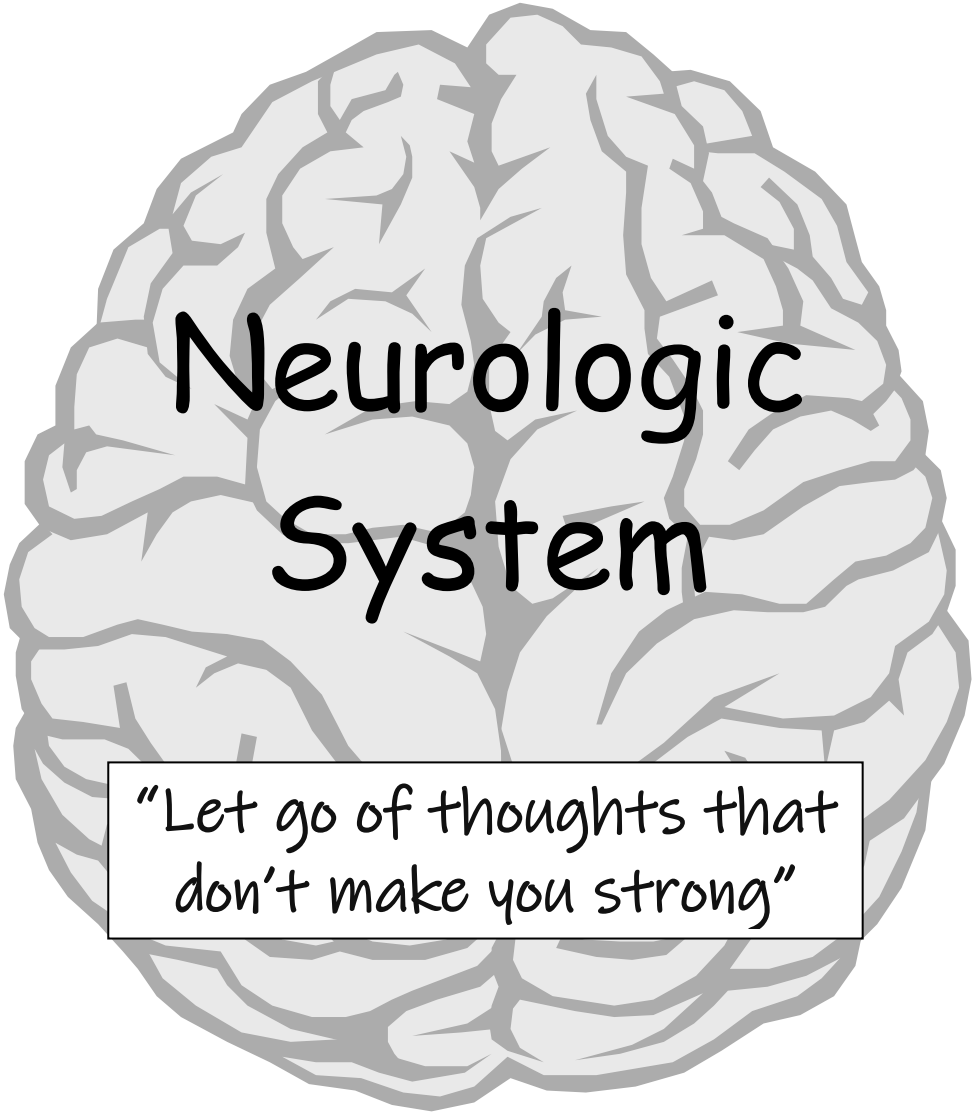
MILD: ≤ 7

MODERATE: 8-11

SEVERE: ≥ 12

Figure 2 – Inpatient Management Algorithm for Nurses





Neurologic System

"Let go of thoughts that don't make you strong"

Cranial Nerve Assessment

Nerve	Classify	Major Functions	Assessment
I Olfactory	Sensory	Smell	May be tested in patients after head injury or pituitary surgery; use coffee for testing
II Optic	Sensory	Vision (acuity and field of vision)	Have patient read something, one eye at a time; test visual fields by having patient cover one eye, focus on your nose, and identify the number of fingers you're holding in each of four visual quadrants
III Oculomotor	Motor	Eyelid elevation, most EOMs, pupil size/reactivity	Check pupillary responses by shining a bright light on one pupil; both pupils should constrict. To check accommodation, move your finger toward patient's nose, pupils should constrict and converge. Check EOMs by having patient look up, down, laterally, and diagonally.
IV Trochlear	Motor	EOM (eyes turn downward and laterally)	Have patient look down and in
V Trigeminal	Both	Chewing; facial and mouth sensation; corneal reflex (sensory)	Ask patient to hold mouth open while you try to close it and to move the jaw laterally against your hand. With patient's eyes closed, touch face with cotton and have patient identify the area touched.
VI Abducens	Motor	EOM (Eye turns laterally)	Have patient move eyes from side to side
VII Facial	Both	Facial expression; taste; corneal reflex (motor); eyelid and lip closure	For motor, test by observing symmetry of face at rest and during deliberate facial movements (smiling, showing teeth, whistling, puckering lips, raising eyebrows). For sensory, test by taste with anterior 2/3 of tongue.
VIII Vestibulocochlear	Sensory (acoustic)	Hearing: equilibrium	To test hearing, use tuning fork or rub your fingers, place a ticking watch or whisper near each ear.
IX Glossopharngeal	Both	Gagging and swallowing (sensory); taste	Touch back of throat with sterile tongue depressor or cotton-tipped applicator; Have patient swallow
X Vagus	Both	Gagging and swallowing (motor); speech(phonation)	Assess gag and swallowing with CN IX. Assess vocal quality.
XI Spinal Accessory	Motor	Shoulder movement; head rotation	Have patient shrug shoulders; turn head to each side
XII Hypoglossal	Motor	Tongue movement; speech (articulation)	Have patient stick out tongue and move it internally from cheek to cheek. Assess articulation

Increased Intracranial Pressure

Signs & Symptoms of Increased Intracranial Pressure (ICP):

Early signs & Symptoms

- Change in LOC (earliest cue!)
- Headache, nausea, vomiting
- Pupil changes
- Restlessness, drowsiness, changes in speech, or loss of judgment
- Increased irritability
- Bulging fontanel
- Motor changes/change in response to pain
  - Weakness
  - Localizing to pain
  - Withdrawing from pain

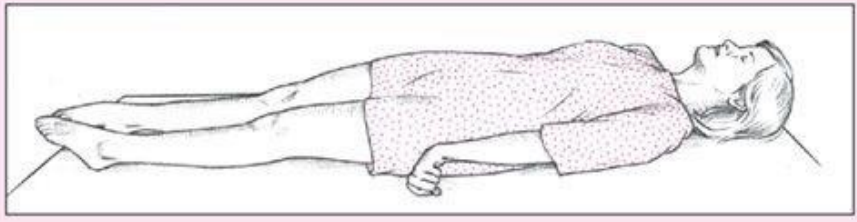
Late signs

- Continued deterioration in level of consciousness
- Decorticate (Flexion) posturing (arms pull toward midline/chest)
- Decerebrate (Extension) posturing (arms extended, fingers out)
- Flaccid (response absent)
- Changes in respiratory rate and pattern (Cheyne-Stokes, agonal respirations)
- Dilated nonreactive pupils
- Vomiting
- Worsening headache
- Hemiplegia
- Seizures
- Unresponsiveness to verbal or painful stimuli
- **Cushing's Triad: Hypertension with widened pulse pressure, bradycardia, and apnea – this is a late sign!**

Bader, M., Littlejohns, L. (2010). AANN Core Curriculum for Neuroscience Nursing, 5th Ed. Sanders CO: Philadelphia

Comparing decerebrate and decorticate postures

Decerebrate posture results from damage to the upper brain stem. In this posture, the arms are adducted and extended, with the wrists pronated and the fingers flexed. The legs are stiffly extended, with plantar flexion of the feet.



Decorticate posture results from damage to one or both corticospinal tracts. In this posture, the arms are adducted and flexed, with the wrists and fingers flexed on the chest. The legs are stiffly extended and internally rotated, with plantar flexion of the feet.

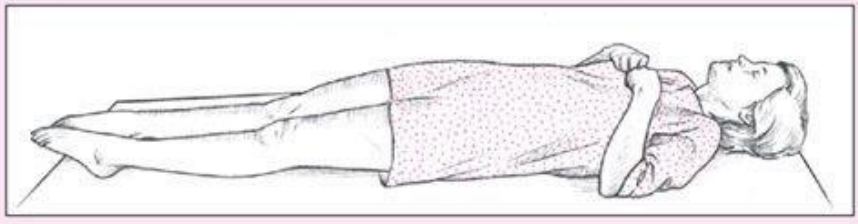
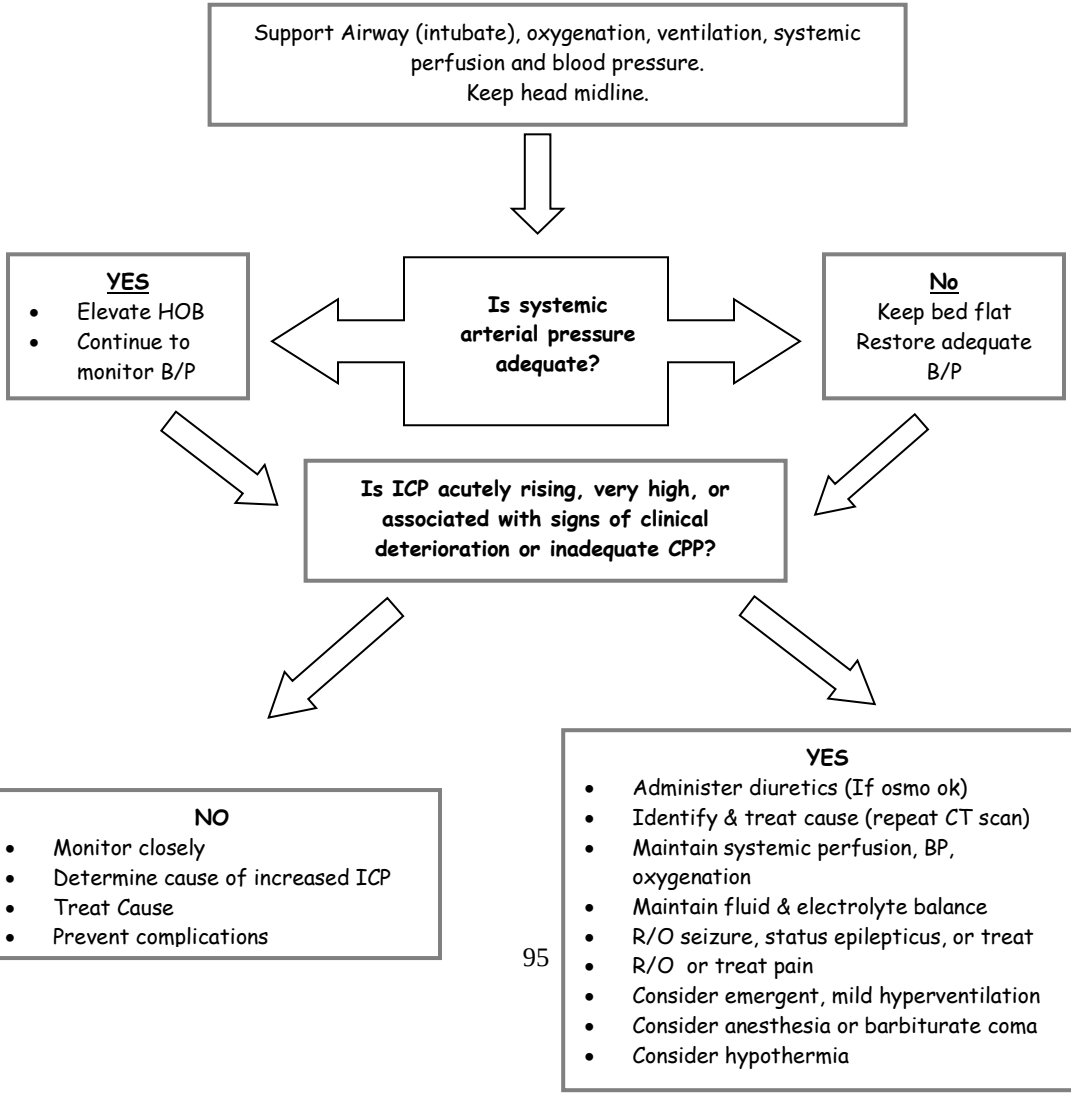


TABLE 38-2

Glasgow Coma Scale

BEHAVIOR	RESPONSE	SCORE
Eye opening response	Spontaneously	4
	To speech	3
	To pain	2
	No response	1
Best verbal response	Oriented to time, place, and person	5
	Confused	4
	Inappropriate words	3
	Incomprehensible sounds	2
	No response	1
Best motor response	Obeys commands	6
	Moves to localized pain	5
	Flexion withdrawal from pain	4
	Abnormal flexion (decorticate)	3
	Abnormal extension (decerebrate)	2
	No response	1
Total score:	*Best response*	15
	Comatose client	8 or less
	Totally unresponsive	3

EVIDENCE OF INCREASED ICP



Mannitol

- ✓ Parenteral osmotic diuretic and orally inhaled bronchoconstrictor
- ✓ Used parenterally to reduce intracranial pressure and cerebral edema
- ✓ Can also be used to promote diuresis in acute renal failure
- ✓ Mannitol works by increasing serum osmolality, which increases the osmotic gradient between blood and tissues – this facilitates the flow of fluid out of tissues, including the brain and eye, and into the interstitial fluid and blood. This activity reduces cerebral edema, intracranial pressure, cerebrospinal fluid pressure, and intraocular pressure. Also inhibits the reabsorption of water and solutes in the renal tubules
- ✓ Dosage
  - IV for increased ICP (pediatric): 0.5 to 1grams/kg or until serum osmolality > 320 mOsm/kg – avoid mannitol administration when serum osmolality is >320 mOsm/kg
  - Check electrolytes and serum osmolality prior to administration unless an emergency
- ✓ Side effects
  - Black box warning: use caution with acute bronchospasm and asthma – requires an experienced clinician – causes bronchoconstriction
  - Pulmonary edema, renal failure, electrolyte imbalances (dehydration, hypovolemia, hypo/hyperkalemia, hypo/hypernatremia), hypotension, metabolic acidosis, seizures, intracranial bleeding, heart failure, thrombosis, wheezing, N/V, headache, polyuria, polydipsia, injection site reaction
- ✓ Administration guidelines:
  - Mannitol is stored at a higher temperature to prevent the drug from crystalizing
    - Mannitol crystals may be present in injection concentrations of 15% or greater, particularly at lower temperatures and at room temperature
    - Inspect the solution for crystals or particulate prior to administration and do not use if you notice crystallization
    - Infuse over 30-60 minutes, or more rapidly in an emergency
    - If drawing up in a syringe, must use a filtered needle – remove the filtered needle prior to administration to the patient
    - When infusing on a pump, use a filter (0.2 micron – TPN filter)
    - In an emergency, draw up using a filtered needle, but after removing the filtered needle, can infuse over 10-20 minutes IV push without a filter – just administer immediately after drawing up the mannitol

25% Mannitol is packaged in a 50mL bottle
12.5grams/50mL

DI/SIADH/Cerebral Salt Wasting

Diabetes Insipidus (DI)

- Central: deficit of Antidiuretic Hormone (ADH) resulting in decreased permeability of the renal distal tubules and loss of free water in the urine
- Primary Renal: when kidney's inherent ability to respond to ADH fails
- Secondary Renal: associated with intrinsic renal disease or other factors that interfere with the kidney's ability to concentrate water
- Risk factors: recent head trauma or surgery, CNS infection or ischemia, midline defects, brain death, intraventricular hemorrhage

Care Management: Care is directed at the prevention of complications associated with hypovolemic shock and hyperosmolar encephalopathy.

- evaluation and support of intravascular volume, systemic perfusion, and fluid and electrolyte balance
- immediate replacement of urinary fluid and electrolyte losses
- the provision of exogenous ADH either in the form of vasopressin or DDAVP.
- close monitoring of serum and urine lytes/osmolality

Syndrome of Inappropriate Andiuretic Hormone Secretion (SIADH)

- Syndrome of secretion of ADH in the absence of a physiologic stimulus which results in increased permeability of the renal distal tubules and collecting ducts, increased water reabsorption, and a resultant decrease in urine volume
- Risk Factors: any inflammation of, injury to, or compression of the pituitary gland (e.g. meningitis, head trauma), ingestion of drugs, CNS lesions including ADH secreting tumors, abrupt discontinuation of high dose steroids

Care Management: Care prevention of complications associated with water intoxication and hyponatremia including:

- fluid restriction (30% to 70% of calculated maintenance requirements)
- close assessment of child's LOC, neurologic function, and systemic perfusion
- treat hyponatremia (avoid rapid correction, it may cause compensatory fluid shifts)
- close monitoring of serum and urine lytes/osmolality

Cerebral Salt Wasting (CSW)

- Syndrome of increased urine sodium following head injury or major neurosurgical intervention

Critical care management: isotonic fluid administration & monitor serum & urine lytes/osmolality

Lab Value	DI	SIADH	CSW
Urine Volume	Increased	Decreased	Increased
Specific Gravity	Decreased	Increased	Increased
Sodium Serum	Increased	Decreased	Decreased
Urine Sodium	Decreased	Increased	Increased
BUN	Increased	Decreased	Increased
Serum Osmolality	Increased	Decreased	Decreased
Urine Osmolality	Decreased	Increased	Increased

		DI	SIADH
Pathophysiology		INADEQUATE ADH	EXCESS ADH
		Neurogenic = *lack* of ADH **Nephrogenic** = *insensitivity* to ADH	Secretion high despite low serum osmolarity
Causes	**Neuro**	Head trauma / intracranial surgery Sarcoidosis Brain tumor – Craniopharyngioma / Pinealoma / Meningioma / Dysgerminoma / Pituitary	Head trauma / CNS tumors Post-surgical Ectopic tumor production Liver disease Lung cancer / pulmonary disease Hypothyroidism Adrenal insufficiency
	Nephro	hypokalemia, hypercalcemia, hypothermia Chronic renal insufficiency Lithium, alcohol	
Symptoms & signs		Mental status changes Weakness, lethargy, seizures, coma Dehydration, polyuria, polydipsia,	Mental status changes Headache, nausea & vomiting, seizures, coma Cerebral edema
		Hypernatremia Low urine osmolarity High urine output Hyperosmolarity (> 320 mOsm/l)	**Hyponatremia** (< 130 mEq/l) High urine osmolarity Low urine output Hypo-osmolarity (< 270 mOsm/l)
			Urine Na > 20 mEq/l Decreased BUN, Cr, albumin
Treatment		$D5^{1}/_{4}NS$ **Neurogenic** – vasopressin / desmopressin / Chlorpropamide (↑ release ADH) **Nephrogenic** – HCTZ	Normal saline, fluid restriction Demeclocycline

Seizures

Implanted Vagal Nerve Stimulator (VNS) Device (NEWLY IMPLANTED POST- OP VNS PATIENTS CARED FOR BY NEUROSCIENCE NURSES ONLY)

- Device similar to a pacemaker sends small electrical pulses to left vagus nerve in the neck
- Vagus nerve delivers electrical impulses to brain
- Mechanism of action not clearly understood, yet it works to eliminate or reduce seizures

Post-op Care: (usually admitted for 24hours)

- The generator will not be turned on until patient returns for post-op check in out patient clinic
- Settings are specific to each patient
- Incisions are not to get wet-gauze is placed over steri-strips until post-op visit
    - Two incisions: first left side of neck to expose left vagus nerve, second one left side of chest for the generator
- Assess incisions for bleeding and swelling, especially incision by the neck

Safety Concerns:

- VNS must be turned off with the handheld device if patient is undergoing surgical procedure with the use of electric cautery
- **If the VNS pulse generator is not turned off prior to MRI, there is a RISK that the coils that are wrapped around the vagus nerve may heat up and essentially "burn" the nerve and render the device useless**
- CT scans, ultrasounds xray okay do not need to turn off generator

Keep in mind during stimulation patient may experience:

- Voice alteration
- Hoarseness
- Cough
- Throat pain
- Dyspnea
- Dyspepsia, vomiting

Cyberonics. VNS Therapy Manuals. Retrieved September 1, 2016 from http://us.cyberonics.com/en/vns-therapy/healthcare-professionals/manuals/

All Patients Admitted with Seizures <u>Must</u> have the following (PC103):

- Bumper pads on rails of every bed/crib
- Side rails up
- Head of bed >30* unless clinically contraindicated
- IV access, unless otherwise ordered
- Wall Suction/Tubing at bedside operational
- Appropriate size Resuscitation Bag and Mask at the Bedside
- Oxygen set-up at the bedside and operational
- Cardiac/Respiratory monitor with alarms set and operating
- Also verify if child has an implanted VNS device. If so, you'll need to have the "magnet" accessible as well as inform/educate the Sitter if applicable.

What to do when your patient is having a seizure (PC103):

- If this is an expected seizure, admitted for VEEG, ensure the "seizure" button is pushed to capture the brain activity
- Lower head of bed, unless clinically contraindicated
- Remember ABC's (Airway, breathing, circulation)
    - Position Patient on his/her side (recovery position)
    - Maintain the airway – suction as needed but try to avoid suctioning during seizure
    - Assess need for oxygen – 100% non-rebreather
- Status Epilepticus
    - **0-5 min:** assess, diagnosis, call for assistance, give oxygen as indicated, record onset of seizure, place in recovery position, stay with patient, suction as needed
    - **6-10 min:** give Lorazepam (Ativan) 0.1mg/kg/dose IV push x 1, may repeat same dose x 1
    - **10-20 min**: give fosphenytoin (Cerebryx) 20mg/kg/dose IV DILUTED or Depacon 10-20mg/kg/dose IV
    - **30+ mins:** give Phenobarbital, Midazolam (Versed), Propofol

- If applicable, swipe/place magnet over VNS device
    - Model 102: swipe 3 times (1 second per swipe)
    - Model 103: hold over the generator for 3 seconds
    - Model 104: hold over the generator for 3 seconds
    - Model 105: Swipe once over the generator
    - Model 106: Swipe once over the generator
- Monitor duration and type of seizure (what did you see)
- Protect patient from injury, but do not restrain
- Attempt to protect IV
- Be prepared to administer a Benzodiazepine i.e. Ativan 0.1mg/kg slow IVP
- Page Pediatric Neurology Resident on call-7678 OR Patti Odgen, APN (3520)
    - If no response, page the Attending Pediatric Neurologist on service

Pulse
Model 102

DemiPulse
Model 103

DemiPulse Duo
Model 104

VNS Model 105

Bader, MK, Littlejohn, LR. (2010) *American Association of Neuroscience Nurses*, "Core Curriculum for Neuroscience Nursing" (5th ed.), St. Louis: WB

Guide to care of the patient with seizures (2004). American Association of Neuroscience Nurses. Retrieved February 20, 2017, from www.aann.org.

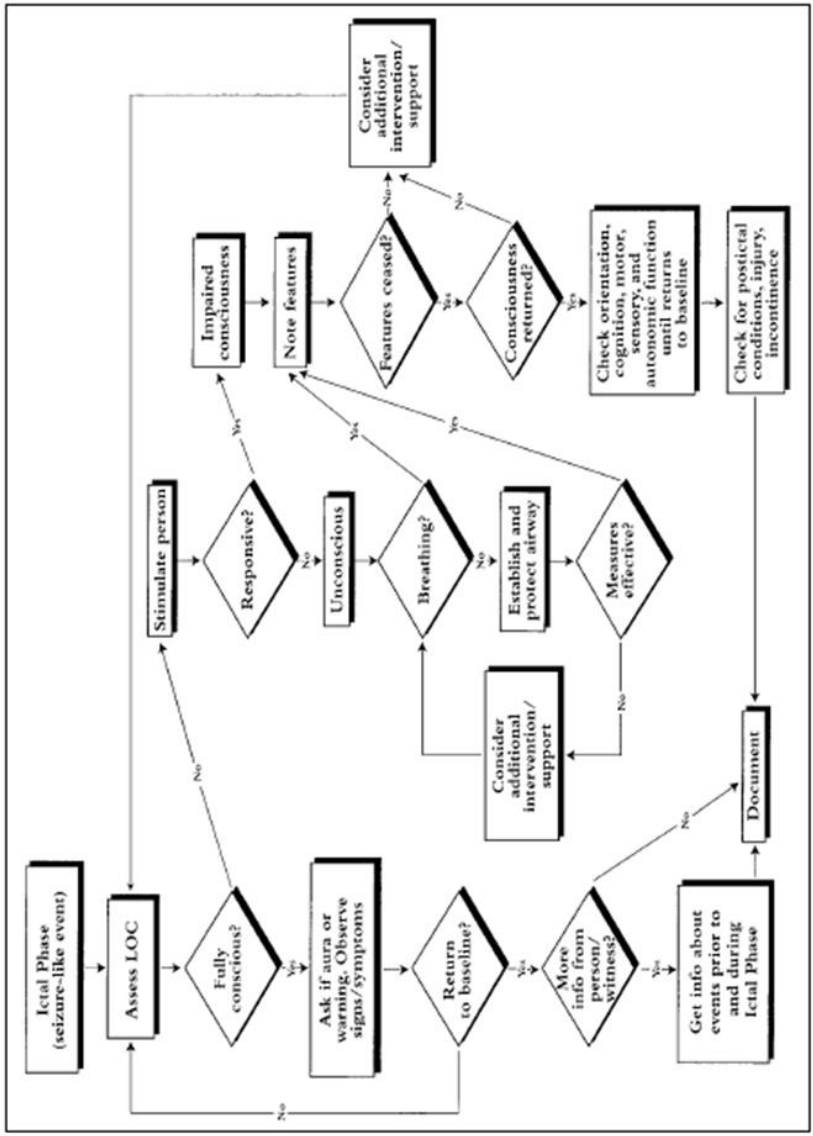
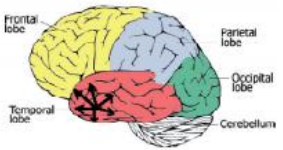


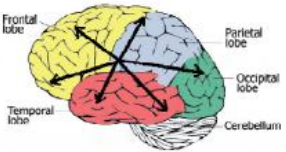
Figure 1. Seizure Assessment Algorithm

Seizure Smart

SEIZURE CLASSIFICATION CHART



PARTIAL
Seizure activity starts in one area of the brain.



GENERALISED
Seizure involves whole brain – consciousness is lost at the onset.

Complex
Altered awareness and behaviour e.g. confusion, repetitive movements.

Simple
Patient remains alert e.g. jerking of a limb, déjà vu, nausea, strange taste or smell

May become generalised (spreading from one area to the whole brain).

Tonic Clonic
'grand-mal' or convulsion with loss of consciousness, stiffening of body then jerking of limbs.

Absence
'petit-mal' or staring or trance-like state.

Tonic or Atonic
'drop attack' or abrupt fall, either with stiffening (tonic) or loss of muscle tone (atonic or astatic attacks).

Myoclonic
sudden muscle jerks.

Keppra

Seizure Smart. (2017, January 23). Retrieved from www.epilepsy.org

Keppra

Indications in children and adolescents

- IV: Adjunctive therapy in the treatment of partial onset seizures
- Adjunctive therapy in the treatment of myoclonic seizures in patients with juvenile myoclonic epilepsy
- Adjunctive therapy in the treatment of primary generalized tonic-clinic seizures in patients with idiopathic generalized epilepsy
- Treatment of refractory status epilepticus or acute repetitive seizure activity

Special Considerations

- Discuss specific use of drug and side effects with patient as it relates to treatment.
- Patient may experience diarrhea, rhinitis, rhinorrhea, insomnia, dyspepsia, pharyngitis, nausea, or lack of appetite. Have patient report immediately to prescriber insomnia, hallucinations, considerable asthenia, severe dizziness, intolerable headache, syncope, change in balance, abnormal gait, significant fatigue, signs of infection, ecchymosis, hemorrhaging, suicidal ideation, depression, anxiety, akathisia, irritability, panic attacks, mood changes, behavioral changes, or signs of Stevens-Johnson syndrome/toxic epidermal necrolysis (HCAHPS).
- Educate patient about signs of a significant reaction (eg, wheezing; chest tightness; fever; itching; bad cough; blue skin color; seizures; or swelling of face, lips, tongue, or throat).
- How does Keppra react with Cannabis? It may enhance the CNS depressant effect of CNS Depressants. RN needs to monitor therapy.

Dose and Frequency

- Dosage Forms Solution, Intravenous:
  - Keppra: 500 mg/5 mL (5 mL)
  - Generic: 500 mg/100 mL (100 mL); 1000 mg/100 mL (100 mL); 1500 mg/100 mL (100 mL); 500 mg/5 mL (5 mL)

Note: When switching from oral to IV formulation, the total daily dose should be the same.

Note: Use oral solution in infants and children ≤20 kg

Preparation for Administration

- Pediatric patients <16 years: Dilute dose from vial in NS to final concentration 15 mg/mL (Ng 2010). A 1:1 dilution of drug from vial with D_5W or NS has also been safely used in patients ≥4 years
- Adolescents ≥16 years: Dilute dose in 100 mL of NS, LR, or D_5W. A 1:1 dilution of drug from vial with D_5W or NS has also been used in patients 4 to 32 yrs old

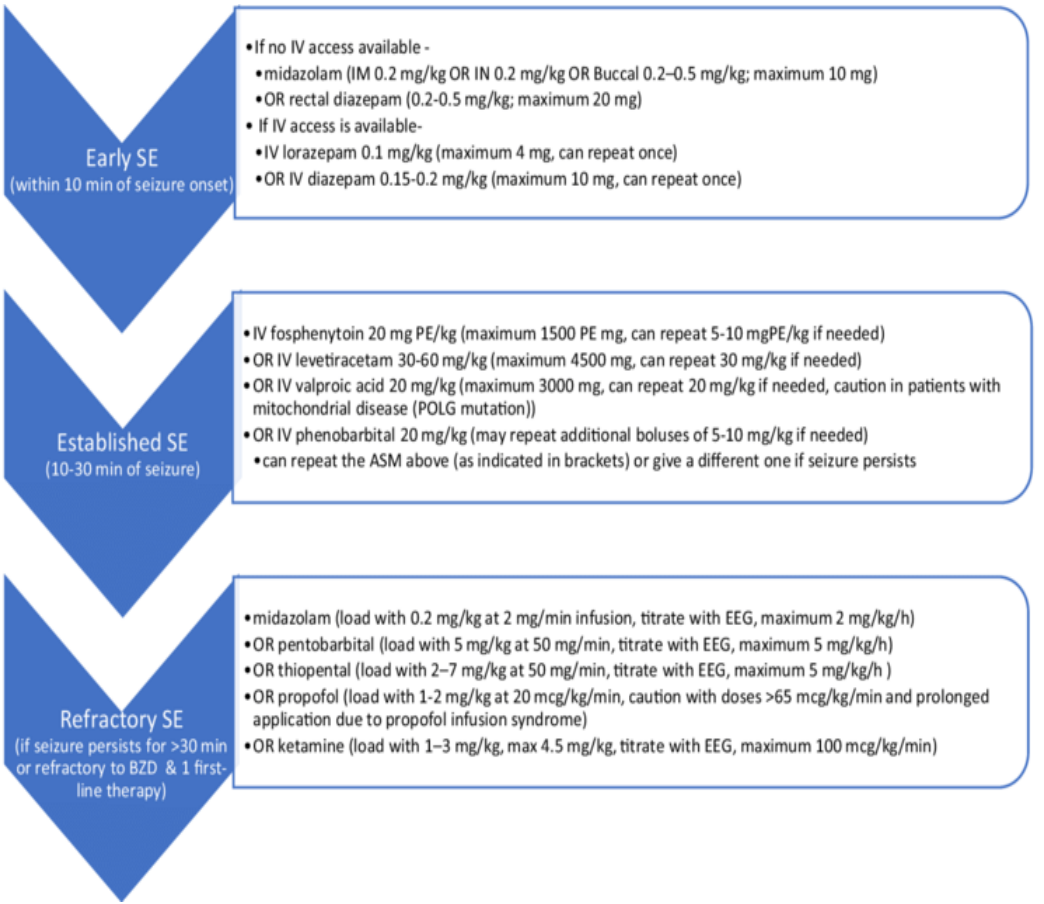
Administration

- IV: Vials must be diluted prior to use.
- Pediatric patients <16 years: Infuse over 15 minutes
- Adolescents ≥16 years: Infuse over 15 minutes

Possible Adverse Reactions

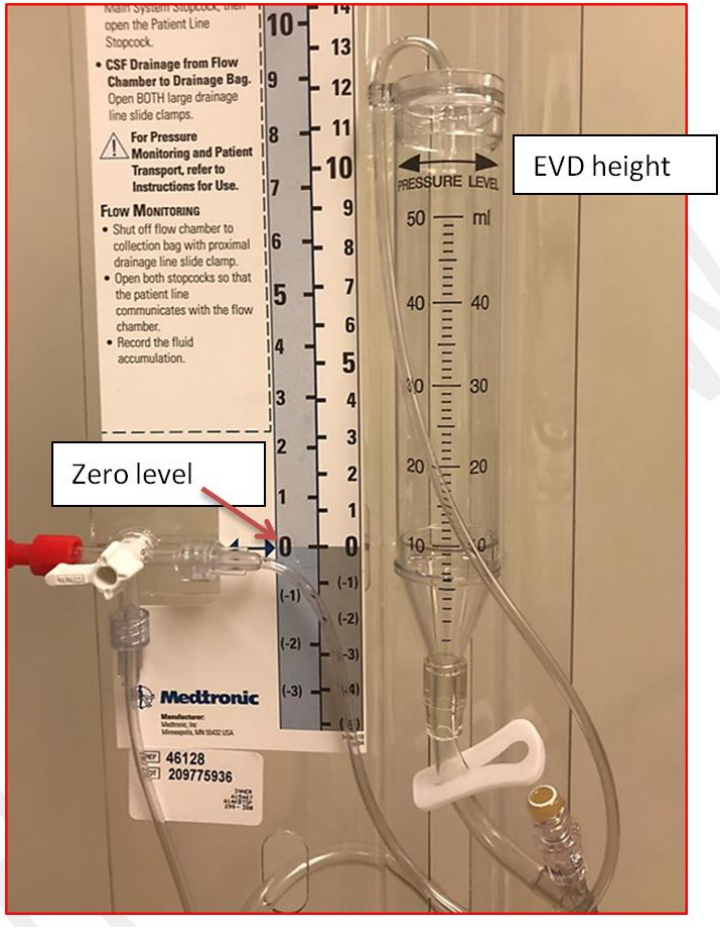
- Cardiovascular: Increased blood pressure (diastolic; infants and children)
- Central nervous system: Aggressive behavior, agitation, amnesia, anxiety, ataxia (partial-onset seizures; includes abnormal gait, incoordination), behavioral problems, confusion, depression, dizziness, drowsiness, fatigue, headache, hostility, insomnia, mood changes
- Gastrointestinal: Anorexia, constipation (children and adolescents), decreased appetite (children and adolescents), diarrhea, gastroenteritis (children and adolescents), nausea
- Ophthalmic: Conjunctivitis (children and adolescents), diplopia
- Otic: Otalgia (children and adolescents)
- Respiratory: Cough, nasal congestion (children and adolescents), nasopharyngitis, pharyngolaryngeal pain
- Miscellaneous: Head trauma (children and adolescents)

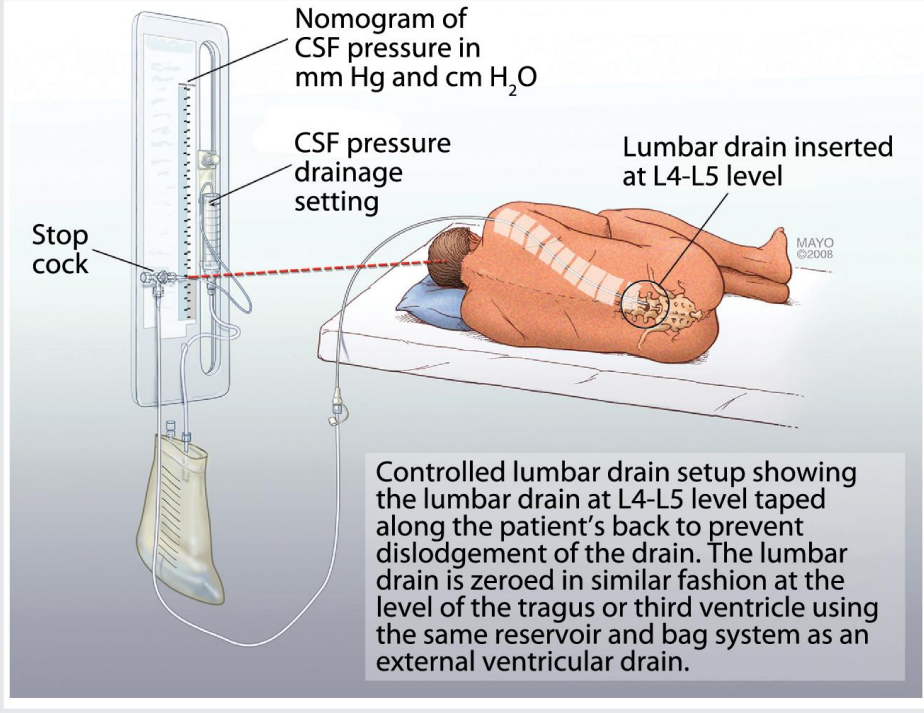
(check Lexicomp for additional reactions if not listed here)


Early SE
(within 10 min of seizure onset)
•If no IV access available -
•midazolam (IM 0.2 mg/kg OR IN 0.2 mg/kg OR Buccal 0.2–0.5 mg/kg; maximum 10 mg)
•OR rectal diazepam (0.2-0.5 mg/kg; maximum 20 mg)
• If IV access is available-
•IV lorazepam 0.1 mg/kg (maximum 4 mg, can repeat once)
•OR IV diazepam 0.15-0.2 mg/kg (maximum 10 mg, can repeat once)
Established SE
(10-30 min of seizure)
•IV fosphenytoin 20 mg PE/kg (maximum 1500 PE mg, can repeat 5-10 mgPE/kg if needed)
•OR IV levetiracetam 30-60 mg/kg (maximum 4500 mg, can repeat 30 mg/kg if needed)
•OR IV valproic acid 20 mg/kg (maximum 3000 mg, can repeat 20 mg/kg if needed, caution in patients with mitochondrial disease (POLG mutation))
•OR IV phenobarbital 20 mg/kg (may repeat additional boluses of 5-10 mg/kg if needed)
•can repeat the ASM above (as indicated in brackets) or give a different one if seizure persists
Refractory SE
(if seizure persists for >30 min or refractory to BZD & 1 first-line therapy)
•midazolam (load with 0.2 mg/kg at 2 mg/min infusion, titrate with EEG, maximum 2 mg/kg/h)
•OR pentobarbital (load with 5 mg/kg at 50 mg/min, titrate with EEG, maximum 5 mg/kg/h)
•OR thiopental (load with 2–7 mg/kg at 50 mg/min, titrate with EEG, maximum 5 mg/kg/h)
•OR propofol (load with 1-2 mg/kg at 20 mcg/kg/min, caution with doses >65 mcg/kg/min and prolonged application due to propofol infusion syndrome)
•OR ketamine (load with 1–3 mg/kg, max 4.5 mg/kg, titrate with EEG, maximum 100 mcg/kg/min)

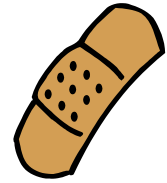
Lumbar Drain Management

- Transducer is leveled at the Foramen of Monroe (approximately at the tragus of the ear, or between the eyes if patient is side-lying) unless given an order to level elsewhere (sometimes level of heart)
- Normal ICP: *<20 cm H20*
- Indications for lumbar drain include pseudo tumor, to decrease CSF (to decrease symptoms of pseudo tumor), or persistent CSF leak related to trauma
- Potential complications of lumbar drain include infection, leak, over drainage (herniation can occur), clogged, bleeding, falls out
- Watch stopcocks!
    - **Must be open to patient and open to chamber to drain CSF.**
- ALWAYS clamp (turn OFF to patient) to transport or reposition i.e. Bathroom or sitting up in Bed/Chair. Don't forget to level, recalibrate, and re-open to patient and chamber once done! Clamping should NOT be longer than 30 minutes. Check during q assessment!
- Raise chamber to level prescribed (e.g. 10 cm H_2O). CSF will drain only when ICP exceeds this level.
- Monitor EVD patency. CSF in tubing should oscillate with patient respirations and movement.
- Open clamps every two hours to empty chamber every 2 hours (if no drainage >2 hours, call service). Document amount and characteristics of CSF drainage.
- To check patient's ICP: *raise the chamber, straighten the tubing & ensure fluid fluctuates. The # at which the fluid fluctuates in the tubing is the ICP reading.*
- Keep dressing clean, dry, and secure. Change when soiled using sterile technique. Clean site with alcohol (not Chlorehexidine because it's neurotoxic), let dry, and apply new gauze and tegaderm. **Call neurosurg APN first (pager 6875).**
- Change collection bag when ¾ full using sterile technique (includes sterile gloves & mask) (one hand will be "dirty" and the other hand will remain sterile - can drop full bag on the floor since it has a one-way valve).


open the Patient Line Stopcock.
• CSF Drainage from Flow Chamber to Drainage Bag. Open BOTH large drainage line slide clamps.
For Pressure Monitoring and Patient Transport, refer to Instructions for Use.
FLOW MONITORING
• Shut off flow chamber to collection bag with proximal drainage line slide clamp.
• Open both stopcocks so that the patient line communicates with the flow chamber.
• Record the fluid accumulation.
EVD height
PRESSURE LEVEL
ml
Zero level
Medtronic
46128
209775936


Nomogram of
CSF pressure in
mm Hg and cm H_2O
CSF pressure
drainage
setting
Lumbar drain inserted
at L4-L5 level
Stop
cock
MAYO
©2008
Controlled lumbar drain setup showing the lumbar drain at L4-L5 level taped along the patient's back to prevent dislodgement of the drain. The lumbar drain is zeroed in similar fashion at the level of the tragus or third ventricle using the same reservoir and bag system as an external ventricular drain.

Pain Assessment in Children:



Assess/document at least every 4 hours with vitals and assessments

- Scale
- Score
- Location
- Intervention
- Response Score

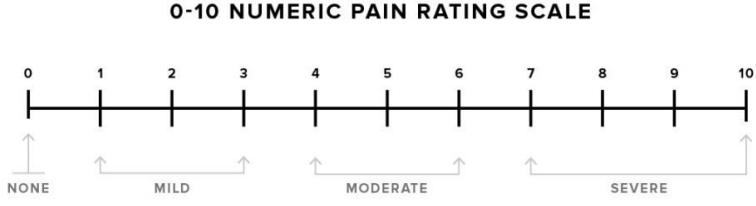
- Reassess & document within 30 minutes for IV and 60 minutes for any oral pharmacologic or non-pharmacologic intervention
- The presence of severe pain is a medical emergency and requires immediate intervention!

Pediatric Pain Assessment Tools (UCM PC 151)

Numerical Pain Scale: Intended patient population is cognitively developed children, adolescents, and adults with the ability to self-report.

The patient is asked to identify how much pain he or she is having by choosing a number from 0 (no pain) to 10 (the worst pain imaginable).

The 0-10 Numeric Pain Scale:

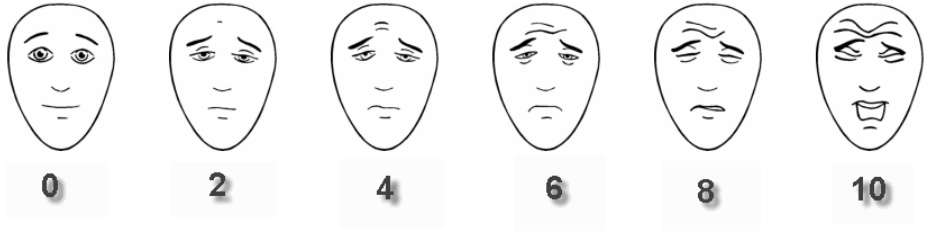


Faces Pain Scale Revised (FPS-R): Intended patient population is children ages 4-12 years or patients who may be cognitively impaired but are able to use the scale to provide a self-report. If preferred by the patient over the numeric scale it can be used beyond the age of 12.

- **Uses** six faces with different expressions on each face. **"These faces show how much something can hurt. This face** *[point to left-most face]* **shows no pain. The faces show more and more pain** *[point to each from left to right]* **up to *this* one.** *[point to right-most face]* **It shows very much pain. Point to the face that shows how much you hurt** *[right now]***."**

Score the chosen face 0, 2, 4, 6, 8, or 10, counting left to right, so "0" equals "No pain" and "10" equals "Very much pain." Do not use words like "happy" and '"sad." This scale is intended to measure how children feel inside, not how their face looks.

Faces Pain Scale - Revised



Don't forget a pain goal score!

r-FLACC: Intended patient population is infants, and children up to age 4 years, cognitively impaired children and adolescents, and critically ill children, adolescents, and young-adults unable to provide self-report. The r-FLACC incorporates caregiver input on child's behaviors when in pain. MEC Approved May 2019 Page 8.

- Uses behavioral indicators to assess **pain**. Each of the 5 categories is scored between 0 and 2, which results in a total score between 0 and 10.

☐ 0 = Relaxed and comfortable

☐ 1-3 = Mild discomfort

☐ 4-6 = Moderate **pain**

☐ 7-10 = Severe **pain** or discomfort or both

Categories	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested, **sad, appears worried**	Frequent to constant quivering chin, clenched jaw, **distressed looking face, expression of fright/panic**
Legs	Normal position or relaxed, **usual tone & motion to limbs**	Uneasy, restless, tense, **occasional tremors**	Kicking, or legs drawn up, **marked increase in spasticity, constant tremors, jerking**
Activity	Lying quietly, normal position, moves easily, **regular, rhythmic respirations**	Squirming, shifting back and forth, tense, **tense/guarded movements, mildly agitated, shallow/splinting respirations, intermittent sighs**	Arched, rigid or jerking, **severe agitation, head banging, shivering, breath holding, gasping, severe splinting**
Cry	No cry (awake or asleep)	Moans or whimpers; occasional complaint, **occasional verbal outbursts, constant grunting**	Crying steadily, screams or sobs, frequent complaints, **repeated outbursts, constant grunting**
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort, **pushing caregiver away, resisting care or comfort measures**

N-PASS: Neonatal Pain, Agitation, & Sedation Scale

Assessment	Sedation		Normal
Criteria	-2	-1	0
Crying Irritability	No cry with painful stimuli	Moans or cries minimally with painful stimuli	Appropriate crying Not irritable
Behaviour State	No arousal to any stimuli No spontaneous movement	Arouses minimally to stimuli Little spontaneous movement	Appropriate for gestational age
Facial Expression	Mouth is lax No expression	Minimal expression with stimuli	Relaxed Appropriate
Extremities Tone	No grasp reflex Flaccid tone	Weak grasp reflex ↓ muscle tone	Relaxed hands and feet Normal tone
Vital Signs HR, RR, BP, SaO_2	No variability with stimuli Hypoventilation or apnea	< 10% variability from baseline with stimuli	Within baseline or normal for gestational age

WAT-1 Assessment Scale

3 indicators obtained from the nursing documentation in the previous 12 hours are scored with one point:

1. *Loose/watery stools*
2. *Vomiting/wretching/gagging*
3. *Temperature elevation*

5 indicators assessed during a 2-minute observation of the patient at rest are scored with one point:

1. *State behavior.*
2. *Sweating*
3. Tremors
4. *Uncoordinated/repetitive movements*
5. *Yawning/sneezing*

2 indicators assessed during a progressive arousal stimulus scored with one point:

1. *Startle to touch*
2. *Muscle tone*

1 indicator assessed during an observation period following the stimulus scored with up to two points:

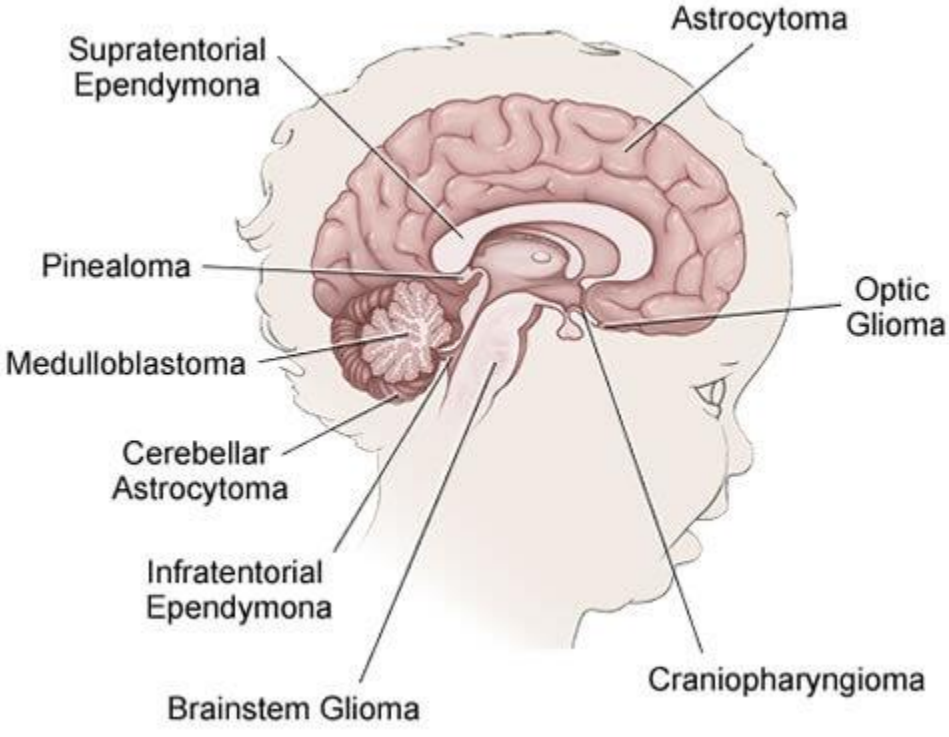
1. *Time to return to calm state* that is greater than 5 minutes will receive 2 points. If the time to return to calm state is 2-5 minutes, it will receive 1 point

The final WAT-1 score is the total sum of all indicators (0-12).
Interpretation: A higher WAT-1 score indicates more withdrawal symptoms while a lower score indicates fewer.

Withdrawal Assessment Tool (WAT Scale)

Description: The WAT-1 is an 11 item/12-point scale for monitoring narcotic (opioid) and/or benzodiazepine withdrawal symptoms in pediatric patients.
Interpretation: A higher WAT-1 score indicates more withdrawal symptoms while a lower score indicates fewer.
Assessment Method:
1. Review the WAT-1, familiarizing yourself with the indicators and how they are scored.
2. Review nursing documentation in the previous 12 hours.
3. Complete a 2 minute observation period with the patient at rest.
4. Assess patient during a progressive arousal then assess patient during an observation period following the stimulus. Use progressive stimuli to elicit the patient's response; specifically, using a calm voice, call the patient's name. If no response, call the patient's name and gently touch the patient's body. If no response, asses the patient's response to a planned noxious procedure, e.g., endotracheal suctioning. If a noxious procedure is not planned then, using a pencil/pen, provide < 5 seconds of direct pressure to the patient's nail bed.

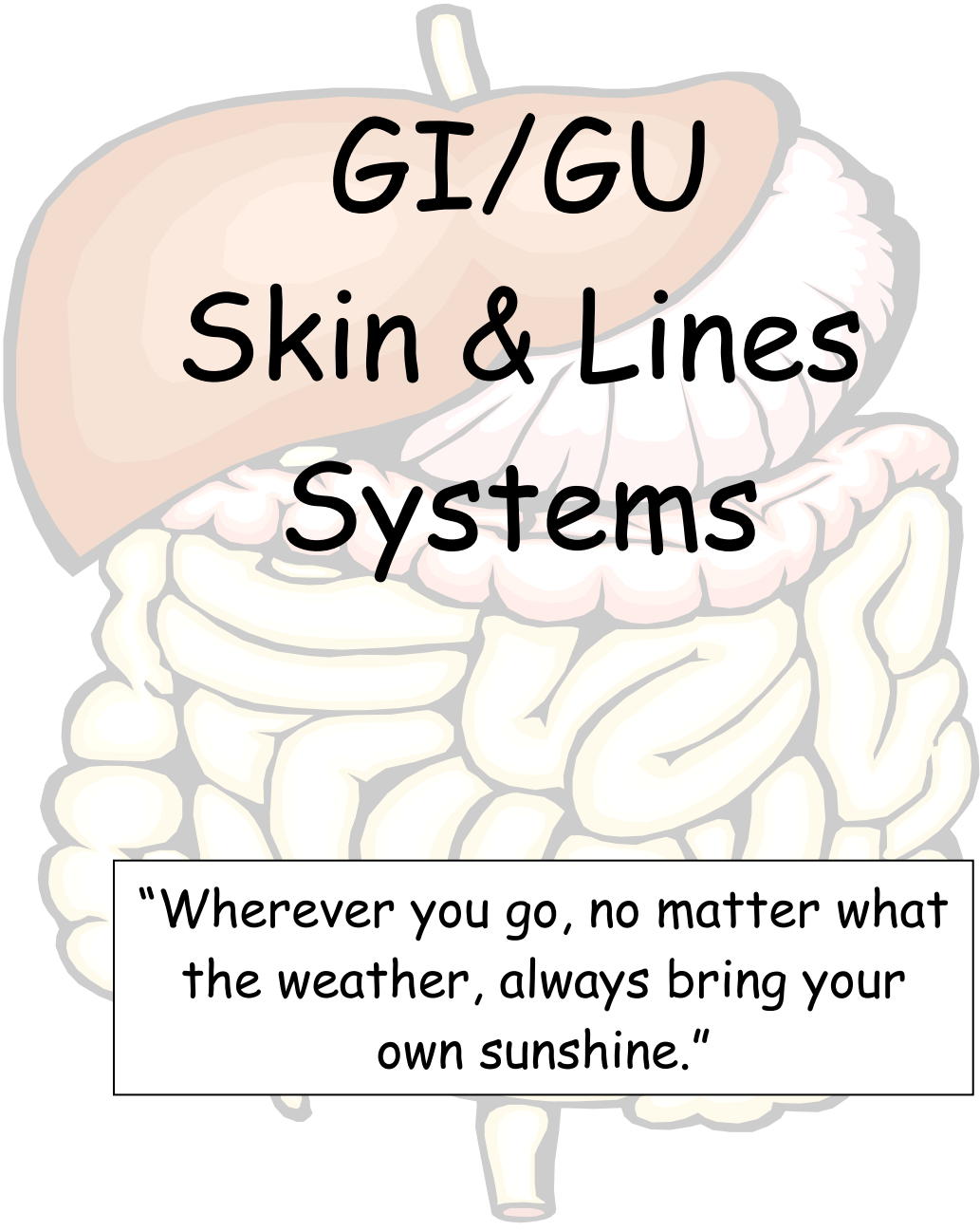
Pediatric Brain Tumors:



TUMOR	RELATIVE INCIDENCE (%)	PRESENTATION	DIAGNOSIS	PROGNOSIS
Medulloblastoma	35-40	2-3 mo of headaches, vomiting, truncal ataxia	Heterogeneous or homogeneously enhancing fourth ventricular mass; may be disseminated	65-85% survival; dependent on stage/type; poorer (20-70%) in infants
Cerebellar astrocytoma	35-40	3-6 mo of limb ataxia; secondary headaches, vomiting	Cerebellar hemisphere mass, usually with cystic and solid (mural nodule) components	90-100% survival in totally resected pilocytic type
Brain stem glioma	10-15	1-4 mo of double vision, unsteadiness, weakness, and other cranial nerve deficits, facial weakness, swallowing deficits, and other deficits	Diffusely expanded, minimally or partially enhancing mass in 80%; 20% more focal tectal or cervicomedullary lesion	>90% mortality in diffuse tumors; better in localized
Ependymoma	10-15	2-5 mo of unsteadiness, headaches, double vision, and facial asymmetry	Usually enhancing, fourth ventricular mass with cerebellopontine predilection	>75% survival in totally resected lesions
Atypical teratoid/rhabdoid	>5 (10-15% of infantile malignant tumors)	As in medulloblastoma, but primarily in infants; often associated facial weakness and strabismus	As in medulloblastoma, but often more laterally extended	10-20% (or less) survival in infants

Modified from Packer RJ, MacDonald T, Vezina G: Central nervous system tumors, *Pediatr Clin North Am* 55:121–145, 2008.

No herniation of spinal cord or meninges
Vertebral arches between L5 and S1, which fail to fuse
Hair tuft
Spina bifida occulta
Saclike protrusion containing meninges and cerebrospinal fluid
Spina bifida cystica: meningocele
Saclike protrusion is filled with cerebrospinal fluid, meninges, nerve roots, and spinal cord.
Spina bifida cystica: myelomeningocele



GI/GU Skin & Lines Systems

"Wherever you go, no matter what the weather, always bring your own sunshine."

Enteral feedings

Administration:

- HOB up at least 30-45 degrees unless contraindicated to prevent aspiration
- All feeds, continuous or bolus, should always be given via a pump
- Enteral feeds may run on Kangaroo pump if feeds are greater than 15ml/ hour. If feeds are less than 15cc/hour, they should run on a syringe pump.
- Blue food dye should **NOT** be routinely added to feeds
- Children should be encouraged to suck on a pacifier while receiving enteral feeds
- Nasogastric tubes are to be changed every 30 days (manufacturer's recommendation)

Residuals/Holding Feeds

Only check residuals if clinical condition or symptoms indicate intolerance to feeding (**Remember you never check residuals for NJ's)**.

- Abdominal distension
- Pain
- Nausea
- Vomiting
- Diarrhea

Continuous feeds:

- Acceptable residual should be <4 hours worth of feeding
- If < 4 hours, refeed and continue to advance feeding rate
- If > 4 hours worth – hold feeds and notify MD

Bolus feeds:

- Assess for symptoms prior to and during feed
- Acceptable residual right before bolus is 1/2 of the previous feeding volume (<120cc if fed 240 cc); if high, hold feed and notify physician (usually hold feeds for 1 hour and then resume).

Venting GT's

*Rationale for venting enteral feeds is to avoid distention that can lead to gastric perforation (esp. in new GT pts.), abdominal pain, or pulmonary disturbances

- New GT's **must** be vented continuously
- GT's more than and/or equal to 6 weeks-old:
  - Continuous feeds should be routinely vented every 4 hours for 5-10-minutes. (Some children may require continuous venting).
  - Bolus feeds should be routinely vented for a minimum of 15 minutes after feeding is administered.

Maximum Hang Times (Per *UCMC PC237 and Collection, Storage, & Prep of Human Milk Protocol*).

Nutrition Source	Maximum Hang-time	Frequency of Syringe Pump Tubing change	Frequency of Feeding bag change
Breast milk	4 hours	Q 4 hours	Syringe pump preferred
Fortified Breast milk	2-4 hours	Q 2-4 hours	Syringe pump preferred
Powdered & Reconstituted Formula (prepared by Nutrition Services)	4 hours	Q 4 hours	Feeding bag is good for 24 hours, rinse with sterile water between hangtimes
Sterile, Ready-to -feed	4-8 hours*	Q 4-8 hours*	Feeding bag is good for 24 hours, rinse with sterile water between hangtimes

* 8 hours for pediatrics and non-immunocompromised infants; 4 hours for neonates and immunocompromised infants.

Formula: Opened or ready to feed formula is good for 24 hrs in refrigerator.

Breast Milk:

- Breast milk is stored in sterile containers and if not immediately consumed by the infant, placed within 30 minutes in a refrigerator or freezer designated for breast milk.
- Individualized labels should be provided to the mother. Place patient label and time/date breast milk refrigerated, frozen, or thawed on container.
- Fresh breast milk is good for 48 hours in refrigerator.
- Defrosted breast milk is good for 24 hours
- Breast milk in our freezer is good for 1 month (at home 6 months).
- Lactation consultant: Pager #9769

Nipples and Flow Rates

-Fast Flow Nipples: Red Similac nipple, New born orthodontic nipple, Pink rimed Enfamil premature nipple

Medium Flow Nipples: Ross/Similac premature nipple (solid, small pink nipple)

-Slow Flow Nipples: *Best for Premature infants, breast & bottle infants, chronic lung disease infants:* Ross standard, clear nipples; Enfamil standard (white rimmed nipple), Cross Cut Nipple (yellow rim nipple) – for infants and toddlers with thickened feeds.

Care of Infants on Phototherapy

Care of Infants on Phototherapy (per FBC 54)

- The infant's skin must be fully exposed except for a diaper.
- The bili-blanket can also be used in conjunction with the bili-lights.
- **Remember to turn off Bili lights when drawing labs.**
- The eye shields can be applied in two ways:
  - Via a strap that attaches to the eye shields with Velcro.
  - By applying the Velcro tabs to the newborns skin at the temples and then securing the eye shield to the tabs.
  - To remove the velcro-tabs use Surgilube and water.

Skin Care

- Infants should wear **only** a diaper or a surgical mask tied in place over the genitals. Expose as much of the skin as possible to the lights.
- Change the infant's position frequently.
- Keep skin clean and dry.
- Do not use oily lubricants or lotions on the skin in order to prevent increased tanning or the "frying effect".
- Because the newborns are naked and the bili-lights do not give off heat, newborns will need to be in an incubator or radiant warmer during phototherapy to maintain the infant's temperature.

Bili-Blanket

- Cover the bili-blanket with its appropriate cover before placing it next to the infant's body.
- During feeding, the parent may hold the infant with the bili-lights turned off, bundle the infant with the bili blanket. Holding the infant with the bili-lights off depends on the infant's bilirubin levels. This must first be cleared with the physician caring for the infant.

***Assessment**: Bilirubin is excreted in the stool therefore it is important to note the number and characteristics of the infant's stools.

***Bili-Meter:** To assure that patients receive therapeutic doses of phototherapy, all phototherapy units must be measured for irradiance q shift. (utilize Elsevier Skills for more information)

Types of Phototherapy	Distance from Patient	Expected Irradiance
Biliblanket	Bilimeter on blanket	30-35 W/cm2/nm
Photo-Therapy 4000 Bluelights	15- 20 inches from patient	17 uW/cm2/nm
Spot (Ohmeda)	20-35 inches from Patient	8-30 uW/cm2/nm
Spot (Girrafe)	23-24 inches from pt. with a 29 cm diameter	30 uW/cm2/nm

Ohmeda Bilimeter

Procedure:

1. Remove the meter from its cover.
2. It is necessary to calibrate the meter prior to its use.
   - Switch the meter to on. Position *with the black cap in place.* 0.0 or 0.1 uW/cm2/nm is an acceptable reading.
3. To measure irradiance of bank lights or overhead lights, remove the cap and place the meter at the level of the infant's mid section.
4. The black button on the right side of the meter can be depressed in order to hold a reading.
5. Document finding in flowchart. To be done at least once per shift. To measure the irradiance of the fiberoptic biliblanket:
   A) Place the meter over the blanket.
   B) Obtain a separate reading for 5 sections of the blanket plus the middle.
   C) Get the average of the 6 readings to obtain the whole number.

Thermoregulation

Infants lose heat a lot faster then adults due to their larger surface area to body mass ratio, decreased insulated fat, and increased skin permeability to water (Blackburn, 2003). Peripheral vasodilatation and sweating also help contribute to heat loss.

Infants at risk for heat loss and thermal stress include:

- Prematurity
- Small for gestation age
- Infants with neurological and endocrine issues
- Infants with altered skin integrity
- Infants with hypoglycemia

Signs and Symptoms of Altered Thermoregulation

The signs and symptoms of altered thermoregulation in the neonate are often very subtle and astute nursing assessment is important for early detection.

Signs and symptoms of hypothermia include (but are not limited to):

- Mottling/pallor
- Acrocyanosis
- Poor feeding
- Bradycardia/tachypnea/apnea
- Lethargy
- Hypoglycemia
- Abdominal distention

Signs and symptoms of hyperthermia due to overheating include (but are not limited to):

- Tachypnea
- Apnea
- Hypotension
- Flushing
- Irritability
- Poor feeding
- Diaphoresis
- Skin temperature >core temperature

Nursing Interventions

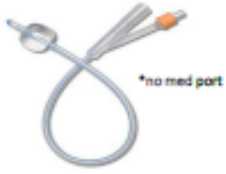
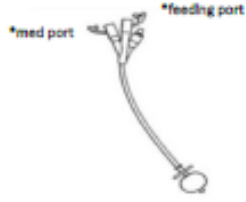
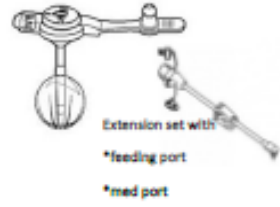
A few simple interventions that can be applied to all infants include:

- Provide a warm, draft free area
- Dry the infant quickly post a bath
- When possible place infant on a pre-warmed surface
- Cover the head
- Warm hands and equipment before touching the infant
- When possible transport infant in a closed and warmed environment
- When in an open crib, dress and swaddle the infant appropriately

Interventions for sick or premature infants whom are placed in an incubator include:

- Assure proper placement of skin temperature probes
- Use double walled incubators
- Set servo temperature according to birth weight/age neutral thermoregulation chart
- Add warmed, ambient humidity
- Use heat lamps when infant is outside of incubator
- Don't leave incubator side walls open for long periods of time
- Open incubator only when necessary/cluster care
- Don't place incubator/radiant warmer near outside window
- Drape blanket over incubator
- When applicable, have parents do kangaroo care when holding infant
- Utilize port holes when doing hands on care

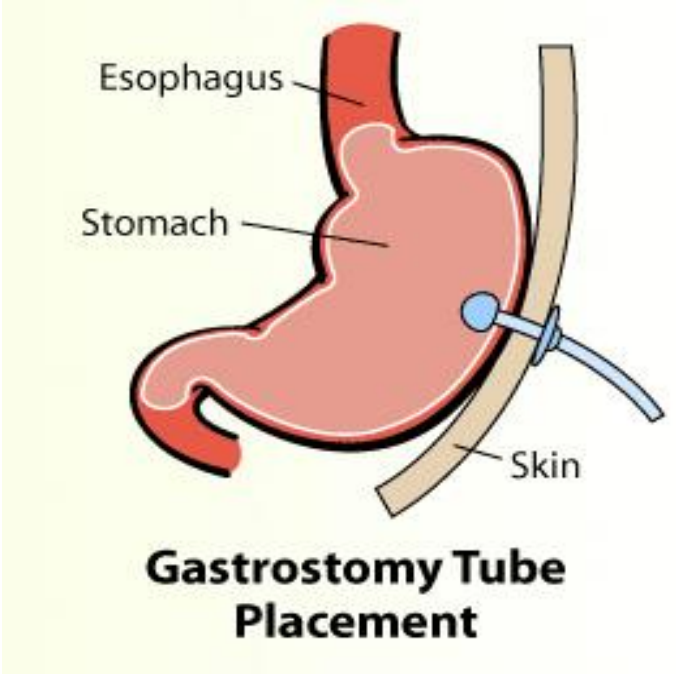
Gastrostomy Tubes:

FOLEY CATHETER	MIC-G	MIC-KEY OR AMT BUTTON
		
• **Post-Op Plan:** -Initial surgical placement:: 8Fr -Upsized in about 2 weeks: 10Fr -Upsized in about 2 weeks: 12Fr Mic-G or Low Profile Button • **Initial Care:** Tube stabilization -Transparent film or -Hollister securement device -Cleanse site with dressing chg -change dressing weekly and PRN • **Refer to care listed at right once changed to a Mic-G or Button** • **Rationale for Foley Placement:** -Allows tract to gradually increase in size to accommodate G-tube -Reduces risk of leakage	• **Post-Op Plan:** -May keep the Mic-G OR -May change to Low Profile Button 4 weeks post-op • **Care:** -Cleanse site with water / pat dry -Position and maintain flange snug against skin to reduce risk of leakage -Use number markings on tube to identify position of flange -Turn /rotate button 1/4 turn QD -May use fenestrated dressing PRN • **Rationale:** Exterior flange -Adjusts to individual patient size -Adjusts for sizes smaller than smallest button available (.8cm) -Accommodates for abdominal distension	• **Post-Op Plan:** -Extension set is necessary for administration of feeds -First Button change: 3 months and then Q 3 months • **Care:** -Cleanse site with water / pat dry -Turn /rotate button 1/4 turn QD -May use fenestrated dressing PRN • **Rationale:** -Low profile is easily managed with children -Parents can be taught to change at home -Short length reduces risk of clogging

Pediatric Surgery APNs #4156

Christa Fox, APN, CPNP	6280 / 4-5340	Chris Speaker, APN, FNP-BC	9883 / 4-9883
Chris Baker, APN, CNS, CWOCN	8048 / 2-9618	Lily Yuen, APN, CPNP	8379/2-9178
Shannon Harris, APN, CPNP	6970 /2-9880	Joyce Espen, APN, CPNP	7172 / 2-5578

Gastrostomy Tubes (cont.)



- 3 types of G-tubes are used
- CALL Pediatric Surgery APN (#4156) when a G-tube comes out unexpectedly
- Pediatric surgery APN will replace ALL G-tubes <6 weeks old and may follow with a GT study
- RN's may replace G-tubes >6 weeks post-op once approved by the Pediatric surgery service
- Mic-G and Mic-Key (button) G-tubes are changed every 3 months by the pediatric surgery APN
- Patients with a Nissen may need to be vented (Farrell bag or syringe)
- G-tube sites should be assessed and cleaned daily/prn to avoid irritation

Care and Maintenance of Gastric Decompression Tubes

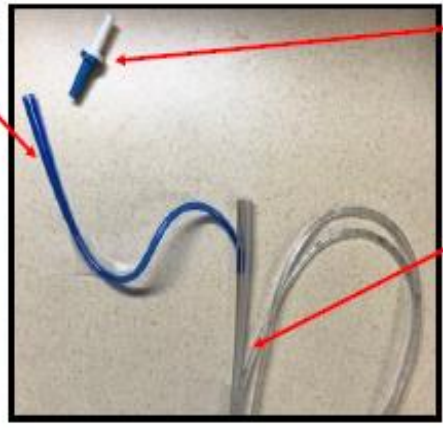
Blue/Air Vent Lumen: provides an air vent, preventing suctioning of gastric mucosa into holes along the distal tip of the tube

Flush every 2-4 hrs & PRN with 5-20 mls (based on pt size) of **AIR**

THIS LUMEN SHOULD ONLY BE FLUSHED WITH AIR!!

If the main lumen is flushed, the air vent lumen should be flushed afterwards.

Temporarily cap off this lumen when flushing the main lumen.



Anti-reflux valve:

Blue end of valve connects to blue air vent lumen

Can place white end of valve into main lumen to clamp off for transport.

Clear/Main lumen: connected to wall suction, for removal of gastric contents.

Flush every 2-4 hrs & PRN with 5-20 mls (based on pt size) of **NS or sterile H_2O**

- Both the blue air vent and the main decompression lumens should be flushed every 2-4 hours AND PRN to ensure patency. **Always** flush the main decompression lumen **FIRST**.
- If using an anti-reflux valve ensure correct placement: **blue** end of valve into **blue** air vent lumen. If placed the other way you are clamping off the air vent, rather than venting, which can cause harm to your patient!
- When flushing the main lumen, the **blue** air vent lumen should be temporarily capped. To do this, place the anti-reflux valve with the white end connected to the blue air vent lumen. **Remember to flip anti-reflux valve back so that the blue end of valve is connected to the end of the blue vent lumen after flushing**
- Maintain tube above the level of the stomach
- Suction should be set at 30-40 mm Hg for low continuous or intermittent suction per order
- The tube can be used without an anti-reflux valve but note that if fluid is backing up into the **blue** air vent lumen the tube is **NOT** functioning properly and you should trouble shoot by flushing both lumens as indicated above until cleared.
- Irrigation tray should be kept at bedside and replaced every 24 hrs
- Remember to account for the volume of NS or sterile H_2O you are flushing with in your I's and O's

Pediatric Patient Post-Catheter Removal Protocol

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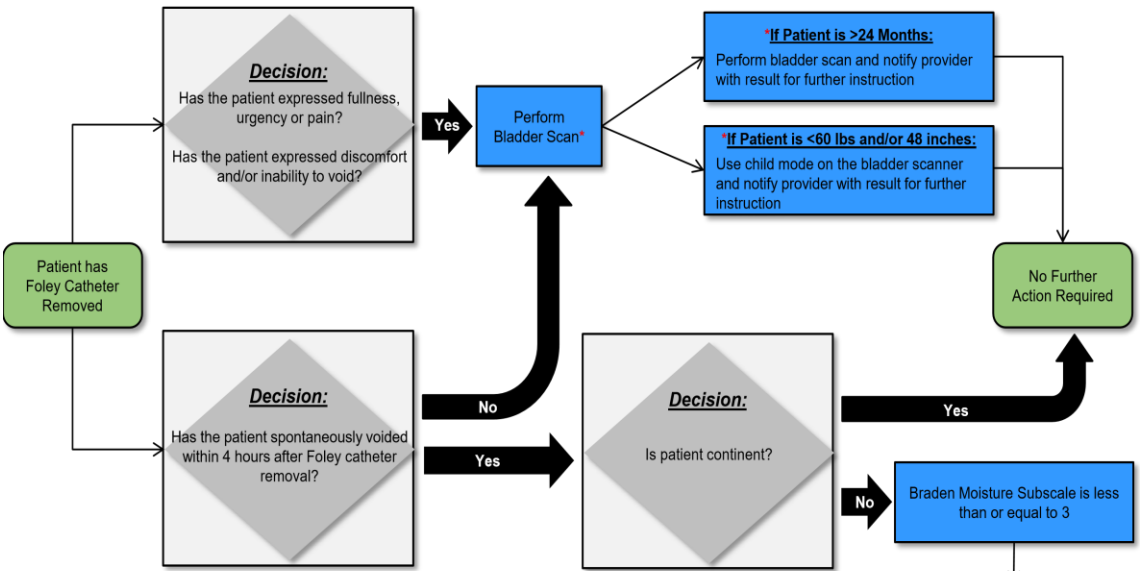

Adolescent Male Patients:

Texas Catheters or Retracted Penis Pouches

- Patient should be measured for size prior to application of Texas Catheter
- Assess skin daily while in use
- Hair must be clipped prior to application of retracted penis pouch

Incontinence Pads / Diapers:

Should only be used:

- If patient is incontinent and in bed
- Only one incontinence pad should be used at a time
- Only use diapers in adolescent patients when up in chair or ambulating
- Acceptable for use in non-potty trained patients

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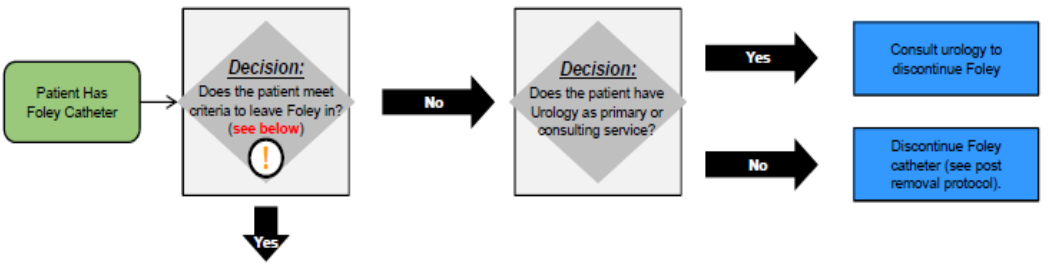
Standard Pathway for Prevention of Catheter-Associated Urinary Tract Infections



Maintain Foley Catheter:

1) Assess need for catheter daily
2) Perform Pericare Q shift and PRN
3) Use catheter securement device
4) Maintain drainage bag lower than level of the bladder
5) Maintain tubing free of kinks and loops
6) Provide patient education about indwelling urinary catheters

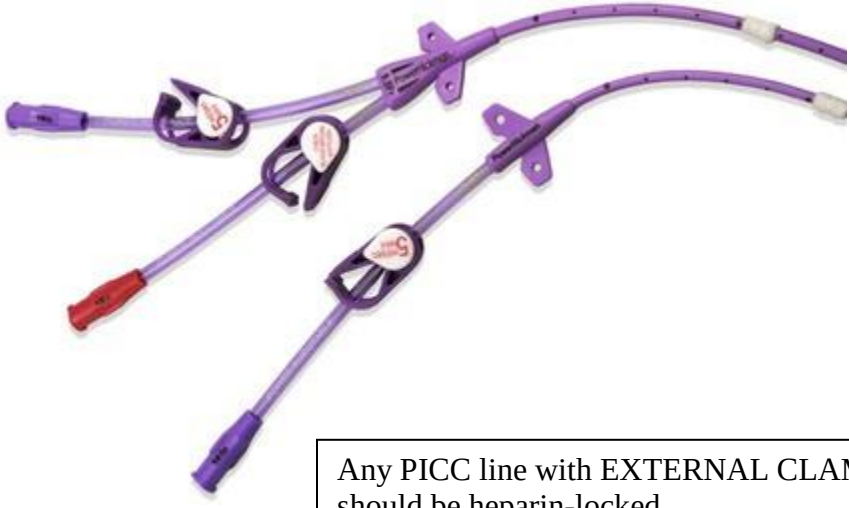
Examples of Surgery on a Contiguous Structure:

- **Urologic** – Prostatectomy, neobladder
- **Gynecologic** – Radical hysterectomy, modified radical hysterectomy, extensive dissection around the ureter/bladder, repair of cystostomy or oversew the bladder
- **Colorectal** – abdominoperineal resection, ileoanal procedure, coloanal anastomosis, proctocolectomy, repair of ileo-vesicle fistula, repair of colo-vesicle fistula, major abdominal surgery in a patient with symptomatic BPH
- **Transplant** – Post Renal Transplant

Patient meets at least one of the following criteria:

- Need for accurate measurement of urinary output in a critically ill patients
- Epidural catheter and ONE or MORE of the following:
  - Known history of urinary retention
  - Lumbar epidural catheter
  - Male greater than 65 years of age
  - Benign Prostate Hypertrophy
- Surgery on a contiguous structure (urologic, gynecologic, colorectal)
- Urinary incontinence in a patient with full thickness wound on the trunk (including muscle or skin flaps/skin graft on the trunk)
- Post-surgical within 24 hours
- Acute urinary retention or bladder outlet obstruction
- Neurogenic bladder
- Prolonged immobilization
  - Potential unstable thoracic/lumbar spine
  - Multiple traumatic injuries such as pelvic fracture
- Hematuria with clots (for irrigation)
- To increase comfort at end of life if needed

PICC Line Updates – How do I know how to flush my patient's PICC line?



Any PICC line with EXTERNAL CLAMPS should be heparin-locked

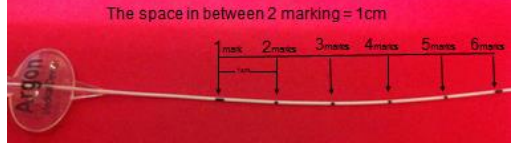
- External clamps indicate that there is NO internal valve in the line – the clamps act as the valve
- Flush with 2mL, 10 units/mL (conc) – q12 hours or more frequently after medication/fluid infusion
- These lines should always have heparin when not in use (not infusing fluids)
- Use a 10 mL syringe or greater when flushing and pulsatile flush when heparin-locking

Any PICC line WITHOUT external clamps has an internal valve and does not require heparin, regardless of the catheter size

- Flush with 3-5 mL of saline q12 hours or more frequently after medication/fluid infusion
- Use a 10 mL syringe or greater when flushing, and pulsatile flush when saline-locking

PICC Lines in the Neonatal Population

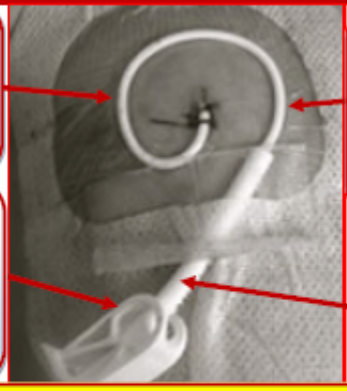
1. Neonatal PICC catheters are very similar to the PICC lines that are used in pediatrics – they are percutaneously inserted into a central vein, so they can be used for all infusions (Except BLOOD products, contrast, or bicarb!!).
2. The dressing change is done only on a PRN basis, not scheduled. If the dressing needs to be changed, contact the NICU Charge Nurse, 56505. The Charge Nurse will send someone to change the dressing. (unocclusive, soiled, etc.).
3. There should always be fluids infusing through a neonatal PICC line. Typically, the fluid is 0.9% NS or D10W with a 0.5-1 units of heparin to keep the line open. The minimum rate of infusion is 0.5mL/hour.
4. Always use at least a 5mL syringe on all neonatal PICC lines – nothing smaller.
5. Always use a syringe pump to administer medications, flushes, etc. Manual flushing creates too much pressure and will cause the line to migrate.
6. Document the site with each assessment. At the beginning and end of the shift, you should assess and document how many marks are visible on the PICC line.



7. No blood draws!! These lines very rarely draw back due to their small size and the risk of line migration is too high, so you will have to perform a heel stick or venipuncture for blood specimens.
8. Also, the line may not be centrally located so make sure to verify that the line is central. If the line is not central, there are limits to the amount of dextrose, calcium, and potassium that can be infused through the line.

Central Line Management TIPS

Keep central line **coiled under transparent dressing**



Dressing must **completely cover the proximal/thin**

Line clamp should always be placed on the **distal/ thicker portion**

Secure the distal / thicker end of the line

Don't Force the FLUSH!!!

*IF usual securement methods are not enough, MAY consider use of an ACE wrap to prevent child from pulling or tugging on line

**Perform QS and PRN skin checks under wrap to avoid skin breakdown*

What to do IF THE LINE BREAKS

1. Place a **PADDED CLAMP** between the patient and the break
2. **Cover broken portion** of the line with transparent film
3. Secure the distal line
4. Notify PRIMARY SERVICE
5. Primary Service to call PEDS SURGERY to assess for repair

Questions? Pediatric Surgery 2-6175 / APN Pager #4156

Sensitivity to Dressing?

Ensure that sensitivity *is to the dressing and not the CHG*

** Tips*

-Ensure CHG is completely dry before applying transparent dressing

-Moisture under dressing can mimic appearance of an allergic reaction

Alternate dressings include:

-dry gauze or 'IV 3000' transparent film dressing

IV 3000: transparent drsg w tape on only 2 sides

**Tip*

-NEED additional reinforcement with tape to secure the line

What can happen if the line is NOT secured

LINE NOT SECURED

PRO

-Tubing coiled under dressing

-Thick portion of line under drsg

CON

-LINE IS NOT SECURED AT EDGE OF TRANSPARENT DRESSING

OUTCOME

-Unsecured line UNCOILED & KINKED under dressing

-Line not observed/kink not observed

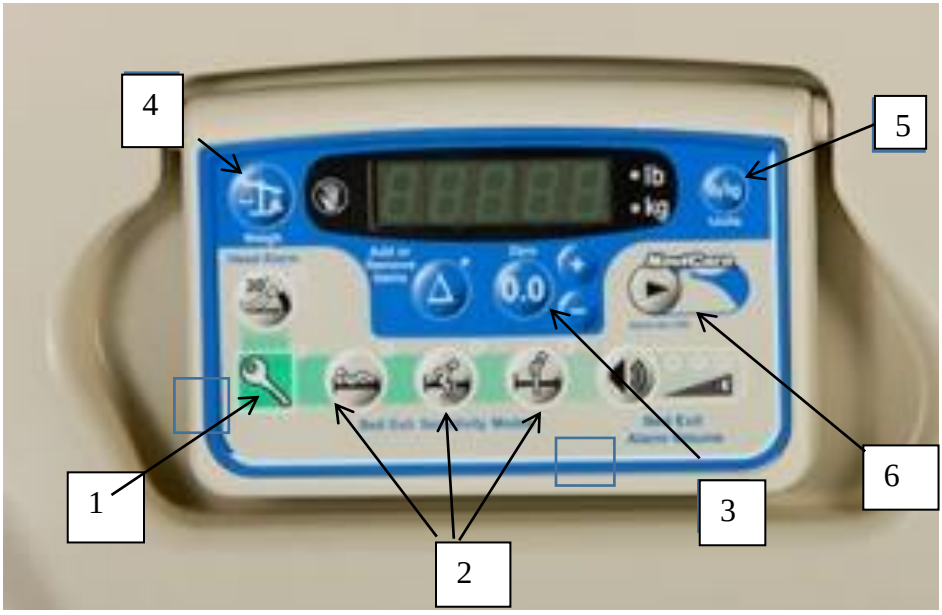
-Flushing attempt met resistance

-Flush forced

-LINE BLEW OUT REQUIRING REPAIR

*This line broke 3 wks after insertion

Bed Alarm: Zero bed scale/Weigh Patient



1. Zero bed when patient is NOT in the bed. Zero bed with any linens, pillows, and/or equipment that the patient will be using in it.
2. ON bed rail, locate caregiver control panel- pictured above.
3. Press key symbol (1) on caregiver panel. Press and hold Zero key (#3) for one second and wait for one beep and zeros on display. Bed is now zeroed.
4. Push weigh button (#4). You can read weight in pound or kilograms by pushing unit button (#5).

Activate Three-Mode Bed Exit Alarm

1. Place patient in bed, centered on mattress. Try to minimize patient movement.
2. Press key button (#1) until illuminated.

3. Set desired bed sensitivity mode (#2).

Note: you can also set bed exit alarm volume (#6).

a. One beep, alarm is set.

b. Several beeps or all three bed exit sensitivity mode (#2) indicators are flashing alarm is NOT set.

i. Check patient position, minimize patient movement.

iii. Verify patient weight by pressing weigh button (#4). If patient weight incorrect, repeat steps above to zero bed.

De-Activate alarm

1. Press key button (#1) until illuminated.

2. Press any of 3 bed sensitivity mode control mode control buttons (#2) until alarm clears.

NOTE: Bed cable must be connected to call light system for bed exit alarm to trigger call light. Verify this is connected prior to setting bed alarm.

Bed Exit Alarm–3 Mode Patient Position Monitor

The bed exit alarm will notify the caregiver when:

- Out of Bed: patient's weight shifts significantly off the frame of the bed.
- Exiting: patient moves away from the center of the bed towards an egress point.
- Patient Position: patient moves toward either siderail or moves away from the head section, such as sitting up in bed.

To Activate:

- Ensure patient is on the bed.
- Press the enable control.
- Press the desired mode control. When the system beeps one time and the indicator light stays on, the system is armed.

To Deactivate:

- Press the Enable Control.
- Press the desired mode control. When the system beeps one time and the indicator light is gone, the system is deactivated.

Hill-Rom

5

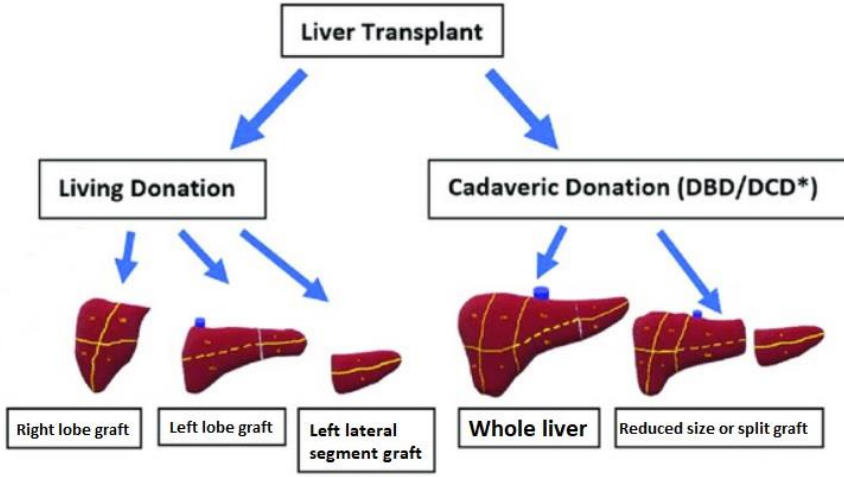
Pediatric Liver Transplantation:

Indications for Pediatric OLT
Chronic liver disease: • Cholestatic ds: BA, PFIC, AGS, INH • Metabolic liver ds: a1-ATdef, tyrosinemia I, Wilson, CF, GSD, TPNALD • Chronic hepatitis: AIH, PSC, post-viral, fibrocystic liver ds, cryptogenic cirrhosis, Budd-Chiari syndrome
Acute liver failure: • Fulminant hepatitis: AIH, viral, drug-induced • Metabolic liver disease: fatty acid oxidation defects, neonatal hemochromatosis, tyrosinemia I, Wilson
Inborn errors of metabolism: • Criggler Najjar I • Familial hypercholesterolemia • Organic acidemia • Urea cycle defect • Primary hyperoxaluria
Hepatic tumors: • Hepatoma • Hepatocellular carcinoma • Hemangioendothelioma

Pre-operative factors affecting post-transplant care

- Malnutrition/malabsorption
- Liver synthetic dysfunction
- Hypersplenism
- Ascites, hypoxia, renal insufficiency
- GI Hemorrhage
- Immunosuppression
- Previous surgeries
- Other associated anomalies-cardiac, pulmonary, GI

Liver Allocation	
Status 1A:	Status 1B:
Patients with severe liver disease at risk of death within 7 days: • Fulminant hepatic failure • Primary nonfunction • Early hepatic artery thrombosis • Acutely decompensated Wilson's disease	Chronic liver disease in ICU with PELD/MELD score of >25 PLUS one: • a. On a mechanical ventilator • b. Gastrointestinal bleeding requiring at least 30 cc/kg of red blood cell replacement within the previous 24 hours; or candidates also on the intestine list, at least 10 cc/kg of red blood cell replacement within the previous 24 hours • c. Renal failure or renal insufficiency on continuous CVVH or continuous CVVD • d. Glasgow coma score <10 within 48 hours of the listing/extension.



Transplant Work-up:

BLOOD WORK:
Blood Type x 2 (at least one test should be a type & screen, the other can be an ABO)
CBC with diff & platelets
PT/INR
Comprehensive Metabolic Panel, GGT, Conjugated bili
Hepatitis A IgG & IgM
Hepatitis B Surface Ab & Ag
Hepatitis C Ab
EBV IgG & IgM
CMV IgG & IgM
HIV1/HIV2 Ab
HSV
Varicella Titer
Measles Titer
Alpha Fetoprotein
ANA
SMA
Vitamin A, D& E levels
Quantiferon-TB Gold

For storage: 1 – 5mL red top tube to transplant immunology lab (ext. 2-0700) for storage. Please send blood with a miscellaneous requisition to the central lab with directions written on it that the blood should be sent to the immunology lab for storage. Notify immunology lab that blood is being sent from patient who is receiving a liver transplant.

OTHER TESTS / EXAMS:
Abdominal ultrasound/doppler
Chest X-ray
EKG
Echocardiogram
Dental exam

Operative factors affecting post-transplant care:

- Blood loss, plasma infused
- Urine output
- ETT size/position
- Medications infused
- IOP VS, lab results
- Warm/cold ischemia times
- Vascular access
- Type of graft, donor attributes
- Color/texture of graft following reperfusion
- Biliary and vascular anastomosis
- Bowel injury or spillage
- Number and type of drains
- Type of wound closure

Post-operative Care (PICU):

- Rapid and thorough assessment
    - Ventilation, hemodynamic stability, vascular access
- Admission labs
    - ABG, CBC, electrolytes, liver function tests, coagulation studies
- Radiological evaluation
    - Chest x-ray
    - Abdominal ultrasound with Doppler
- Monitor hemodynamic indicators: VS, CVP, Urine output, skin perfusion, acid-base balance
- Post-operative indicators of graft function
    - Earliest: appearance and consistency of liver after reperfusion, bile formation
    - Hemodynamic stability, good neurological recovery
    - Abnormalities in coagulation are common in the first 24-48 hours
    - Rising bilirubin: graft congestion, bile leak, sepsis, drug toxicity, reperfusion injury
- Hemodynamic indicators
    - Post-operative hypertension

        - Volume shifts
        - Poor pain control
        - Medications
    - Asymptomatic bradycardia
        - Excessive intravascular volume
        - Normalization of pre-operative vasodilatory tone
        - Vagal stimulation or injury
        - Medications
        - Venous access position
        - Mechanical ventilation
- Postoperative indicators of surgical complications
    - Postoperative bleeding
    - Early bile leaks: intra-abdominal collection, intestinal perforation, duct anastomosis problems
    - Chylous ascites – lymphatic disruption, bowel perforation

Postoperative Orders:

- IVF should ensure adequate graft and vital organ perfusion
    - D5 ½-NS + 20meq/L KCL at maintenance rates when there is adequate urine output and normal hydration status
    - D5 ½ NS at insensible rates when there is oliguria and over hydration
    - NS or 5% albumin for volume expansion
    - Begin TPN per transplant team ONLY
    - PO/NG feeds early
    - Maintain serum albumin ≥ 2.7 g/dl
- Hyperkalemia and metabolic acidosis are early clues to graft vascular insufficiency or major dysfunction
- Heparin therapy
    - Prophylaxis against arterial thrombosis
    - Therapeutically after thrombectomy when arterial or portal vein thrombosis has already occurred.
    - Prophylaxis is started in patients who weigh less than 20 kg
    - Duration is intended to be around 5 days

    - Initiation is UPON ARRIVAL unless bleeding or INR > 2
- *Prophylactic heparin:*
    - Infusion of 10 units/kg/hr started without a bolus.
    - This dose will be decreased only if the PTT is more than 50 seconds.
    - PTT should be checked q12 hours unless there are bleeding complications, in which case it should be checked q4 hours.
- *Therapeutic heparin:*
    - 20 units/kg/hr (adjusted according to the PTT value).
    - Dose should be adjusted to keep the PTT between 55-70 seconds.
    - PTT should be checked q4 hours until a stable value within the therapeutic window (55-70 seconds) has been achieved.
    - After that check PTT q12 hours unless bleeding complications occur.
    - If PTT is low, follow the heparin protocol.
- Contraindications for heparin therapy:
    - Active bleeding requiring packed cell transfusion of more than 20cc/kg every 4 hours.
    - PT > 25 seconds- check with Transplant
    - Platelet count <20,000
- Reasons to stop heparin therapy:
    - Surgery: Heparin should be stopped 4 hours prior to surgical procedures
    - Liver biopsy: Heparin should be stopped 8 hours prior to biopsy and may be restarted 6 hours after biopsy
    - Other hemorrhagic complications
- Jackson Pratt Drains:JP drainage to be replaced with
    - cc for cc with FFP if INR >3
    - cc for cc with 5%albumin
    - 25% albumin at 1cc per 5cc JP output, depending upon volume status
    - replacement usually is done in the first 72 hours
    - MONITOR for bilious drainage and report immediately.
- Transfusion of Blood Products:
    - Platelets:
        - if platelet < 20,000/ml or if there is clinical bleeding.
        - Order filtered platelets.

- PRBC:
    - Do not transfuse unless Hemoglobin<7-8 or if there is active bleeding.
    - Order CMV-negative blood when transfusions are required.
    - Washed PRBC's are to be used if CMV negative blood is not available.
    - Irradiated blood products
- Immunosuppression:
    - Induction therapy- polyclonal AB (thymoglobulin), monoclonal AB (basiliximab & daclizumab).
    - Corticosteroids and a calcineurin-inhibitor (cyclosporine or tacrolimus).
    - Additional antimetabolites (AZT, MMF): for additional anti-rejection treatment.
    - Antilymphocyte antibodies (OKT-3, thymoglobulin) for refractory rejection.
- Evaluation of Fever:
    - Cultures to be ordered only once per 24 hrs, for temps >38.5C
    - Blood for C & S and fungus (Peripheral, CVP, Arterial Lines)
    - Urine for C & S and fungus
    - CMV, EBV, adeno- PCR
    - RVP
    - Respiratory culture
- Aspirin
    - Vascular thrombosis prophylaxis
    - Start on POD #5 for 3 months
    - Do Not give if platelets < 50,000
- Pain Control
    - Narcotics: fentanyl or morphine/ 3-4 days
    - Sedation: short-acting anxiolytics

- Medication prophylaxis
    - Antibiotics
    - CMV prophylaxis:
        - IV Ganciclovir X 14 days(5mg/kg q12h) followed by Oral Valcyte for 12 months post OLT(10mg/kg QID).
        - ➔**All patients < 1 year old** receive CMV prophylaxis. **All patients > 1 year old** receive CMV prophylaxis **if** they are CMV seropositive at the time of transplant regardless of graft status; **if** they are CMV seronegative receiving a seropositive graft; **if** they are being re-transplanted; or **if** they are currently being treated with OKT3.
    - PJP prophylaxis
    - Fungal prophylaxis
- Lab monitoring:
    - Assess graft function
    - Metabolic balance
    - Ventilatory support
    - Drug levels
    - Cultures if temp>38.5C
- Postoperative laboratory indicators:
    - **ALT/AST**
        - Reperfusion injury, infection
        - Vascular thrombosis
        - Pressure necrosis
        - Medication reaction
        - Thermal surface injury
        - Rejection
    - **Bili/ Alk Phos/ GGT**
        - Reperfusion injury
        - Biliary leaks
        - Medication reaction
        - Infection
        - Graft congestion

- Biliary obstruction, rejection

Postoperative Complications:

- Hepatic artery thrombosis – operative intervention if acute
- Portal vein thrombosis – operative intervention if acute
- Biliary leak – management depends on timing
- Biliary stricture – treated with endoscopic procedures in IR
- Injury to surround structures – bowel, diaphragm
- Primary non-function
    - Absence of metabolic and synthetic activity of OLT
    - Occurs < 5% - status of donor liver contributes significantly
    - Organ preservation and retrieval contributes
    - Requires re-transplant
- Acute cellular rejection
    - Histologic triad: endothelialitis, portal triad mixed infiltration and bile duct injury with/wo hepatic parenchymal cell inflammation
    - 50-65% prevalence – Tacrolimus assoc with lower cases as compared to cyclosporine
    - Symptoms: fever, lethargy, jaundice, pruritis, ascites, anorexia
    - Increased bilirubin, transaminases, alkaline phos, GGT, and PT, decreased albumin levels
    - Treatment – solumedrol bolus therapy, CD3 monoclonal antibodies (OKT3) or IL-2 monoclonal antibodies – possible re-transplant
- Infection – most common source of mortality and morbidity after OLT
    - Bacteria, fungal, viral
- Post-transplant lymphoproliferative disease (PTLD)
    - Abnormal proliferation of B-lymphocytes – ranges from polyclonal lymphoid hyperplasia to monoclonal malignant lymphoma
    - Related commonly to EBV infection post liver transplant
    - 10% post OLT develop – those receiving high immunosuppression
    - Routine EBV cultures, treated with reduction of immunosuppression, resection of node, chemo/radiation

Category	Risks
Calcineurin inhibitors (tacrolimus, cyclosporine)	Nephrotoxicity Hypertension, Diabetes, Hyperlipidemia Electrolyte changes (low Mg, low Phos, high K) Neurotoxicity (headaches, tremors, seizures)
Antimetabolites (mycophenolate, azathioprine)	Leukopenia, thrombocytopenia GI side effects (diarrhea, nausea, upset stomach) Hepatotoxicity, rash
mTOR inhibitors (sirolimus, everolimus)	Delayed or impaired wound healing Oral ulcers Hyperlipidemia, Hypertriglyceridemia Pneumonitis
Corticosteroids (methylprednisolone, prednisone)	Stunted growth, hyperglycemia/diabetes, HTN, weight gain, mood changes, etc.

Medications

IV Fluid Therapy

PERIPHERAL AND CENTRAL VENOUS LINE TUBING CHANGE

Infusion	Size of Filter Required	Frequency of Tubing, Needleless Connector & Filter Change
Continuous IV Infusions	No Filter unless specified	Change tubing and needleless connector every 96 hours
Parenteral Nutrition – Amino acid and Dextrose-containing solutions + intralipids	0.2 micron filter for TPN and 1.2 micron filter for intralipids	Change tubing, needleless connector, and filters with every new bag, at least every 24 hours
Parenteral Nutrition without intralipids	0.2 micron filter for TPN	Change tubing, needleless connector, and filters with every new bag, at least every 24 hours,
Intralipids infusing separately	1.2 micron filter	Change tubing, needleless connector, and filters with each new container not to exceed 24 hours
Blood and Blood Products	170-260 micron Blood filter	Blood administration tubing must be replaced according to the manufacturer's recommendations. If the manufacturer does not specify a time limit for use, blood administration tubing must be replaced after four (4) hours of use regardless of add-on devices used or the number of products administered.
Other Medications Administered via Secondary Tubing	Per Pharmacy specifications	Every 96 hours if continuously attached to primary tubing. Every 24 hours if disconnected from primary tubing, or per Pharmacy and manufacturer's specifications.

Fluid Administration:

- **RN assesses peripheral IV and Central/PICC Line sites q1 hour for signs of infiltration and patency, and documents findings.**
- Do not administer Dextrose concentrations greater than 12.5% peripherally unless in a patient emergency

Epidural Pump:

- Staff Nurses may: program a bolus/loading dose, change the programming per medical order, change the batteries, change the infusion bag, and reinforce the back dressing.
- Pain Service only: changes the tubing (Q72-96hrs) and performs complete dressing changes.
- Assessments: Minimum assessment & documentation of respiratory rate, sedation score and pain score in the epidural flow sheet in Epic = every hour x 24 hours & then q 4 hours

CADD EPIDURAL PUMPS

Changing a patient's current program while the pump is running

With the pump running, all parameters can be changed except reservoir volume

Program the pump

1. Scroll ↑ or ↓ to highlight the patient specific parameter you want to change. Press Select.
2. Unlock the keypad using the security code or the pump key.
3. The patient specific parameter is displayed. Scroll ↑ or ↓ to the new value then press Save.

   NOTE: If the desired value is outside the soft limit, press Confirm. Verify the soft limit override by pressing Yes.

   Repeat steps 1 and 3 for each patient specific parameter that you want to change.

   NOTE: If a security code was used to unlock the keypad, always relock the keypad after making a change by pressing the right soft key twice [Tasks, then Lock Keypad]. If a key was used, turn the key clockwise to relock the cassette and keypad.
4. Verify that the keypad and cassette are locked.

Changing a patient's current program with the pump stopped

Stop the pump

1. Press Stop/Start.
2. "Stop Pump?" displays. Press Yes.

Program the pump

3. Scroll ↑ or ↓ to highlight the patient specific parameter you want to change. Press Select.
4. Unlock the keypad using the security code or the pump key.
5. The patient specific parameter is displayed. Scroll ↑ or ↓ to the new value then press Save.

   NOTE: If the desired value is outside the soft limit, press Confirm. Verify the soft limit override by pressing Yes.

   NOTE: The next bolus setting allows for a one time override of the intermittent bolus cycle as defined by the bolus interval.

   Repeat steps 3 and 5 for each patient specific parameter that you want to change.

When programming is complete

6. Press Stop/Start.
7. "Review pump settings" displays. Press Review.
8. Choose Accept Value to confirm the value is correct for the highlighted patient specific parameter or press Select to edit the highlighted parameter.

Changing a patient's current program with the pump stopped continued

9. Continue until all patient specific parameters have been reviewed, accepted and display checkmarks. Press Next.
10. "Start Pump?" displays. Press Yes.

    NOTE: If a security code was used to unlock the keypad, the keypad automatically relocks when the pump is started. If a key was used to unlock the cassette/keypad, use the key to relock the cassette/keypad lock.

Resetting the reservoir volume without changing the cassette

Changing the IV bag or syringe without changing the tubing

Stop the pump

1. Press Stop/Start.
2. "Stop Pump?" displays. Press Yes.

   Aseptically remove the empty IV bag or syringe from the tubing and attach the new IV bag or syringe.

Reset reservoir volume

3. Scroll ↓ until Reservoir Vol is highlighted. Press Select.
4. Screen displays "Reservoir Volume remaining: XXmL Reset?" Press Yes.
5. Unlock the keypad using the security code or the pump key.
6. The screen displays the current reservoir volume and a scroll range.
7. Press Select to reset the reservoir volume or scroll ↑ or ↓ to adjust the value. Press Save.

When programming is complete

8. Press Stop/Start.
9. "Review pump settings" displays. Press Review.
10. Choose Accept Value to confirm the value is correct for the highlighted patient specific parameter or press Select to edit the highlighted parameter.
11. Continue until all patient specific parameters have been reviewed, accepted and display checkmarks. Press Next.
12. "Start Pump?" displays. Press Yes.

    NOTE: If a security code was used to unlock the keypad, the pump will automatically relock when the pump is started. If a key was used to unlock the cassette/keypad, use the key to relock it.
13. If you're not starting the pump immediately, press No when "Start Pump?" appears. Lock the keypad by pressing the right soft key twice [Tasks then Lock Keypad]. Ensure that the cassette is also locked by turning the cassette/keypad lock clockwise to the locked position.

CADD EPIDURAL PUMPS

Changing the batteries

Stop the pump

1. Press Stop/Start.
2. "Stop Pump?" displays. Press Yes.
3. Remove the used batteries.
4. Insert the new batteries.
5. Press the power switch to turn the pump on.
6. The screen displays "Do you want to start a new patient?" Press No.
7. Press Stop/Start to start the pump.
8. "Start Pump?" displays. Press Yes.

Screensaver

The screensaver allows the pump to conserve battery power when not in an edit mode and if no keypad buttons have been pressed for 30 seconds. The pump displays a blank screen. Press any button on the keypad to turn the display on.

Alarms and troubleshooting

Alarm Conditions

High Priority Alarm

If the pump is running, it always stops when a high priority alarm is activated. Accompanied by a red screen, it continues until acknowledged or until the condition that triggered the alarm goes away.

Medium Priority Alarm

This alarm does not stop the pump. Accompanied by an amber screen, it continues until acknowledged or until the condition that triggered the alarm goes away.

Low Priority Alarm

A low priority alarm does not stop the pump. Accompanied by a blue screen, the alarm automatically clears after 5 seconds or until the condition that triggered the alarm goes away.

Informational Message

This alarm does not stop the pump. This message appears in the status bar. It is displayed for 5 seconds and is generally silent, requiring no acknowledgement.

Alarms and troubleshooting continued

Troubleshooting

Screen is blank and alarm is sounding

Alarm Priority High. The pump has lost power and is no longer delivering. The pump was delivering and the batteries were removed or the battery door was opened. Clear this alarm by replacing the batteries or closing the battery door. Then turn the pump back on or the alarm stops after the power has been off for a minimum of 2 minutes.

Air-in-line detected. Press "acknowledge" then prime tubing

Alarm Priority High. The pump is stopped and can not run. The air detector has detected air in the fluid path; the fluid path may contain air bubbles. Acknowledge the alarm. Then, if the fluid path contains air bubbles, close the clamps, disconnect the fluid path from the patient, and follow the instructions for priming to remove the air.

Battery depleted. Pump stopped

Alarm Priority High. Install 4 new AA batteries or a fully charged rechargeable battery pack. In order to start delivery, good batteries must always be installed, even when an external source of power is connected. If appropriate, restart the pump.

Battery low, replace battery

Alarm Priority Low. Change the rechargeable battery pack or the 4 AA batteries soon.

Current settings require high/standard volume set. Change cassette

Alarm Priority High. A high volume or standard volume administration set is required. The pump is stopped and will not run. Remove the administration set to continue.

Delivery limit reached. Or, delivery limit reached and partial dose delivered

Pump's status bar reads "KVO = 0"

Alarm Priority Low. The programmed delivery limit has been reached, and the pump is not delivering fluid. This alarm occurs when the continuous rate or a PCA dose has caused the delivery limit to be exceeded. Acknowledge the alarm (the alarm automatically clears after 5 seconds).

Pump's status bar reads "Del Limit"

Alarm Priority Low. The programmed delivery limit has been reached, and the pump is delivering fluid at the KVO rate of 0.1mL/hr. This alarm occurs when the continuous rate or a PCA dose has caused the delivery limit to be exceeded. Acknowledge the alarm (the alarm automatically clears after 5 seconds).

Peak and Trough Levels

Aminoglycosides q 8 hr dosing

- Trough: Draw **30 minutes before** dose is due
- Peak: Draw **30 minutes after** the end of a 30-minute infusion (drug + flush)
- Once a day dosing: 2 hrs after end of infusion and 8 hrs after end of infusion

Vancomycin

- Trough: Draw **30 minutes before** dose is due
- Peak: Draw **60 minutes after** the end of a 60-minute infusion (drug + flush).
- Peak: If run over 2 hours, draw peak immediately after

Antiepiletic Medications

- Want to achieve a therapeutic level at which the patient does not seize.
- Measure trough levels

Optimal Sampling times:

Medication	Therapeutic Range	Optimal Sample Time
Phenytoin/fosphenyton	10-20mcg/ml (FREE 1-2mcg/ml)	**Post loading dose level** 4 hours after the dose **Trough:** 30 minutes before dose
Phenobarbital	20-40 mcg/ml	**Troughs:** 30 minutes before dose
Carbomazepine	4-12mcg/ml	**Troughs:** 30 minutes before dose
Valporic Acid	50-100mcg/ml	**Troughs:** 30 minutes before dose

Hyperkalemia: Emergency Reconstitution Instructions

* For non-emergency situations, please contact pharmacy for a sterile mixture

Treatment of Hyperkalemia with Insulin and Dextrose

- Only to be ordered by ICU or ED Fellow or Attending.
- Only to be administered with the supervision of an ICU or ED RN.
- Only to be given after calcium has been administered to all pediatric patients.
- For infants and children > 3 months, only to be administered after sodium bicarbonate has been administered.

Pediatric patients LESS THAN 60 kg

Supplies:

- Dextrose 10% (D10W) 250 mL IV bag
- Insulin regular 100 units/mL vial (NICU to obtain from Pharmacy or PICU Omnicell)
- 1 mL IV syringe + 25G needle
- 60 mL IV syringe + 18-25G needle

Instructions:

- Remove **35 mL** from a D10W 250 mL bag (note ~25 mL overfill in bag)
    1. D10W 240 mL remains when accounting for removal of overfill
- Draw up **6 units (0.06 mL)** insulin regular in a 1 mL syringe
- Add insulin regular to the 240 mL D10W to make insulin regular 0.025 units/mL
- Move bag back and forth in hands to mix well
- Administer **4 mL/kg** (max 240 mL) over 30 minutes through a central or peripheral line (provides 0.1 units/kg of insulin regular + 400 mg/kg dextrose)
    1. Patients ≤ 15 kg: Draw up dose into syringe
    2. Patients > 15 kg: RN to program IVPB pump to deliver exact dose (4 mL/kg)
- Check blood sugar Q 15 minutes x 4 after intermittent bolus dosing

Pediatric patients GREATER THAN OR EQUAL TO 60 kg

Supplies:

- Dextrose 10% (D10W) 250 mL IV bag
- Insulin regular 100 units/mL vial
- 1 mL IV syringe + 25G needle

Instructions:

- Draw up insulin regular ~0.1 units/kg dose into a 1 mL syringe:
    1. 60-64 kg: 6 units = 0.06 mL
    2. 65-74 kg: 7 units = 0.07 mL
    3. 75-84 kg: 8 units = 0.08 mL
    4. 85-94 kg: 9 units = 0.09 mL
    5. 95 kg or greater: 10 units = 0.1 mL
- Add insulin dose into D10W 250 mL bag
- RN to administer insulin regular/D10W 250 mL IV bag mixture over 30 minutes through a central or peripheral line
- Check blood sugar Q 15 minutes x 4 after intermittent bolus dosing

Types of Insulin

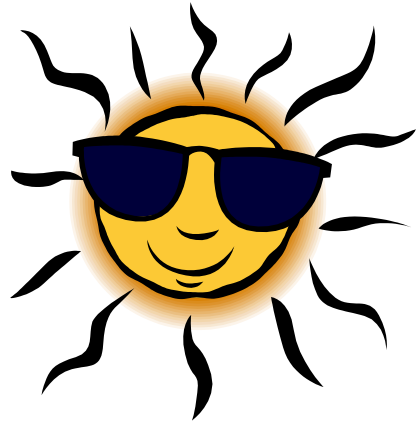
[1] UCMC Formulary product which will be dispensed

Insulin	Brand Name	*Pharmacodynamics* (*Estimated Times*)			Appearance	May be Mixed with
		Onset	Peak	Duration		
Rapid Acting						
Lispro	HumALOG	15-30 min	30 min - 1.5 hr	3-5 hrs	Clear	NPH
Aspart	NovoLOG[1]	10-30 min	1-3 hrs	3-5 hrs	Clear	NPH
Short Acting						
Regular	NovOLIN Regular- R[1]	0.5-1 hr	1-5 hrs	6-10 hrs	Clear	NPH
Regular	HumuLIN Regular- R	0.5-1 hr	1-5 hrs	6-10 hrs	Clear	NPH
Intermediate Acting						
NPH	NovOLIN - NPH (N)[1]	1-2 hr	6 -14 hrs	18->24 hrs	Cloudy	Regular
NPH	HumULIN NPH- (N)	1-2 hr	6 -14 hrs	18->24 hrs	Cloudy	Regular
Long Acting						
Glargine	Lantus[1]	3-4 hrs	2-20 hrs	20-24 hrs	Clear	Do NOT mix with any other insulin
Intermediate + Short Acting						
Humulin 70/30 (70% NPH, Human Insulin and 30% Regular Insulin)	HumULIN 70/30 mix	30 min	1.5hrs to 12 hrs	24+ hrs	Cloudy	Do NOT mix with any other insulin
Novolin 70/30 (70% NPH, Human Insulin and 30% Regular Insulin)	NovoLIN 70/30[1]	30 min	1.5hrs to 12 hrs	24+ hrs	Cloudy	Do NOT mix with any other insulin

Infusions Which Require Protection from Light

Aminophylline
Bumetanide (Bumex) -infusion only (not intermittent)
Doxycycline
Epinephrine
Furosemide (Lasix)- infusion only (not intermittent)
Nicardipine
Nitroprusside (Nipride)
Norepinephrine (Levophed)
Octreotide
Phytonadione (Vitamin K)
Rifampin
Sulfamethoxazole/trimethoprim (Bactrim)
Terbutaline

<u>Light exposure during infusion ok:</u>
Amphotericin B
Argatroban



Pediatric Hematology, Oncology, SCT

The human spirit is stronger than anything that can happen to it

When chemotherapy has been ordered for your patient:

See UCMC Policy PC-33

1. Verify that chemotherapy has been ordered for your patient.
    a. Only chemotherapy competent nurses will have access to BEACON, which is the chemotherapy ordering and viewing system in EPIC; you will be able to have a limited view that chemotherapy was ordered for your patient.
    b. Wrench in "Oncology Springboard" – this will allow you to view the limited orders. Also, the chemotherapy will show up on the eMAR. When your patient has a chemotherapy plan, an orange banner will appear at the top of the Onc Springboard Report.
    c. Notify the Comer 6 charge RN (5-7900) as soon as chemotherapy has been ordered for your patient. This will allow for the Comer 6 staff to arrange for 2 nurses to come down to administer and allows for the orders to be released for the PICU nurse.

2. Inform the oncology/Comer 6 nurse of the following:
    a. Name of the drug, route, time the drug to be administered
    b. If the patient requires premedications such as an antiemetic or pre/post hydration (as per orders)

3. Comer 6 Nurse responsibilities:
    a. Check BSA (based on admission weight) – daily weights are completed to monitor fluid status
    b. Check ANC, platelet counts

c. Review orders: checks for modifications, cycle number, protocol consent is signed, SPTP, roadmap; verifies medication, route of administration
d. Checks pre-medications/fluids, calculates dosing (usually based on mg/m^2)
e. Releases orders and labs – labs cannot be drawn by the PICU nurse until the Comer 6 nurse releases the labs
f. Verifies side effects, monitoring, administration guidelines
g. Patient/parent education

4. PICU/NICU/C5 nurse responsibilities:
    a. Verifies that chemotherapy has been ordered
    b. Verifies: pre-medications and pre/post fluids
    c. Documents current height and weight*
    d. Administers pre-medications and pre/post fluids
    e. Completes lab work that has been ordered
    f. Prime either 0.9NS or D5W (the fluid that the drug is prepared in) through primary tubing
    g. Have a Baxter/syringe pump ready for use
    h. Reviews: side effects, monitoring, administration guidelines
    i. Implements monitoring guidelines (ie) U/A, specific gravity
    j. Patient/parent education
    k. Meticulous monitoring of IV site
    l. Patient reaction – pause chemo infusion, notify MD

5. Remember, only chemotherapy-competent nurses can administer chemotherapy *(with the exception of oral chemo for non-malignant conditions).

6. Document a chemotherapy note every 12 hours on every in-patient who is actively receiving chemotherapy.

Notes → New Note → Type: Tx Plan Nursing → chemo → Chemotherapy note (smart text)

Type the word *chemo* in the smart text box or *.phemchemo* in the text box

Safe Handling/Disposing of Chemotherapy (PC 146)

- The nurse caring for the patient may take down and dispose of the bag and tubing, wearing gloves & a chemo gown (blue fluid resistant).

- Chemo IV Tubing including the flush bag need to be changed down to the site with every administration: **REMEMBER: dispose of medication bag, tubing and gloves into the yellow chemotherapy bucket.**

- Safe handling applies not only to chemotherapy agents, but also to certain antiviral agents, biologic agents, and immunosuppressive agents. **The purpose of safe handling (gloves and gown) is to protect you!** Drugs may include, but are not limited to: Cellcept, Ganciclovir, Tacrolimus, Foscarnet, Cyclosporine, Interferon alpha

- During Chemotherapy administration and 48 hours after infusion complete
    - Dispose of all diapers or any other items with patient's bodily fluids on them, into yellow chemotherapy bucket or hamper
    - Urine can be dumped in the toilet – urinal should be placed in the yellow bucket
    - Soiled linen should be placed in a regular linen bag

- For chemotherapy spills
    - Identify drug and request MSDS sheet: (800-451-8346)

- Notify EVS 2-6296 if spill > 5ml
- Obtain chemo spill kit (supply cart) – notify Comer 6 to assist with the clean-up
- Stop leakage if applicable
- Fill out a patient safety report

Fever & Neutropenia

Neutropenia: A decrease in the number of circulating neutrophils, as determined by the absolute neutrophil count (ANC). Risk of infection increases as ANC decreases

ANC	Implications
ANC 1000-1500	Mild neutropenia
ANC 500-1000	Moderate neutropenia – some risk of infection. The body may be able to fight infection, but it's important to follow trends to see if the WBC is rising or falling.
ANC < 500	Severe neutropenia – significant risk of infection. Patients with a fever above 38°C) will be admitted for IV antibiotics. They are considered to be neutropenic and should be placed on Protective Isolation. The patient must wear a mask in the hallway—No Playroom Privileges!
ANC <200	Severe neutropenia. The body doesn't have enough WBC's to combat infection. The patient will be confined to the room, with the exception of essential tests.

ANC

Formula 1: *ANC = (% segs (polys) + %bands (stabs)) x total WBC (in 1000s)*

OR

Formula 2: *(segs+bands) x WBCs x 10*

Examples:

% segs – 33	% segs - 24
% bands – 1	% bands - 1
WBC – 3600	WBC - 2400
(0.33+0.01) = 0.34 x 3600 = 1224	(24+1) x 2.4 x 10 = 600

Often, lab will simply report segs and bands as neutrophils or as granulocytes. In such a case, substitute neutrophils or granulocytes for (segs + bands)

Example:

3. % Neutrophils -17
   WBCs- 2,700

Formula 1: 0.17 x 2700= 459
Formula 2: 17 x 2.7 x 10 = 459

BSA = $\sqrt{[(wt\ (kg) \times ht\ (cm))/3600]}$

Example: (20kg, 120cm) $\sqrt{[(20 \times 120)/3600]} = 0.816$ BSA

Hydration: To calculate hyper-hydration:

125 ml/m^2/hr x BSA (or) 3000ml/m2/24 hours

Example: BSA = 1.15
1.15 x 125 = 143.75 ml/hour
3000 x 1.15 = 3450/24 = 143.75 ml/hour

Causes of Neutropenia

- Chemotherapy
- Radiation Therapy
- Immunotherapy
- Stem Cell or Solid Organ Transplants
- Infections
- Splenic sequestration
- Medications:
  - Antibiotics
  - Anticonvulsants
  - Anti-inflammatory agents
  - Psychotropic agents
- Congenital processes
- Nutritional deficiencies

Standard of Care for the Neutropenic Patient

- Good HAND WASHING!!!!!!!
- Notify MD/APN with temperature > 38.0°
- If applicable, *always* access *BOTH* Ports of port-a-cath
- Visitors should be screened for symptoms of potential respiratory infection and viral infections
- Daily bath
- Thorough assessment of skin integrity, including perianal area qshift
- Alternate lumens with each administration of antibiotics and document on eMAR
- Maintain separate IV tubing for each lumen of PICC, central line or Port
- Monitor ANC level
  - **ANC < 500:** Protective Isolation
    Mask in hallway, Blue sign on d door, NO PLAYROOM
  - **ANC <200:** Confinement to room
- Meticulous Oral Care – 4x day and assessment of oral mucosa
- Administer oral antifungal, antiviral, and antibacterial medications as ordered.
- Provide adequate hydration
- **Nothing per Rectum! No temps nor meds!**

Standard of Care for the *Febrile* Neutropenic Pediatric Patient

The following process should be followed to ensure the patient receives antibiotics within one hour (maximum) of onset of fever (>38.0) or at time of admission:

1. Immediate notification of physician/APN team regarding new onset fever
2. STAT drawing of blood cultures from all lumens of central line(s) and documentation on culture bottle of lumen sample obtained from.
3. Ensure order entry of antibiotic within 10-15 minutes post physician/APN notification. Order should contain instructions "*First dose STAT*". If order not entered within 15 minutes, escalate up the chain of command.
4. Communication with pharmacy regarding new antibiotic orders, including the information "febrile and neutropenic patient missing first antibiotic dose". If drug not received within 30 minutes of input into EPIC, RN should telephone pharmacy to facilitate process and escalate as appropriate.
5. Prompt/STAT administration of antibiotic, ensuring that blood cultures have been obtained prior to first dose – Antibiotic must be given within **ONE HOUR** of the onset of the fever.
6. Determine with provider the need for peripheral blood cultures, sputum cultures, urine cultures, and chest x-ray.
7. Administer cooling measures; recheck temperature 1 hour post intervention.
8. If the patient remains febrile (>38.0), obtain and document full set of vitals.

Daily Care for the febrile neutropenic patient:

- Communicate each fever to physician/APN team
- Draw blood cultures from *all* lumens every day and document on bottle from which lumen it was drawn from and document in Medical Record (i.e. medial, lateral, red lumen, etc.)
- Administer antibiotics promptly and communicate missing medications to pharmacy within 30 minutes of missed dose.
- Administer Tylenol as needed for fever, but do not mask the fever by giving it ATC
- Alternate lumens of antibiotics with each administration, utilizing separate tubing for each lumen, and document on eMAR

Cyclosporine Administration

ADMINISTRATION GUIDELINES

- Cyclosporine should be administered through a designated line
  - Administer all immunosuppressive meds through the non-power lumen of the PICC line. If there is no PICC line, then administer through the white/blue port of the Broviac or the blue port of the tunneled pheresis catheter (patient may have either type of line)
  - RED PORT OF THE BROVIAC LINE/TUNNELED PHERESIS CATHETER = blood draw port for Cyclosporine levels – DO NOT infuse Cyclosporine through the red port (RED = BLOOD)
  - If a drug level is drawn from a lumen that has infused the Cyclosporine, then the level will be abnormally elevated.
  - When drawing Cyclosporine levels, be sure to stop all infusing medications/pumps and clamp other lumens to ensure accuracy of the drug level.
- For continuous Cyclosporine infusion:
  - Tubing is changed daily, down to the clave (sterile technique)
  - The new bag of Cyclosporine or Tacrolimus must be hung AT THE SAME TIME EVERYDAY in order to maintain therapeutic levels
  - Prime 15mL to the tip prior to starting – bag and flush is infused over 24 hours exactly – flush started at hour 20
  - Cyclosporine should NEVER be turned off

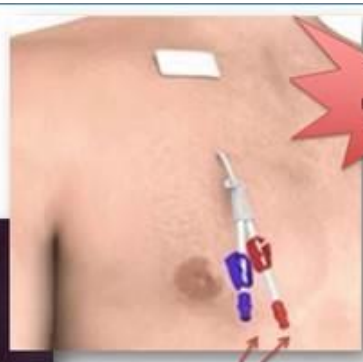
DRUG LEVEL TIMING

- Cyclosporine levels are sent in a lavender tube.
- Levels for continuous infusions can be drawn at any time, but are often coordinated with the 4am lab draw to minimize accessing the line
- For oral/IV intermittent dosing (Q12 hour dosing), be sure to draw a true trough level **30 minutes prior** to giving the am dose of Cyclosporine. Once an intermittent dose is given, a drug level cannot be done for that day (enter exact time of lab draw when collecting in EPIC)
  - On weekdays: for 9am dosing, draw levels at 8:30 am
  - On weekends: for 9am dosing, draw levels by 7:30am – blood needs to get down to the lab by 8am on the weekend

- If a patient is changed from continuous dosing to BID dosing (9a and 9p), then make sure to draw the level at 0830 and not with the 4am labs.

SCT Line Identification

-Most pts will have a PICC and CL.
-PICC is the preferred line to infuse immunosuppressants through.
-DO NOT draw immunosuppressant levels from the PICC line.



ALWAYS DO BLOOD DRAWS FROM RED LUMEN

Immunosuppressants (tacrolimus and cyclosporine) ALWAYS run through PICC line

Fluids/antibiotics/TPN (Draw Lab levels from CL)

-If your pt does not have a PICC line, infuse immunosuppressants through **blue** lumen.
-ALWAYS DRAW LABS FROM **RED** LUMEN (If infusing through blue lumen, stop infusion while drawing from RED lumen).

CAR T-Cell Therapy

- Chimeric Antigen Receptor Modified T-Cell
- CAR T-Cell Therapy, involves the harvesting of the patient's own T-cells through a pheresis procedure.
- These T-cells are then treated and transformed to attack the cancer cells through the insertion of a gene into each T-cell using a virus.
- B-cell non-Hodgkin's lymphoma and pre-B ALL both carry an antigen called the CD19 antigen. CAR T-cell therapy infuses the cells with an anti-CD19 gene but differs from monoclonal antibody therapy in that the T-cells actually penetrate the cancer cells, instead of just attacking the surface antigens**.**
- Once the cells are treated, they are reinfused into the patient, similar to an autologous stem cell transplant, after a short course of chemotherapy as a conditioning regimen (Fludarabine and cyclophosphamide).
- The infusion of the cells elicits an immune response, which may cause the listed side effects (cytokine release syndrome and neurotoxicity).

CAR T-Cell Infusion:

- Verify the following:
  - 2 doses of tocilizumab are available (pharmacy role)
  - Verify order, central line access, type and screen
- Pre-medications
  - 30-60 minutes before the infusion (Tylenol, diphenhydramine)
- Emergency equipment: suction, ambu bag, nasal cannula/non-rebreather
  - Medications: epinephrine, hydrocortisone, diphenhydramine
- Tubing set-up:
  - Primary tubing with a Y-type adapter connected (stem cell team to bring up tubing – currently kept on Comer 6)
  - Primed with 0.9NS, NO filter
  - Connect the tubing directly to the hub of the CL (no clave) with a stopcock, check blood return
- Final preparations:
  - Make sure the patient ID bands are on
  - Obtain Vital Signs and auscultate lungs
  - Confirm APN and attending physician is present
- Administration:

- To gravity, cells must be infused in 30 minutes or less
- Flush tubing with 0.9NS to ensure all of the product is infused
- Cells cost $500,000 (pay careful attention to the infusion process)

- Monitoring:
  - VS and lung auscultation prior to infusion, ***Q5min for 15 minutes, Q15 minutes for the remainder of the infusion***, ***immediately after infusion***
  - Post transfusion VS
    - Q15 minutes x 1 hour
    - Q30 minutes x 1 hour
    - Q1 hour X 2 hours

Infusion Reaction:

Cells are cryopreserved in DMSO (dimethylsulfoxide) which can have several side effects:

- Foul breath odor
- Flushing
- Pulmonary distress (capillary leak)
- Abdominal cramps
- Hypotension
- Allergic reactions (hives, wheezing, respiratory distress, fever, rash)
- **Bradycardia**
- Arrhythmias
- Heart block

Cytokine Release Syndrome (CRS)

- When the cells are reinfused after being treated, the patient may exhibit an extreme immune response (CRS)
- Transient and variable; graded 1-5 based on severity
- Hypotension, tachycardia, fever
- Early recognition of symptoms and careful monitoring is essential
- Risk period for the start of CRS: 3-7 days after infusion
- Treatment: fluids, vasopressors, PICU monitoring
- Tocilizumab – monoclonal antibody that binds to the IL6 cytokine – decreases reaction
- Corticosteroids – used as a last resort – can suppress the immune system

GRADING OF CRS

Note: CRS grade should be determined at least twice daily and any time there is a change in patient's status.

CRS Parameter	Grade1	Grade 2	Grade 3	Grade 4
Fever	Temperature ≥ 38°F	Temperature ≥ 38°F	Temperature ≥ 38°F	Temperature ≥ 38°F
With Either:				
Hypotension	None	Not requiring vasopressors	Requiring one vasopressor with or without vasporessin	Requiring multiple vasopressors (excluding vasopressin)
And/Or				
Hypoxia	None	Requiring low-flow nasal cannula (≤ 6 liters/minute) or blow-by	Requiring high-flow nasal cannula (> 6 liters/minute), facemask, non-rebreather mask, or Venturi mask	Requiring positive pressure (*e.g.*: CPAP, BiPAP, intubation and mechanical ventilation)

CRS grade is determined by the more severe event: hypotension or hypoxia not attributable to any other cause.

Neurotoxicity:

- Neurotoxicity can be profound: starts as a high fever and lethargy
- Aphasia/dysphasia, confusion, somnolence, seizure
- Typically resolves in 1-4 weeks
- Seen 4-5 days post infusion
- Grade 1-4 based on severity
    - ***Grade I*** – mild somnolence, drowsiness, confusion, encephalopathy, dysphasia; no LOC change
    - ***Grade 2*** – moderate somnolence; limiting ADLs, confusion; dysphasia – impairing spontaneous communication; brief generalized seizure
    - ***Grade 3*** – obtunded, severely confused/ disoriented; severe dysphasia impairing ability to read, write, communicate; multiple seizures; complete bowel/bladder incontinence
    - ***Grade 4*** – life threatening; mechanical ventilation, life-threatening prolonged repetitive seizures
- Treatment: monitoring, support, Tocilizumab, corticosteroids
- PICU transfer at the onset of neurotoxic symptoms

Grading of Immune effector Cell-Associated Neurotoxicity Syndrome (ICANS)[2]

Note: for toxicities not listed here, please refer to CTCAE, version 4 for grading.

Neurotoxicity Domain	Grade 1	Grade 2	Grade 3	Grade 4
ICE Score for children > 12 years	7-9	3-6	0-2	0 – Patient is unarousable and unable to perform ICE
CAPD score for children ≤12 years	<9	<9	≥9	Unable to perform CAPD
Depressed level of consciousness	Awakens spontaneously	Awakens to voice	Awakens to only tactile stimulus	Patient is unarousable or requires vigorous or repetitive tactile stimuli to arouse. Stupor or coma.
Seizure (any age)	N/A	N/A	Any clinical seizure focal or generalized that resolves rapidly; or Non-convulsive seizures on EEG that resolve with intervention	Life-threatening prolonged seizure(>5 minutes); or Repetitive clinical or electrical seizures without return to baseline in between
Motor Weakness (any age)	N/A	N/A	N/A	Deep focal motor weakness such as hemiparesis or paraparesis
Raised ICP/Cerebral Edema (any age)			Focal/local edema on neuroimaging	Decerebrate or decorticate posturing; or Cranial nerve VI palsy; or Papilledema; or Cushing's triad; or Signs of diffuse cerebral edema on neuroimaging

Chemotherapeutic Supportive Agents:

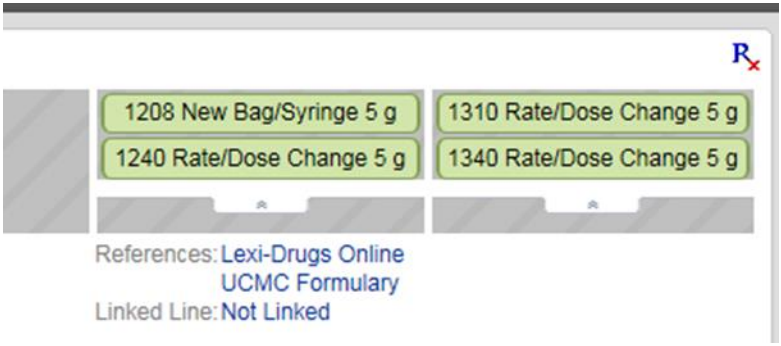
Drug	***Side Effects***	***Special Considerations***
Allopurinol (Zyloprim) *Xanthine oxidase inhibitor* *Routes: PO*	Rash, fever, granulomatous hepatitis, ocular lesions, alopecia, myelosuppression, drowsiness, peripheral neuropathy, GI symptoms, agranulocytosis, toxic epidermal necrolysis, severe systemic vasculitis, exfoliative dermatitis	Dose reduction is required in moderate to severe renal impairment. Increased toxicities may occur when used with 6-MP or axathioprine; Cyclophosphamide, warfarin, oral antidiabetic drugs, ampicillin, amoxicillin, or thiazide diuretics – use with caution - Adequate hydration necessary
Dexrazoxane (Zinecard) *Cardioprotectant agent* *Route: IV only* *Brand name Zinecard – only good for 1 hour at room temp and 4 hours in the refrigerator: plan accordingly and communicate with pharmacy if any delays Generic dexrazoxane is stable for 6 hours at room temp and in the refrigerator*	Pain on injection, phlebitis, myelosuppression, transient increase in triglycerides/ amylase/ALT; mild nausea, vomiting, and diarrhea	Recommended dosage ratio of dexrazoxane:doxorubicin is 10:1 Doxorubicin must be given within 30 minutes from beginning of dexrazoxane infusion (both should be given in a 30 minute window – dexrazoxane first, over 15 minutes, then doxorubicin over 10-15 min)
Leucovorin calcium *Water soluble vitamin (folinic acid)* *Routes: IV, IM, PO*	Rare side effects: allergic sensitization, rash	Used as a cellular rescue when intermediate or high-dose methotrexate is given Usually given as a single dose at hour 24 after methotrexate administration or at hour 24 & 30 after IT administration for the following protocols: AML08 and Down Syndrome patient receiving ALL therapy. Must be given exactly at the times ordered

Drug	***Side Effects***	***Special Considerations***
Mesna (Mesnex) *Routes: IV, PO* Given during ifosfamide infusion, but mixed in the bag with the chemotherapy agent Given after ifosfamide at different intervals depending on the protocol - 4h and 8h after the start of the infusion - 5h and 9h after the start of the infusion - May be given 4x after the ifosfamide at: 5h, 8h, 11h, 14h - Ifosfamide is on a 20h cycle, so the times of the mesna will be different each day - Mesna may also be ordered for Cytoxan.	Bad taste with oral use, nausea, vomiting, stomach pain, headache, pain in arms/legs/joints, fatigue, rash transient hypotension, allergy, diarrhea **** There will be one order for each round of hours: for instance, one order set will be for the 4h dose, but this will be at a different time each day. The next order will cover all of the 8h doses and so on. There may be up to 4 orders of mesna depending on how many times the mesna will be given after each dose of ifosfamide.*	False positive test for urinary ketones Check for compatibilities when giving IV May be mixed with cyclophosphamide or ifosfamide Must be given exactly at the times ordered Do not use in young infants or neonates because the preservative benzyl alcohol is used. Young children receiving high doses may develop gasping syndrome (manifested by metabolic acidosis and multiple organ system failure)

IVIG Infusion

1. Remember that IVIG should be dosed based on ***ideal body weight***. The calculations can be found on the Intranet:
    a. Call pharmacy to double check your calculations if necessary
2. If you infuse the IVIG on the primary line, then you can set the infusion in the multistep mode. If you do this, then you can infuse the flush on the secondary line – just try to run your fluids down to secondary infusion port to ensure that all of the IVIG has infused, then clamp the primary line to infuse your flush. I know this seems cumbersome, but these Baxter pumps are not designed to infuse the multistep mode on the secondary infusion.
    b. You can use primary or secondary mode on the IV pump
3. Remember, IVIG is only compatible with D5W, so the flush solution both before and after the IVIG infusion needs to be D5W.
4. Q30 vitals for the ENTIRE infusion (Q rate change)- CHART THESE IN MAR
5. Chart COMPLETED time in EPIC
6. Side effects: Fever, chills, nausea, headache, dizziness, joint pain, abdominal cramping, rash, anaphylaxis.

*Example of charting rate changes in your MAR. Make sure to chart COMPLETED once infusion done



Calculating Rate:

1. 0.5ml/kg/hr for 30 minutes
2. 1.0ml/kg/hr for 30 minutes
3. 1.5ml/kg/hr for 30 minutes
4. 2.0ml/kg/hr for 30 minutes ****MAX DOSE IF RENAL ISSUES PRESENT****
5. 2.5ml/kg/hr for 30 minutes
6. 3.0ml/kg/hr for 30 minutes
7. 3.5ml/kg/hr for 30 minutes
8. 4.0ml/kg/hr for 30 minutes
9. 4.5ml/kg/hr for 30 minutes
10. 5.0ml/kg/hr for 30 minutes

*Document each rate change in your MAR/Flowsheet

Weight Equations

Ideal Body Weight (IBW) (kg)

Adults

IBW_{male} = 50 kg + 2.3 [Height (in) – 60]

IBW_{female} = 45.5 kg + 2.3 [Height (in) – 60]

Pediatrics

< 5 feet tall: [$Height_2$ (cm) x 1.65]/1000

≥5 feet tall: IBW_{male} = 39 + 2.27 [Height (in) – 60]

IBW_{female} = 42.2 + 2.27 [Height (in) – 60]

Adjusted Body Weight (AdjBW) (kg)

Use if actual body weight (ABW) > 20% over IBW

AdjBW = IBW + 0.4 (ABW-IBW)

(Lexicomp, UCMC Formulary, 2019)

Rituximab (Rituxan)

What: monoclonal antibody, anti-CD20, immune suppressant. This drug binds to the CD20 antigen on B-cell lymphocytes, resulting in cell death.

Who: Treatment is commonly used in CD20-positive, B-cell non-Hodgkin's lymphoma, CD20-positive chronic lymphocytic leukemia (CLL), for treatment of moderately to severely-active rheumatoid arthritis, as well for the treatment of systemic autoimmune disorders.

How: Prior to infusion, **pre-medicate** patients with Acetaminophen and Benadryl

When: **Vital Signs**, baseline and Q15 x 1 hour then Q30 throughout the infusion with each rate change, Q30 for one hour post infusion then Q4 routinely. Continuous pulse oximetry and cardiac monitoring throughout the infusion.
Assess for hypersensitivity. If an infusion-related event develops, the infusion should be temporarily slowed or interrupted. The infusion can continue at one-half the previous rate upon improvement of patient symptoms.

Drug Precautions: Use same precautions as toxic/high risk drug. Double gloves & gown.

Locations: Drug okay to be given on all inpatient and outpatient areas.

Side Effects include: (similar to all other monoclonal antibodies [IVIG])

- Anaphylaxis
- Acute respiratory distress
- Hypersensitivity: angioedema
- Flushing
- Hypertension/hypotension
- Peripheral edema
- Pruritus
- Skin rash
- Urticaria

(Lexicomp, UCMC Formulary, 2019)

Peg-aspargase

Indications in children and adolescents:

- Acute lymphoblastic leukemia as a first-line treatment or in patients with hypersensitivity to native forms of L-asparaginase

Dosing:

- 2500 units/m2 (maximum single dose and maximum dose per course)
- Minimum time between courses: 14 days

Administration:

- Have available appropriate agents for maintenance of an adequate airway and treatment of a hypersensitivity reaction (antihistamine, epinephrine, oxygen, I.V. corticosteroids). Be prepared to treat anaphylaxis at each administration.
- IM administration
    - Must be administered as a deep intramuscular injection into a large muscle
    - Do not exceed 2ml per injection site; use multiple injection sites for I.M. injection volume >2ml
- IV administration
    - Administer over 1-2 hours through a running I.V. infusion line; do not administer I.V. push
    - May dilute in NS or D5W

Warnings/Precautions/Most Common Adverse Reactions:

- Allergic reactions: anaphylaxis and serious allergic reaction may occur – observe patients for 1 hour after administration
    - Bronchospasm
    - Hypotension
    - Laryngeal edema
    - Local erythema or swelling
    - Systemic rash, urticaria

- Coagulopathy:
    - Increased prothrombin time, increased partial thromboplastin time, and hypofibrinogenemia may occur.
    - Severe or symptomatic coagulopathy may require treatment with fresh-frozen plasma
- Glucose intolerance:
    - Hyperglycemia
- Hepatoxicity:
    - Altered liver function tests:
    - Increased AST, ALT, alkaline phosphatase, bilirubin
    - Decreased serum albumin, decreased plasma fibrinogen
- Pancreatitis:
    - Promptly evaluate patients with abdominal pain
    - May need to discontinue if clinical pancreatitis develops: vomiting, severe abdominal pain, increased amylase/lipase levels (3x normal values for > 3days)
- Thrombotic events:
    - Serious thrombotic events, including sagittal sinus thrombosis may occur
    - Anticoagulation prophylaxis during therapy may be considered in some patients

<u>Monitoring Parameters:</u>

- Lab work: CBC with differential, platelets, amylase/lipase, liver function tests, fibrinogen, PT, PTT, renal function tests, urine glucose, blood glucose
- Vital signs during administration – minimally: baseline and at the end of the infusion. VS may need to be more frequently if the patient exhibits a reaction.
- Monitor for onset of abdominal pain
- Monitor for signs/symptoms of an allergic reaction – these patients should be monitored for at least one hour after administration

Response to Adverse Reaction:

- Stop the infusion immediately
- Notify the physician
- Monitor VS frequently – at least every 5 minutes
- Prepare for a fluid bolus of 0.9NS (10-20ml/kg)
- Document reaction in the patient's medical record and report the Patient Safety Event via the Intranet
- Confirm medication orders and presence of the following medications in Omnicell for possible infusion related reaction, prior to initiation of infusion
    - Epinephrine 1:1000 injection 0.01mg/kg/dose (max 0.3mg) IM q15 minutes
    - Acetaminophen (Tylenol) 15mg/kg/dose (max 650mg) – PO Q4-6 hours
    - Diphenhydramine (Benadryl) 1mg/kg/dose (max 50mg) – IV Q6 hours
    - Hydrocortisone (Solu-Cortef) 1mg/kg/dose (max 100mg) – IV Q8hours
- Ensure that you are using the correct concentration of ***ephinephrine***
    - ***1:1000 (not 1:10,000)***
    - Use a filtered needle when drawing from an ampule
    - Ensure that the epinephrine is given intramuscular, not subcutaneous - IM administration is absorbed quicker than subcutaneous epinephrine and is recommended for anaphylactic reactions

(Lexicomp, UCMC Formulary, 2019)

Thiotepa

Nursing Assessment/Interventions:

- All patients will be **weighed daily** unless a higher frequency is ordered by the physician.
- Nurses must "wrench" in the **Thiotepa flowsheet (ID 720025)** in EPIC and document with each bath.
- Nurses will review appropriate laboratory parameters. This includes calculation of patient Absolute Neutrophil Count (ANC).
    - Monitor Renal Function (BUN, Creatinine)
- All IV hubs will be accessed aseptically with chlorahexidine wipes prior to drawing of labs or administration of medications. Do not touch skin with chlorahexidine.
- Inspect Thiotepa prior to administration; if solution is grossly opaque or contains precipitates do not use.
- As Thiotepa can be **excreted through sweat and tears** the following standards must be observed while the patient is receiving Thiotepa and for 48 hours following the last dose:
    - Patient should **bathe 4 times per day (q6hrs)**, and whenever the patient sweats or becomes very warm. The first bath should begin **3-4 hours after the 1st dose**.
    - **GENTLE NON-SOAP CLEANSER OR JUST WATER ONLY** should be used when the patient bathes. Do not use any moisturizer, barrier cream, antiperspirant or deodorant in conjunction with the bath. Soap must be rinsed off thoroughly.
    - Avoid leaving skin damp, dry skin folds well by patting, do not rub the skin.
    - **ALL BED LINEN** should be changed with every bath.
    - **NEW CLOTHING/GOWN** should be put on after every bath. Clothing should be loose fitting
    - Central line dressing should be changed with every bath—4 times a day!
        - Using soap and water
        - Sterile procedure, make sure mask is worn

        - **Alcohol swabsticks + Gauze + Ace wrap (NO TAPE ON SKIN!!)**
        - Change ace wrap with each dressing change
    - No occlusive dressings (Tegaderm) during Thiotepa administration and for 48 hours after.
    - **Alcohol swabsticks** should be used when changing the central line dressing. Do not use Chlorhexidine swabsticks for these dressing changes until 48 hours after the last dose of Thiotepa.
    - Wear chemotherapy PPE (chemo gown, **double gloves for Thiotepa use**- see page 3) when handling bodily fluids, changing diapers, linens or patient clothing, and if helping the patient to bathe.
    - Chucks pads or diapers must be changed between every 1-2 hours; do not use baby wipes, use only warm moist washcloth and avoid rubbing the skin.

- **Documentation:** Wrench in **Thiotepa Flowsheet** in Epic (ID 720025) and document with each bath.

Education:

- The patient and caregiver should be educated regarding common/occasional side effects to report:
    - Nausea, vomiting, anorexia, myelosuppression, **mucositis** and esophagitis, gonadal dysfunction, infertility, **dizziness**, headache, confusion**, hyperpigmentation of the skin/sunburn like skin irritation, especially in the skin folds.**
- Additional education regarding neutropenic and thrombocytopenic precautions and line care should be included.
- Caregiver should be taught to wear gloves and either a gown or long-sleeved shirts and pants when holding or caring for their child during the Thiotepa administration and for 48 hours after the infusion.
- Importance of use of provided mouth rinses to prevent/treat mucositis and esophagitis.
  (Lexicomp, UCMC Formulary, 2019)

ATGAM (Anti-thymocyte globulin)

What: ATGAM is prepared by injecting human thymocytes (T-lymphocytes) into rabbits. As a result of these injections, rabbits produce antibodies that are capable of destroying human leukocytes. When ATGAM is infused into a patient, the antibodies attack the patient's T-Cells.

Who: ATGAM is utilized primarily with stem cell transplant patients in order to prevent or treat graft vs host disease (GVHD).

When: Q15 min x 4, Q30 min x 2 and then every hour thereafter until infusion is complete.

How: Because ATGAM is a foreign protein, patients can experience a reaction. Patients will be pre-medicated with hydrocortisone and Benadryl.
Side Effects include:

- Fever, chills, and rigors
- Arthralgia
- Chest pain
- Anaphylactic reaction: **stop infusion and administer epinephrine**
    - SOB
    - Hypotension
- Headache
- Phlebitis
- Thrombocytopenia and Leucopenia
- Rashes

References:

1. Sanofi-Aventis (2016). Thymoglobulin® (Anti-thymocyte Globulin [Rabbit]): Product Monograph.
2. Sydney Children's Hospital (2015). Protocol: Antithymocyte Globulin ATGAM® Administration.
3. (Lexicomp, UCMC Formulary, 2019)

Aldesleukin

Make sure RN releases all ordered labs in chemo plan on day of admission

*MUST OBTAIN A PATIENT WEIGHT **DAILY***

Aldesleukin

-Compatible with D5W only
-Benadryl and morphine are compatible with Aldesleukin
-Benadryl and Tylenol should be scheduled Q6H
-You should NOT be giving steroids unless there is a severe clinical emergency
-Perform rate checks Q4H to make sure 24hr infusion in on track
- Aldesleukin does not need to be flushed between syringes. A flush is used on the final day
-ONLY include a flush when calculating the rate for the final dose

Setting up IL-2

- Aldesleukin can only run with D5W
- Aldesleukin should have a stop-cock or splitter and drug should run in stop cock lumen closest to central line, D5W should go on bottom portion of the stop-cock or on the other side of the splitter
*Flush all medications with D5W

Vital Signs

-Q15 for the first hour, once first hour is complete, switch to Q4

Blood Cultures/Lab Draws during infusion:

-Line A= Fluids, PCA
-Line B= Antibody or Chemotherapy

If patient is requiring a lab draw during infusion, follow instructions:

1. Put all pumps on hold.
2. Do not disconnect line B (Chemotherapy/Antibody line).
3. Disconnect line A.
4. Flush line A.
5. Complete blood sample collection for blood culture vials from line A.
6. Flush line A.
7. Reconnect line A.
8. Resume all pumps.
9. Once Chemotherapy/Antibody is complete, draw blood cultures from line B. (May be varied amounts of time from when line A cultures were drawn).

Dinutuximab

Make sure RN releases all ordered labs in chemo plan on day of admission
*MUST OBTAIN A PATIENT WEIGHT **BID***

- Flush all medications with D5W
- GMCSF should be given 1 hour before dinutuximab *if part of specific patient treatment plan*
- Start 10/kg bolus of 0.9 normal saline one hour before dinutuximab
- Start the PCA + loading dose 30 minutes before hanging dinutuximab
- Always refer to your MAR, but typically dinutuximab is run at a rate of 5ml/hr for the first 30 minutes, then 10ml/hr for the remainder of the infusion, if tolerated
- Dinutuximab comes as a secondary bag, it is run with a 0.9 normal saline primary line.
- **PRIME dinutuximab TO the TIP prior to starting infusion**
- Record exact start time, rate change, and stop times of infusion in the MAR.
  When documenting the rate change in the MAR, be sure to document it as ***rate change, **not** ***given***. (If given is charted the system counts that as one of the patient's number of doses which can lead to them not receiving their entire treatment)

Supplies for Setup:
2 IV pumps
1 PCA pump
1 syringe pump

(Lexicomp, UCMC Formulary, 2019)

1 hour before infusion = 10mg/kg bolus of NS, give GMCSF (if ordered)
30 mins before infusion= Start PCA + give Loading Dose + Premeds (Benadryl, Tylenol, Zofran if ordered)
Start = *prime drug to tip*, start infusion at 5ml/hr for the first 30 minutes
30 minutes after start = increase rate to 10ml/hr ***If ordered; some patients do not require rate increase**
Vital Signs= Q15min for first hour. Then, Q1hour for remainder of infusion

Morphine Wean:

The RN should first consult the patient or family to assess their weaning preference and if there is no preference they may use this general recommendation. Wean by 0.01mg/kg/hr Q30-60 minutes starting 2 hours after dituxumab completion. Assessment of pain should occur with each wean.

Blood Cultures/Lab Draws during infusion:

-Line A= Fluids, PCA
-Line B= Antibody or Chemotherapy

If patient is requiring a lab draw during infusion, follow instructions:

1. Put all pumps on hold
2. Do not disconnect line B
3. Disconnect line A
4. Flush line A
5. Complete blood sample collection for blood culture vials from line A
6. Flush line A
7. Reconnect line A
8. Resume all pumps
9. Once Chemotherapy/Antibody is complete, draw blood cultures from line B. (May be varied amounts of time from when line A cultures were drawn)

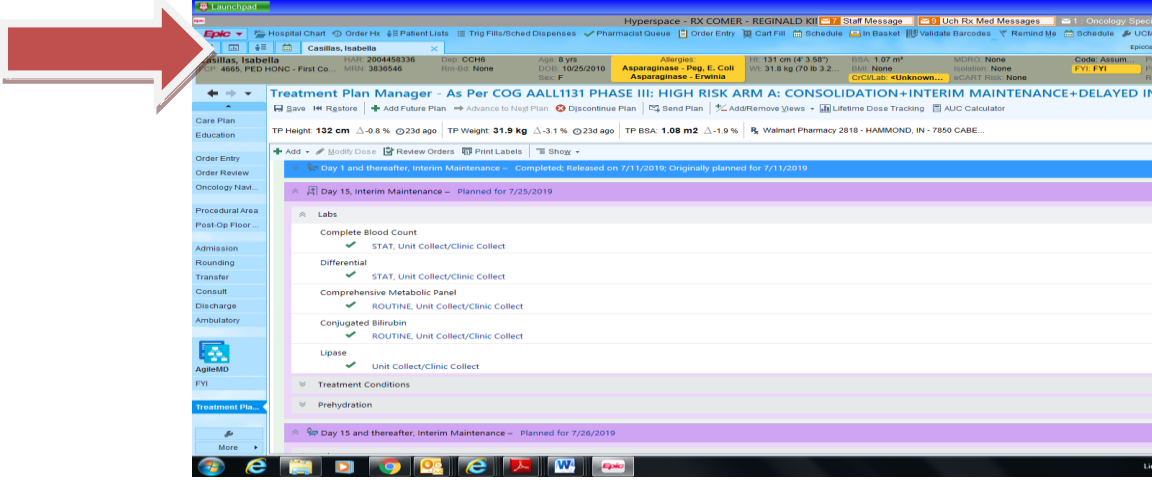
(Lexicomp, UCMC Formulary, 2019)

BEACON

1. Verify that BEACON order matches:
    a. CPIT (Chemotherapy Performance Improvement Team) – UCM's summation of the protocol
    b. The orders may not match both the CPIT if they are off protocol
        i. Check treatment modifications
        ii. Notify the attending

2. Compare the orders to the MAR in EPIC for verification of timing/correct cycle after the patient's orders have been dual checked by 2 chemotherapy pharmacists.
    a. There will be a red stop sign in the upper right hand corner of the medication in the MAR until it has been verified
    b. Once it is verified by the chemo pharmacist the red stop sign will no longer appear

3. The next cycle to be administered will be highlighted in purple:



4. Check for Treatment modifications in EPIC – any treatment modifications should be followed over the initial orders/CPIT

5. Orders to be released by **nursing** (make sure to release chemo orders by midnight if the patient is admitted the night before chemo is to be administered. If released after midnight, then all of the dates for the labs will be off by one day)
    a. Labs (release one by one to ensure you are not releasing the entire tx plan)
    b. Treatment information
    c. VS/Monitoring

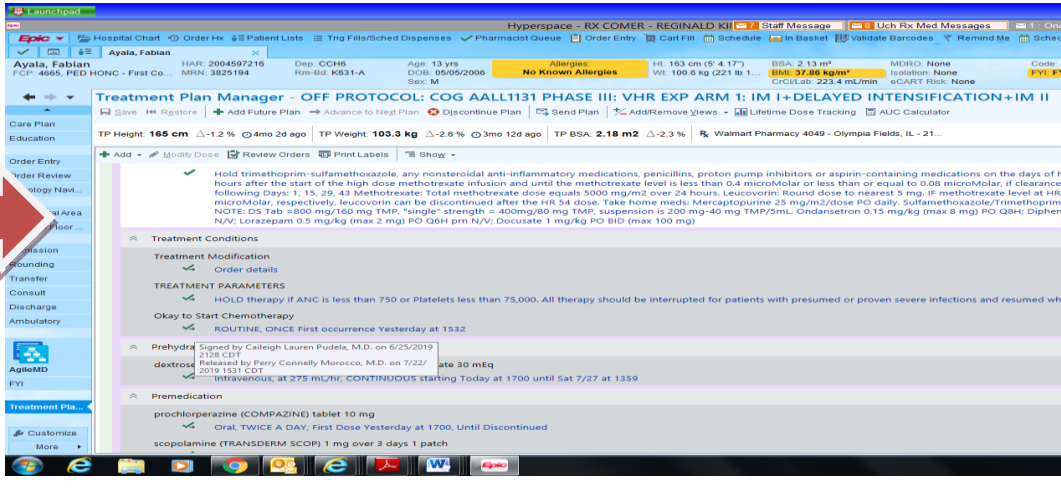
6. Orders to be released by **fellow/attending/chemo APN**
    a. OK to start chemotherapy
    b. Treatment modifications

7. Orders to be released by **pharmacist ONLY**
    a. Treatment medications

8. Verify the following:
    a. Height/weight completed upon admission & double verified in EPIC by 2 RN's, BSA calculated per bedside RN
        i. Daily weights should be completed by 10am to evaluate fluid/nutrition status
    b. Calculate out each drug dosage (using CPIT dosing & any treatment modifications present) based upon current BSA.
        i. Verify that the ordered chemotherapy dose on the MAR is within 10% of the calculated dose per current weight/height (BSA)
        ii. For inpatients – use the inpatient admission height/weight to calculate BSA. In the event chemo does not start on day of admission, utilize the current height and weight (from the day of chemo to start)
    c. Cycle number (if applicable)
    d. ANC – bedside nurse to calculate and compare to protocol standard
        i. If the ANC is less than the requirement to start chemotherapy, notify the primary service

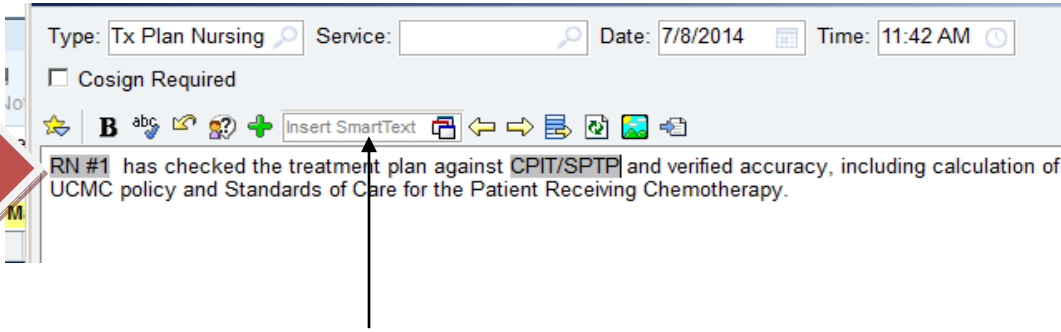
e. Platelet count – bedside nurse to check and compare to protocol standard
    i. If the platelet count is less than the requirement to start chemotherapy, notify the primary service

9. Check that the "OK to Start Chemotherapy" is signed by a heme/onc attending/fellow/chemo APN
    a. Grey arrow will be present when the order is released; green check indicates that the order has been signed (if you hover over the check mark you will see the name of the provider):



10. Verify side effects and administration guidelines, including monitoring during the administration of each chemotherapy drug by using the UCM formulary/lexicomp. You can also verify maximum single dose and course dose as well.

11. If all components match the CPIT/MAR and are appropriate, go to notes and enter a Tx Plan Nursing Note regarding verification of chemotherapy. Two nurses must enter separate notes, RN#1 and RN#2. Choose a treatment plan nursing note as the type of note.

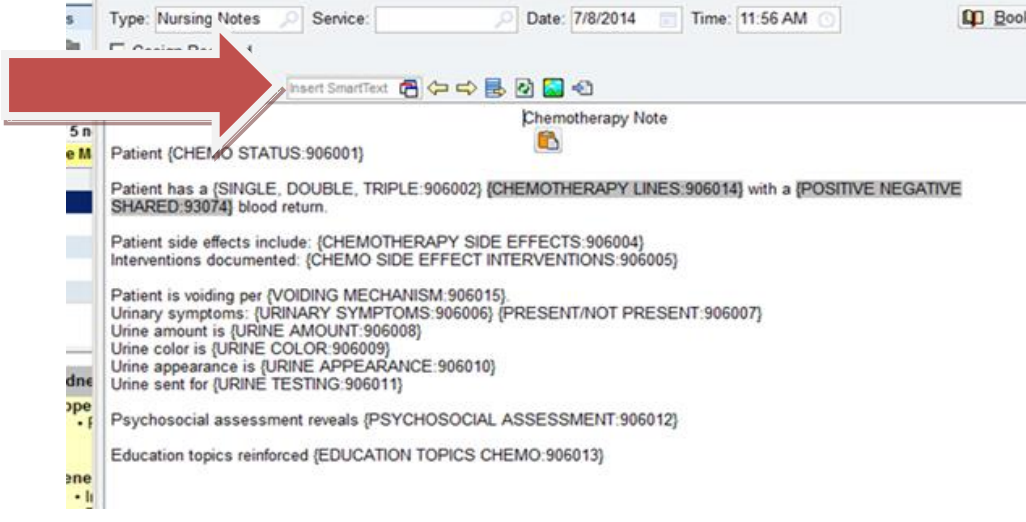


Enter the word "chemo' in the smart text box or type the phrase ".phemchemo" into the text box to pull up this smart text note. Choose either RN#1 or RN#2, and then choose that the CPIT has been verified. **Please note: the SPTP is no longer utilized.*

12. If a component does not match:
    a. If chemotherapy dose/schedule/# of doses does not match, there must be a treatment plan modification entered. If it is not entered, please notify the fellow.
    b. If supportive therapy or labs do not match. Please initiate conversation with the team re: the discrepancy. Only chemotherapy requires a treatment modification order. However, you may see treatment mods for changes to supportive care as well.
    c. A resident can write an order to change the type of fluids that are to be infused (ie: can change from D5.9NS to just NS) but **any rate change for IVF dictated by the type of chemotherapy the patient is receiving** should be ordered by the fellow/attending physician through a treatment modification

d. Contact the attending/fellow for any questions or doubts #4363 (HEME)
    i. The medical residents are not responsible for any Beacon or chemo-related issues/decisions

13. A chemotherapy note should be documented every shift (q12 hours) on every in-patient who is actively receiving chemotherapy. This is a nursing note; enter the word chemo into the smart text box to pull up this smart text note. Fill in the details.



COMPATIBILITY CHART

• Zofran • Benadryl • Pepcid • Amikacin • Cefotaxim • Ceftazidime • Clindamycin • Decadron • Lasix • Hydrocortisone • Flagyl • Vanco • Gentimicin • Solumedrol • Ativan • Micafungin (no lipids)	• Zofran • Benadryl • Hydrocortisone • Pepcid • Rocephin • Flagyl • Cefotaxim • Ceftazidime • Clindamycin • Decadron • Octreotide • Zosyn • Ativan • Micafungin (not compatible w/ morphine) • Gentamicin (no heparin) • Vancomycin (no heparin)

IVIG, ambisome, GCSF, and cellcept with D5W only!!!!
Acyclovir with D5W, 0.9%NS, or combo fluid (D5NS)
Mesna, Solumedrol NOT compatible with Heparin

★CYCLOSPORINE/TACROLIMUS MUST BE INITATED IN PICC – PURPLE LUMEN★

DRUG LEVELS SHOULD BE DRAWN FROM RED LUMEN OF CENTRAL LINE ONLY

Stem Cell Transplant - Infusion

Supplies/Equipment for Cellular Transplant (Allogeneic/Autologous):

- 0.9 Normal Saline Bag, 250ml
- Free flow blood tubing
- Stopcock
- 0.9 Normal Saline flushes
- Sterile gloves, chloraprep wipes, gauze, mask – to attach the set up using sterile technique
- Monitoring equipment (BP, pulse ox, ECG, temperature, lung sounds)
- Emergency medications (see below)

Emergency Medications at Bedside:

- Diphenhydramine 1mg/kg IV (max dose 50mg)
- Hydrocortisone 2mg/kg IV (max dose 100mg)
- Epinephrine (1:1,000) 0.01mg/kg IM (max dose 0.3 mg)

Vital Signs during Cellular Transplant (Allogeneic/Autologous):

Measure and record the patient's temperature, blood pressure, pulse, and respiratory rate, and breath sounds according to the following schedule:

- Prior to infusing the first cryobag/fresh bag
- VS Q5 minutes for the first 15 minutes, then
- Every 15 minutes during the infusion
- Immediately after infusion of the last cryobag/fresh bag, then
- VS Q15 minutes x1 hour, then
- VS Q30 minutes x 2 hours, then
- VS Q1 hour x 2 hours, then
- VS Q2 hours x 2 hours
-

Infusion-Related SCT Complications in the Pediatric Patient:

- Any patient receiving cryopreserved stem cells, either autologous or allogeneic, will be exposed to the cryopreservative Dimethyl Sulfoxide (DMSO)
  a) DMSO can induce a histamine release and cause the following: flushing, pulmonary distress (capillary leak), abdominal cramps, hypotension, and allergic reactions (hives, wheezing, respiratory distress, fever, rash), bradycardia, arrhythmias, heart block

b) DMSO emits a pungent odor, which can also be experienced by the patient through the sense of taste. Patients will continue to expel this odor through their lungs for up to two days after the procedure.
c) To minimize or prevent DMSO toxicity, the volume of DMSO infused is not to exceed the patient's weight – no more than 1mL of DMSO/kg/day
d) If the volume of DMSO is anticipated to exceed 1mL/kg/day, it is generally recommended that half of the cells be given on each of two consecutive days.

- During processing of the hematopoietic cells, it is unavoidable that some contaminating red blood cells (RBCs) will remain in the product. RBCs do not tolerate cryopreservation and will therefore lyse. Most of the cryopreserved peripheral blood and marrow products infused, rarely have significant amounts of red cells. However, if a stem cell product has more than 40mLs of RBCs (cumulative in all the bags infused at a time), the free hemoglobin can potentially clog renal tubules resulting in renal insufficiency or failure.
    a) Hematuria can be present for up to 24 hours post infusion due to the hemolyzed RBCs.
    b) Increased BUN/Creatinine, decreased urine output
- Fluid overload – can occur d/t renal insufficiency and from capillary leak syndrome (histamine release)
    a) Monitor the patient: Hypotension/hypertension, edema, lung sounds (rales/rhonchi), perfusion (capillary refill, pulses, color, skin temp), urine output
- ABO Incompatibility - Allogeneic
    a) A Major Incompatibility is characterized by the infusion of ABO incompatible donor red cells to the graft recipient, such as the infusion of A red blood cells to an O recipient.
    b) A Minor Incompatibility is characterized by the infusion of ABO incompatible serum to the graft recipient, such as the infusion of O serum to an A recipient.
    c) For all ABO incompatible progenitor cell products, the red cell and plasma volume will be as reduced as possible (<40mL RBC and < 300mL plasma)
    d) After transplantation, the recipient will be monitored closely for the onset of hemolysis with daily: HCT, urine (checked for hemoglobin)

Pediatric Palliative Care- Comer 6

Room Guidelines

- Continuous infusions in a PCA pump are acceptable; examples of this can be a fentanyl PCA and or ketamine on a Baxter pump.
- Ketamine if infusing on Baxter pump should utilize Critical Care Drug Library and lock keypad once programming pump is completed and infusion is running.
    - Locking Baxter pump: press numbers 429 to lock and unlock (Numbers 429 also spells out the word K-E-Y).
- Continuous infusions of benzodiazepines are not allowed on Comer 6.
- Precedex is not allowed on Comer 6.
- In terms of respiratory support, bipap is not allowed unless staffed by PICU nurse due to availability of respiratory therapists on Comer 6.
- High flow, in palliative care situations, will be allowed.

The goal is to keep the patient and family comfortable together with staff they know on Comer 6 while ensuring that the patient is kept comfortable with all desired therapies.

High Flow Nasal Cannula (HFNC)

What is it?

A method of oxygen delivery that provides:

- Up to 100% Oxygen
- Heated, humidified air
- Flow rates from 0.5 LPM up to 20 LPM allowed on Comer 6
- HFNC cannot accurately provide PEEP.

Benefits of its Use:

1. **Humidity-** is essential because it provides for optimal gas exchange and airway defense.
2. **Patient Comfort**- nasal cannula set up vs. a face mask may be better tolerated by our pediatric patients.
3. **Secretion Clearance**- mucous is more easily cleared from the respiratory tract when warm humidified air is provided.
4. **Predictable FiO_2-** with oxygen titrated via a blender system

High Flow System

- Flow limit based on size of cannula in use
  1. Optiflow Junior System
     a. Can go up to 25L (flow limits are based on the size of the cannula being used)
        i. Neonatal (Yellow)- up to 8L per minute
        ii. Infant (Violet)- up to 20L per minute
        iii. Pediatric (Green)- up to 25L per minute
     b. Uses a blender- allows for more manipulation of FiO2
     c. High pressure hose must be plugged into wall
  2. Optiflow System
     a. Can go up to 60L (flow limits are based on the size of the cannula being used), minimally 10-liter flow
     b. Intended for large children or adults
        i. Small- Minimum of 10 L per minute
        ii. Medium
        iii. Large
     c. Uses a blender- allows for more manipulation of FiO2
     d. High pressure hose must be plugged into wall

Troubleshooting the HFNC System:

- **Nasal cannula size**: Nasal prongs should occupy 50% of the patient's nares. Are the nasal cannula prongs too big/small for your patient?
- **Humidification:** Has the sterile H_2O bag run dry?
- **Heater:** is the heater on?
- **Oxygen source:** is the HFNC system hooked up to a 15L O_2 source?
- **Rainout:** Has condensation gathered in the tubing occluding the passage of humidified oxygen to the patient? If so, must remove accumulated H_2O in order to allow humidified O_2 to reach the patient.
- **System disconnect:** ensure that nothing has been disconnected from the system inadvertently.
- **Patient's breathing pattern:** HFNC system may not be effective if significant airflow occurs through the mouth instead of the nose.

Low-Dose Ketamine Infusion Practice Calculations

- Rate calculation for drug dosed in mcg/kg/min:

$$\text{Rate (ml/hr)} = \frac{\text{Weight (kg) X dose (mcg/kg/min) X 60 (min/hr)}}{\text{Concentration (mcg/ml)}}$$

Remember that 1mg=1000mcg

Sample Calculation:

22kg patient written for low dose ketamine infusion to run at 3mcg/kg/min concentration of the drug that you have on hand is 2mg/ml. Calculate the rate of the infusion (ml/hr).

Concentration (mcg/ml) = (2mg/ml) X (1000mcg/1 mg) = **2000 mcg/ml**

$$\text{Rate (ml/hr)} = \frac{\text{22 kg X 3(mcg/kg/min) X 60 (min/hr)}}{\text{2000 mcg/ml}} = 1.98 \text{ mL/hour}$$

(which is equal to 3960 mcg/hr or 3.96 mg/hr

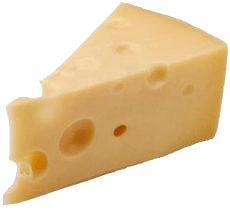
Bone Marrow Transplant Diet Guidelines

After a bone marrow transplant patients have a weak immune system and are at a higher risk of getting sick. Basic food safety guidelines can help keep the foods that you/your child eat every day safer. In addition to following the food safety guidelines there are certain foods you should NOT eat.

Below is a diet that outlines the specific foods that you should NOT eat because they are more likely to cause an infection. When choosing foods you should select foods from the "May Eat" column. DO NOT eat foods in the "DO NOT Eat" column. This diet should be followed before and after all conditioning therapy (chemotherapy and/or radiation) and while on medicines that suppress your/your child's immune system (cyclosporine, tacrolimus, cellcept). Your/your child's health care provider and dietitian will let you know when the diet is no longer required.

The length of time you/your child will need to follow these diet guidelines depends on the type of transplant you/your child had:

- **Autologous transplant patients**: follow the diet until Day +100 after chemotherapy or transplant.
- **Allogeneic transplant patients**: follow the diet until you are off all medicines that suppress your immune system such as cyclosporine, prednisone, Tacrolimus®, sirolimus, or MMF

FOOD GROUP	MAY EAT	DO NOT EAT
DAIRY 	• Dry, refrigerated, or frozen pasteurized whipped topping (Cool Whip®) • All pasteurized, grade "A" milk and milk products including eggnog, yogurt, ice cream, frozen yogurt, sherbet, ice cream bars, milkshakes, processed cheese slices and spreads, cream cheese, cottage cheese and ricotta cheese • Commercially packaged hard and semi-soft cheeses such as cheddar, mozzarella, parmesan, Swiss, Monterey Jack, etc. • Cooked and pasteurized soft cheeses such as brie, goat, camembert, feta, farmer's cheese. Though not completely risk free, the risk of contracting food borne illness from COOKED soft cheeses is low. • Commercially sterile ready-to-feed and liquid-concentrate infant formulas (avoid powdered infant formulas if a ready-to-feed or liquid concentrate alternative is available)	• Non-pasteurized or raw milk and milk products made from non-pasteurized or raw milk. • Cheeses from delicatessens • Cheese containing chili peppers or other uncooked vegetables • Cheeses with molds (such as blue, Stilton, Roquefort, gorgonzola) • Mexican-style soft cheese such as queso fresco, queso blanco (Unless made with pasteurized milk and cooked)

FOOD GROUP	MAY EAT	DO NOT EAT
MEAT AND MEAT SUBSTITUTES 	• All meats cooked to well done (temperature log attached) or canned meats (beef, pork, lamb, poultry, fish, shellfish, game, ham, bacon, sausage, hot dogs) • Eggs cooked until both white and yolk are firm • Pasteurized eggs, egg substitutes (such as Egg Beaters®), and powdered egg white (all can be used uncooked) • Commercially-packaged salami, bologna, hot dogs, ham and other luncheon meats, heated until steaming • Canned and shelf-stable1 smoked fish (refrigerate after opening) • Pasteurized or cooked tofu2* • Refrigerated smoked salmon or trout if cooked to 160F or contained in a cooked dish or casserole	• Raw or undercooked meat, poultry, fish, game, tofu2 • Raw or undercooked eggs and non-pasteurized egg substitutes; no eggs over easy, soft-boiled eggs, or poached eggs. • Meats and cold cuts from delicatessens • Hard cured salami in natural wrap • Uncooked refrigerated smoked, seafood such as salmon or trout labeled as “nova-style,” “lox,” “kippered,” “smoked” or “jerky” • Pickled fish • Tempe (tempeh) products

FOOD GROUP	MAY EAT	DO NOT EAT
FRUITS AND NUTS 	• Well washed3* raw and frozen fruit; foods containing well washed raw fruits • Cooked, canned, and frozen fruit • Pasteurized juices and frozen juice concentrates • Dried fruits • Canned or bottled roasted nuts • Shelled, roasted nuts and nuts in baked products • Commercially-packaged nut butters (such as peanut butter, almond butter, soybean butter)	• Unwashed raw fruits • Fresh berries • Unroasted raw nuts • Roasted nuts in the shell • Non-pasteurized fruit and vegetable juices • Fresh fruit salsa found in the grocery refrigerator case • Non-pasteurized items containing raw fruits found in the grocery refrigerator case

FOOD GROUP	MAY EAT	DO NOT EAT
ENTREES AND SOUPS	• All cooked entrees and soups	• All miso products (such as miso soup and miso paste)

FOOD GROUP	MAY EAT	DO NOT EAT
VEGETABLES 	• Well washed3* raw and frozen vegetables • All cooked fresh, frozen, or canned vegetables (including potatoes) • Shelf-stable1* bottled salsa (refrigerate after opening) • Cooked vegetable sprouts (such as mung bean sprouts) • Fresh, well washed3* herbs and dried herbs and spices (added to raw or cooked foods)	• Unwashed raw vegetables or herbs • Raw broccoli • Fermented vegetables such as kimchi or sauerkraut • Fresh, non-pasteurized vegetable salsa found in the grocery refrigerator case • Non-pasteurized items containing raw vegetables found in the grocery refrigerator case • All raw vegetable sprouts (alfalfa sprouts, clover sprouts, mung bean sprouts, all others) • Salads from delicatessens and restaurants

FOOD GROUP	MAY EAT	DO NOT EAT
BREADS, GRAINS, AND CEREALS 	• All breads, bagels, rolls, English muffins, muffins, pancakes, sweet rolls, waffles, French toast • Potato chips, corn chips, tortilla chips, pretzels, popcorn • Cooked grains and grain products, including pasta and rice • All cereals, cooked and ready-to-eat	• Raw (not baked or cooked) grain products (such as raw oats on top of a loaf of bread)

FOOD GROUP	MAY EAT	DO NOT EAT
BEVERAGES 	• Commercially-bottled waters6 • All canned, bottled, and powdered beverages • Instant and brewed coffee and tea; cold brewed tea made with boiling or bottled water • Herbal teas brewed from commercially-packaged tea bags • Commercial nutritional supplements, liquid or powdered (Pediasure, Ensure, Boost, etc.) • Commercially sterile ready-to-feed and liquid-concentrate infant formulas (avoid powdered infant formulas if a ready-to-feed or liquid concentrate alternative is available)	• Un-boiled well and tap water • Cold-brewed tea made with warm or cold water • Non-pasteurized fruit and vegetable juices • Mate´ tea • Kombucha

FOOD GROUP	MAY EAT	DO NOT EAT
DESSERTS 	• Refrigerated commercial and homemade cakes, pies, pastries and pudding • Refrigerated cream-filled pastries • Cookies, both homemade and commercially prepared • Shelf-stable3 cream-filled cupcakes (such as Twinkies®, Ding Dongs®) and fruit pies (such as Poptarts® and Hostess® fruit pies) • Canned and refrigerated puddings • Ices, popsicles, and similar products • Candy, gum	• Unrefrigerated cream-filled pastry products (not shelf-stable1)

FOOD GROUP	MAY EAT	DO NOT EAT
FATS 	• Vegetable oils and shortening • Refrigerated lard, margarine, butter • Commercial, shelf-stable3* mayonnaise and salad dressings including Blue Cheese and other cheese-based salad dressings (refrigerate after opening) • Cooked gravy and sauces	• Fresh salad dressings (stored in the grocery's refrigerated case) containing raw eggs or cheeses listed as "Do Not Eat" under "Dairy".

FOOD GROUP	MAY EAT	DO NOT EAT
OTHER 	• Commercial pasteurized Grade A honey7* • Salt, granulated sugar, brown sugar • Jam, jelly, syrups (refrigerate after opening) • Ketchup, mustard, BBQ sauce, soy sauce, other condiments (refrigerate after opening) • Pickles, pickle relish, olives (refrigerate after opening) • Vinegar	• Raw honey; honey in the comb • Herbal and nutrient supplement preparations • Brewer's yeast, if uncooked • Black pepper

1 Shelf-stable refers to unopened canned, bottled, or packaged food products that can be stored before opening at room temperature; container may require refrigeration after opening.
2 Aseptically packaged, shelf-stable tofu and pasteurized tofu do not need to be boiled. Unpasteurized tofu must be cut into 1-inch cubes or smaller, and boiled a minimum of five minutes in water or broth before eating or using in recipes.
3 Rinse under clean, running water before use, including produce that is to be cooked or peeled (such as bananas, oranges and melon).
4 Bring tap water to a rolling boil and boil for 15-20 minutes. Store boiled water in the refrigerator. Discard water not used within 48 hours (2 days).
5 Recommend using boiled or bottled water if using a water service other than city water service.
7 Honey products are not allowed for any child less than one year of age and not allowed for children with SCIDS until 9 months post-transplant.

Food Temperature Guide	
Food Type	**Internal temperature**
Beef, Pork, Veal, and Lamb (chops, roasts, steaks)	145°F with a 3 minute rest time
Ground Meat	160°F
Ham, uncooked (fresh or smoked)	145°F with a 3 minute rest time
Ham, fully cooked(to reheat)	140°F
Poultry (ground, parts, whole, and stuffing)	165°F
Eggs	Cook until yolk & white are firm
Egg Dishes	160°F
Fin Fish	145°F or flesh is opaque & separates easily with fork
Shrimp, Lobster, and Crabs	Flesh pearly & opaque
Clams, Oysters, and Mussels	Shells open during cooking
Scallops	Flesh is milky white or opaque and firm
Leftovers and Casseroles	165°F

Adapted from FDA

Blood Products & Labs

"To save a life is a real and beautiful thing"

Blood Products					
Product Type	**Rate of Infusion**	**Filter**	**Usual Dose**	**Common Reasons for Infusion**	**Special Instructions**
PRBC	2-3 ml/kg/hour. Not to exceed 3 hrs. If rapid replacement for shock, can push	Yes	10-20 ml/kg 10ml/kg increases Hb by 5-7%	• Improve tissue oxygenation associated with anemia	• Washed PRBCs for hyperkalemia • Irradiated cells prevent GVHD
Whole Blood	Not to exceed 3 hours. If rapid replacement for shock, then can push	Yes	15 ml/kg	• Massive hemorrhage and trauma	• Contains RBCs, WBCs, plts, coags
Platelets	Can infuse as rapidly as patient can tolerate. Not to exceed 3 hours.	Yes	10ml/kg Should raise count approx. 50,000 mm3	• Active bleeding d/t thrombocytopenia • Platelet dysfunction • Platelet count < 20,000	• DO NOT put in blood refrigerator • Peak 60 min after infusion • Single or multiple donors • 1 unit = 50ml • Pheresis pack = 5 units (250ml). Can be volume reduced.
Fresh Frozen Plasma (FFP)	Can infuse as rapidly as patient tolerates. Not to exceed 3 hours.	Yes	10-20 ml/kg	• Bleeding related to decreased coags • Coagulation defects	
Cryoprecipitate	1-2 cc/minute Not to exceed 3 hours	Yes	About 1 unit for every 5 kg	• TTP refractory to FFP & other fibrinogen deficiencies	

Product Type	Rate of Infusion	Filter	Usual Dose	Common Reasons for Infusion	Special Instructions
Albumin 5%	Over 30-60 minutes Max 2 -4 ml/min Rate depends on severity of hypovolemia & pt's symptoms	No	0.5 – 1 gram/kg = 10-20 ml/kg	• Hypovolemia, • Hypoproteinemia • Nephrotic syndrome	• Administer within 6 hours of entering vial • Change tubing every 4 hours • Too rapid infusion may result in vascular overload
Albumin 25%	Usually over 30-60 min Max rate 1 ml/min **Usually NOT pushed**. Rate depends on severity of hypovolemia and pt's symptoms	No	0.25 – 1 gram/kg = 1 -4 ml/kg	• See above (Albumin 5%) • Used in patients in whom fluid intake is minimized	• Administer within 6 hours of entering vial • Change tubing every 4 hours • Too rapid infusion may result in vascular overload
Factor VII	Slow bolus over 2-5 minutes	No	90 mcg/kg	• Refractory hemorrhage	Repeat Q2 hours until hemostasis or treatment judged ineffective

Blood Type	RBC Compatibility	Plasma & Platelet Compatibility
O	O	O, A, B, AB
A	A, O	A, AB
B	B, O	B, AB
AB	AB, A, B, O	AB
Rh type	Red blood cell Rh type	Plasma Rh type for transfusion
Positive	Positive or Negative	Positive or Negative
Negative	Negative	Positive or Negative
Note regarding universal donors: O-negative is the universal donor for red blood cells. AB-positive is the universal donor for FFP.		

BLOOD ADMINISTRATION (REFER TO PC -083)

INFORMED CONSENT:

- A signed informed consent is required prior to transfusion of blood products
- It is the provider's responsibility to obtain the consent
- A consent does not expire within any specific time period.

OTHER INFORMATION ABOUT BLOOD:

- A physician, nurse practitioner, or physician's assistant can order a blood product
- A pretransfusion sample and barcoded blood band identifier are good for twenty-eight days for patients above 4 months of age who have not been transfused or pregnant within the past three months
- Blood product transfusion must be completed within **three hours** of initiation. Blood tubing is also good for **3 hours.**
- If blood product is not spiked within **20 minutes** of arrival, return blood to blood bank or store in approved blood bank refrigerator
- Only the attending physician can initiate MTP activation or deactivate the MTP, order additional blood products or request a modified MTP pack
- Nurses are permitted to place EPIC orders for type and screen and MTP transfusion pack with the MTP
- Refusal for blood product transfusion must also be documented in the medical record.
- Central/PICC lines: recommended to be 3.0 French or larger for blood infusion
- Peripheral IV's: it is best to use a 22-24-gauge catheter
- All UCMC blood products are CMV safe (leukodepleted)
- CMV (-) blood products are given for specific immunocompromised patients (e.g. transplant)
- Cellular blood products are irradiated for all infants up to 4 months and immunocompromised or immunosupressed children to eliminate risk of GVHD

Preparing blood products for administration

- Check the blood product with 2 RNs
- If drawing up syringes of a blood product, only access one unit at a time. As those syringes are depleted, you can then spike the next bag.

Handing off blood products to others for administration

- Only hand off blood products for administration which have been checked by 2 RNs
- Ideally all syringes should be labeled prior to patient administration. In extreme emergencies, you may verbally inform the clinician administering the blood product of

the product type.

Administration

- Ideally only one blood product should be administered at a time.
- Document VS and other pertinent information in EPIC

Remaining blood products

1. Blood products not spiked within **20 minutes** of arrival to the unit must go in the refrigerator or to blood bank. Be sure all accompanying paperwork is with the product. Platelets should be returned to blood bank if not administered right away.
2. Any surplus syringes of blood products or partially infused bags that are not used within three hours should be disposed of in biohazard waste. Your records should reflect exact amount of each unit used.

MASSIVE TRANSFUSION PROTOCOL (MTP): PC 235

- Can only be initiated by an attending physician when: Patient requires six or more units of PRBCs within a 3-4 hour period, or has active/uncontrolled bleeding, or requires replacement of an entire body volume of blood

- MTP Pack includes 6 units PRBCs, 4 units FFP, 1 platelet pheresis pack - If not all products are needed, please specify

- A nurse or designated contact person must call the Blood Bank to activate the MTP

- Blood Bank will request a type and screen specimen if needed. This must be immediately ordered in EPIC along with a MTP transfusion order. These orders can be placed by a nurse or provider.

- If no type and screen is requested, the MTP transfusion order (s) can be placed in EPIC by a nurse or provider as soon as possible

- Unit representative to quickly walk to blood bank; it will not be tubed

- Emergency Transfusion Release form must be signed by physician as soon as possible

- 20mL/kg dosing (10-15mL/kg for anemia)

Refer to MTP Tip Sheet on the Intranet for more information

PEDIATRIC TRAUMA MASSIVE TRANSFUSION PROTOCOL

To rapidly order and retrieve blood products in an emergency involving a pediatric trauma patient, contact the blood bank and activate the "massive transfusion protocol" with the following information:

1. Provide the patient name and medical record number.
2. Direct the Blood Bank staff where to send the blood (ED, Comer OR, GOR, PICU)
3. Try to obtain a Type and Cross prior to the blood administration.
   Protocol Products: 6 units PRBC's—2 units FFP—1 Pheresis pack of platelets

Emergency Blood Administration

- **Checking blood in an emergency**: Blood must ***always*** be checked ***at the bedside*** before administering (no matter how emergent).
  - Cross-matched blood products: See UCMC Policy: PC 83 for details
  - Group O-Negative PRBCs uncross-matched: Check product to ensure it is O-negative and not expired. Not necessary to check blood product with patient's blood band, as product has not been cross-matched to patient.

- **Bringing blood products to the bedside**: Verify blood product is the correct blood product intended for the patient. If no patient name is on the paperwork, verify with the bedside nurse that the uncross-matched blood product was ordered for the patient before handing the product over.

- **Preparing blood products for administration**
  - Check the blood product with 2 RNs
  - If fast infusion is necessary (faster than infusion pump can deliver), the blood product can either be hung by gravity or drawn up in individual syringes from the filter.
    a. Gravity tubing works best in larger bore IVs, larger volume (You need to ask blood bank to send this tubing with the blood product)
    b. Syringes are best for smaller IV size, smaller volume (i.e. infants/toddlers)
  - If drawing up syringes of a blood product, only access one unit at a time. As those syringes are depleted, you can then spike the next bag.
  - If extra syringes have accumulated, be sure they are labeled with product type &

patient's label

- **Handing off blood products to others for administration**
  - Only hand off blood products for administration which have been checked by 2 RNs
  - Ideally all syringes should be labeled prior to patient administration. In extreme emergencies, you may verbally inform the clinician administering the blood product of the product type.

- **Administration**
  - Ideally only one blood product should be administered at a time.
  - If the patient is unstable and requires simultaneous blood product infusions:
    a. Each blood product infusing at the same time should infuse into separate IV sites
    b. If pushing blood products with a syringe back to back into the same IV site, be sure to flush with 0.9NS between each product type and each different unit. (i.e. FFP — 0.9NS flush — PRBC).

- **Documentation**
  - Documentation requirements of emergent blood administration are no different than standard administration (See PC 83).
  - "Emergency/Urgent Transfusion Request" form must be signed by the physician and returned to the blood bank

- **Remaining blood products**
  - Blood products not spiked within 30 minutes of arrival to the unit must go in the refrigerator or to blood bank. Be sure all accompanying paperwork is with the product.
  - Any surplus syringes of blood products or partially infused bags that are not used within four hours should be disposed of in biohazard waste. Your records should reflect exact amount of each unit used.

- **Complications of Massive Transfusion & Steps to Prevent & Treat**
  - Massive Transfusion = replacement of patient's estimated circulating blood volume in < 6 hours (see Tool Box Section for estimates).
  - Electrolyte disturbances: hypocalcemia, hyperkalemia, hypokalemia
    - Monitor labs frequently

        - Monitor for ECG changes
        - Replace low electrolytes/ treat hyperkalemia
    - Acid/Base disturbance: acidosis or alkalosis
        - Frequent ABGs
        - Monitor for ECG changes
    - Hypothermia
        - Monitor HR & B/P
        - Use blood warmer
        - Heat lamps
        - Monitor for ECG changes
    - Dilutional thrombocytopenia/ coagulopathy
        - Monitor coags
        - Requires platelet or plasma transfusion
    - Transfusion related lung injury (TRALI)
        - Acute lung injury that develops within 6 hours after transfusion
        - No specific treatment or screening at this time

Order of Blood Draw

In order to ensure quality of collected blood samples, tubes should be collected in the following order:

Draw

1. Blood Culture (Bactec Bottle/Yellow top tube (SPS))
2. Light Blue top tubes for coagulation.
3. SST (Serum Separator Tube)/glass or plastic red top tubes.
4. Mint Green/Green top tubes (Heparin)
5. Lavender top tubes (EDTA)
6. Gray top tubes (Oxalate/fluoride)
7. Any remaining additive tubes

Blood Cultures

Age	Blood culture bottle type & volume of blood
Neonates (<30days old or weighing <5kg)	Pink Peds Plus Bottle with 0.5-3ml blood
>Neonate to <2 yrs	Pink Peds Plus Bottle with 1-3ml blood
2yr to ≤ 10yr	Pink Peds Plus Bottle with 2-3ml blood & Purple Standard Anaerobic Bottle with 3-8ml blood
11yr and older (with or without antibiotics)	Gray Aerobic Plus Bottle with 8-10ml blood & Purple Standard Anaerobic Bottle with 8-10ml blood

BLOOD REQUIRMENTS FOR GREY AND PURPLE CULTURE BOTTLES

BD BACTEC™ Plus Aerobic/F Culture Vial **(Gray)**	Optimal: 8-10 mL Minimum: 3 mL Maximum: 10 mL
BD BACTEC™ Lytic/10 Anaerobic/F Culture Vial **(Purple)**	Optimal: 8-10 mL Minimum: 3 mL Maximum: 10 mL

Clave must ALWAYS be changed prior to obtaining blood cultures

Specimen Tube Type Requirements (Laboratory Handbook)

LAB/TEST	TUBE STOPPER	QUANTITY	STAT	ROUTINE
BLOOD BANK				
HLA Typing	Special arrangements:		NA	7-10 days
	CALL 2-6225			
Type & Cross Match	Lavender (7mL tube)		1 hour	4-6 hours
CLINICAL CHEMISTRY/ GENERAL & SPECIAL				
Ammonia	Lavender (4mL tube) **ON ICE**	2mL (Peds: full lavender microtainer **on ice**)	NA	4 hours
Basic Metabolic Panel	Mint Green PST (3.5mL)	4mL (Peds: two full green microtainers)	1 hours	4 hours
CK-MB Isoenzyme Panel	Mint Green PST (3.5mL)	2mL	1.5 hours	4 hours
Calcium	Mint Green PST (3.5mL)	2mL (Peds: full green microtainer)	1 hour	4 hours
Comprehensive Metabolic Panel	Mint Green PST (3.5mL)	4mL (Peds: two full green microtainers)	NA	4 hours
Cyclosporine (Whole Blood)	Lavender (4mL)	2mL	NA	4 hours
Digoxin	Red top (4mL)	1mL serum	2 hours	4 hours
Electrolytes	Mint Green PST (3.5mL)	3mL (Peds: full green microtainer)	1 hour	4 hours
Glucose	Mint Green	3mL (Peds: full green	1 hour	4 hours

	PST (3.5mL)	microtainer)		
LAB/TEST	**TUBE STOPPER**	**QUANTITY**	**STAT**	**ROUTINE**
HDL Cholesterol or Lipid Panel	Mint Green PST (3.5mL)	4mL	NA	4 hours
Hepatic Function Panel	Mint Green PST (3.5mL)	3mL (Peds: full green microtainer)	NA	4 hours
Lactate	Gray (4mL) **ON ICE**	2mL (Peds: full green microtainer on ice)	1 hour	4 hours
Theophylline	Red top (4mL)	1mL serum	1 hour	4 hours
CLINICAL CHEM/ LIGAND ASSAY & ENDOCRINOLOGY				
Hepatitis A IGM Antibody	Red top (4mL)		NA	2-5 days
Hepatitis B Surface Antibody	Red top (4mL)	2mL red top tube for one only	NA	2-7 days
Hepatitis B Surface Antigen	Red top (4mL)		NA	24-72 hours
Hepatitis B Core IGM Antibody	Red top (4mL)		NA	2-5 days
HIV-1/HIV-2 Antibody	Red top (4mL)	3mL minimum (unless supplementing /confirmatory testing is required)	NA	24-48 hours
Toxicology Screen	Urine	20mL in a cup or in two 10mL tubes (Peds)	1 hour	4 hours
COAGULATION				
DIC Screen	2 Lt. Blue and 1 Lavendar	6.0mL 3.0mL	NA	4 hours

Fibrinogen	Lt. Blue	Vacutainer, fill to appropriate level	1 hour	4 hours
LAB/TEST	**TUBE STOPPER**	**QUANTITY**	**STAT**	**ROUTINE**
PT	Lt. Blue	Vacutainer, fill to appropriate level	1 hour	4 hours
PTT	Lt. Blue	Vacutainer, fill to appropriate level	1 hour	4 hours
HEMATOLOGY				
Pediatrics - CBC/DIFF	Lavender	1 microtainer or microvette (minimum 500uL)	1 hour	8 hours
Pediatrics - Platelets		2 unopette dilutions	1 hour	8 hours
Pediatrics - CBC, DIFF, Platelets ESR	Lavender	3mL draw tube (minimum 1.5mL)	1 hour	8 hours
MICROBIOLOGY				
Pediatrics - Blood Culture	Direct Bottle Inoculation	SEE Laboratory - Specific Information, Microbiology, Specimen Table, Table 1.	NA	5 days if neg
Other Cultures		SEE Laboratory - Specific Information, Microbiology, Specimen Table	TAT - SEE General Information section	

EMERGENCY RELEASE BLOOD REQUEST

1. GIVE O NEG RBCS FROM REFRIGERATOR IF AVAILABLE
2. CALL BLOOD BANK: 2-6827
   a. "I need ___ (quantity) units of emergency release _____."
   b. "The patient's name is _____ and MRN is _____."
   c. "Patient is ___ years old and their date of birth is _____."
   d. The patient is a _____ (male or female)."
   e. "Patient's location is _____ (unit), room _____."
   f. "The physician requesting blood is _____." (give full name)
   g. "My name is _____ and my call-back number is _____."
3. YOU MAY REQUEST

BLOOD PRODUCT	QUANTITIY
RED BLOOD CELLS	1-5 UNITS
FRESH FROZEN PLASMA	1-3 UNITS
PLATELETPHERESIS	1 UNIT

   a. Allow up to 5 minutes to receive products
   b. Plasma may require up to 30 minutes if thawing is required

4. PLACE EPIC TRANSFUSION ORDER(S) WHEN TIME PERMITS
   a. Keyword search "emergency", "transfuse", or "release"
5. CALL BLOOD BANK FOR PRODUCTS OR MTP 2-6827

****ACTIVATE MTP IF ≥6 RBCS NEEDED FOR ADULTS****

Author: Ariana King. January 2018. UChicago Medicine.

DESIGNATE ONE PERSON TO CALL BLOOD BANK

Emergency Transfusions

	Emergency Release (EREL) 3 – 5 min TAT	Massive Transfusion Protocol (MTP) 5 – 10 min TAT
	Acute Emergency	Massive Emergency
1. Activate or Request	Call Blood Bank, 2-6827	
2. Get Blood Products	*Retrieve products from department fridge **if available***	
	 Tube system	 Care team runner to Blood Bank, CCD 2-730
Red Cells	1 – 5	6
Plasma	1 - 5	6
Platelets	1	1
Cryo	NONE	1 upon request (included with OB MTP)
3. Place Epic Orders	Emergency Transfusion	Massive Transfusion; MTP

MASSIVE TRANSFUSION PROTOCOL
Pediatric Activation

1. CALL BLOOD BANK TO ACTIVATE: 2-6827

a. "I am activating the Massive Transfusion Protocol."
b. "The patient's name is _____ and MRN is _____."
c. "Patient is ___ years/months old and their date of birth is ____."
d. "The patient weighs _____ kg."
e. "Patient is a ____." (male or female)
f. "Patient's location is _____ (unit), room _____."
g. "We need a _____ (single or continuous) pack."
h. "The physician requesting the MTP is _____." (give full name)
i. "My name is _____ and my call-back number is _____."

2. CARE TEAM RUNNER WILL TRANSPORT:

Products Sent with MTP Runner		Recommended Administration				
<40 kg	≥ 40 kg	5-9 kg	10-19 kg	20-29 kg	30-39 kg	≥ 40 kg
4 RBC	6 RBC	1 RBC	2 RBC	3 RBC	4 RBC	6 RBC
4 FFP	6 FFP	1 FFP	2 FFP	3 FFP	4 FFP	6 FFP
1 PLT[1]	1 PLT[1]	½ PLT	½ PLT	½ PLT	1 PLT	1 PLT
Cryo by request only		1 UNIT Cryo	1 UNIT Cryo	1 UNIT Cryo	1 POOL Cryo[2]	1 POOL Cryo[2]

1. ONE (1) PLATELETPHERESIS = SIX (6) OR MORE PLATELET UNITS.
2. ONE (1) CRYOPRECIPITATE POOL = FIVE (5) CRYOPRECIPITATE UNITS.

a. May request cryoprecipitate if needed
b. Allow up to 10 minutes to receive first MTP pack
c. Allow up to 30 minutes to receive cryoprecipitate

3. CALL BLOOD BANK IF: 2-6827

a. Additional MTP pack needed
b. Different MTP needed (e.g. from continuous to a single-pack)
c. Patient transferred to new unit

4. PLACE EPIC ORDER(S) WHEN TIME PERMITS

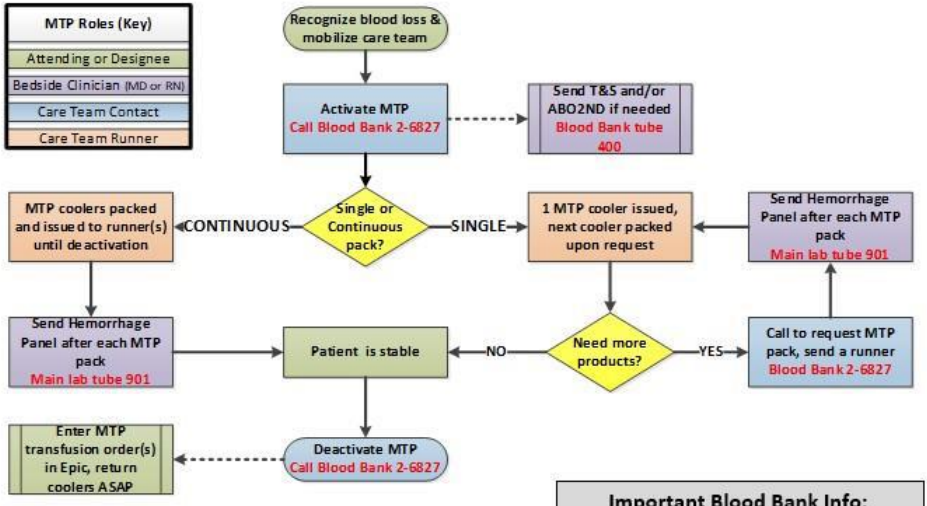
5. CALL BLOOD BANK TO DEACTIVATE

February 2020, UChicago Medicine.

DESIGNATE ONE PERSON TO CALL BLOOD BANK

AT THE FOREFRONT
UChicago Medicine

Massive Transfusion Protocol (MTP) Algorithm
Adult, Obstetrics, Pediatrics



Important Blood Bank Info:

Phone: 2-6827
Tube #: 400
Room: CCD 2730

Turn-Around-Times

1st MTP pack	10 min
Thaw time (Frozen plasma or cryo)	25-30 min
Stat Type & Screen (T&S)	60 min from receipt
Stat ABO verification (ABO2ND)	15 min from receipt

MTP Pack Contents:

	RBCS	FFP	PLT	CRYO POOL
Adult	6	6	1	1 on request
Obstetrics	6	6	1	1

Products Sent with MTP Runner		Recommended Administration				
<40 kg	**≥ 40 kg**	**5-9 kg**	**10-19 kg**	**20-29 kg**	**30-39 kg**	**≥ 40 kg**
4 RBC	6 RBC	1 RBC	2 RBC	3 RBC	4 RBC	6 RBC
4 FFP	6 FFP	1 FFP	2 FFP	3 FFP	4 FFP	6 FFP
1 PLT[1]	1 PLT[1]	½ PLT	½ PLT	½ PLT	1 PLT	1 PLT
Cryo by request only		1 UNIT Cryo	1 UNIT Cryo	1 UNIT Cryo	1 POOL Cryo[2]	1 POOL Cryo[2]

HOTLINE FLUID WARMER SETUP INSTRUCTIONS

Supplies Needed

Baxter IV Pump

Primary IV Tubing

IV extension set (if needed)

HOTLINE Fluid Warming Set Tubing

HOTLINE Fluid Warmer

Step 1- Set up the HOTLINE Warmer

1. Check that the level is above the minimum level mark on the reservoir. Add recirculating solution to the reservoir through the fill-port if required.
2. Check the condition of the HOTLINE Warmer with visual inspection before using. Remove from service any HOTLINE warmer that shows physical damage.
3. Plug the HOTLINE Warmer into properly grounded power outlet.

Step 2- Set up the HOTLINE Fluid Warming Set

1. Remove the reflux plug from the socket on the right side of the HOTLINE warmer
2. Plug the Twin-Tube connectors on the HOTLINE Fluid warming set into the socket.
3. Turn ON the power switch.
4. The green Operating LED on the display panel illuminates
5. The recirculating solution temperature display will begin to increase
6. The recirculating solution path in the HOTLINE fluid warming set will automatically prime.
7. Remove the end cap and inspect the patient end of the HOTLINE fluid warming set for leaks to confirm the integrity of the intravenous pathway.

Step 3- Connect the Intravenous Administration Set

1. Connect the IC fluid and the intravenous administration set to the HOTLINE fluid warming set.
2. Fully prime the intravenous administration set, the HOTLINE Fluid warming set and patient extension set (if used).
3. Connect the distal end of the HOTLINE fluid warming set to the patient's intravenous access site without entrapping air.

Step 4 Using the HOTLINE warmer

1. The recirculating solution temperature display will reach 37C from ambient in about 4 minutes
2. Adjust the rate of IV fluid using the clamp on the intravenous administration set or via the IV pump.

NOTE: **Do not kink the Fluid warming set. Do not restrict the circulation of solution through the tubing.**

Step 5 After Use

1. Turn OFF the power switch
2. Remove the HOTLINE fluid warming set and insert the reflux plug into the socket
3. After use handle and dispose of the HOTLINE fluid warming set as a potential biohazard.

NOTE: Dispose of the HOTLINE fluid warming set in in a safe manner according to local guidelines for disposal of contaminated medical waste.

Troubleshooting:

1. **Alarms:** visual (red indicator light) and Audible (pulsed alarm).
    - Check disposables and confirm that the HOTLINE fluid warming set is properly installed. Push the twin-tube connectors firmly into the socket on the right side of the HOTLINE warmer.
2. **Difficult Insertion of HOTLINE Warming Set into Warmer:** Lubricate the O-rings in the socket. Refer to section 10 of Operators manual for the procedures.

Recirculating solution leaks at the Socket: Replace the O-rings. Refer to section 10 of the operator's manual for the procedure.

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UCMC Policy: N1450. Administration of Breastmilk.

UCMC Policy: PC 83. Blood Products, Procurement and Administration.

UCMC Policy: PC 118: Intravenous Therapy and Vascular Access

UCMC Policy: PC 1414G: Oro/nasogastric, Gastrostomy/jejunum tube feeding

UCMC Policy: PC 125D: Pediatric and Adult Parenteral Nutrition

UCMC Policy: Policy: Management of Extravasation of Chemotherapy Agents

UCMC Policy: PC-99. Continuous and Patient Controlled Epidural Analgesia

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Notes

Notes

Notes

Care and Maintenance of Gastric Decompression Tubes

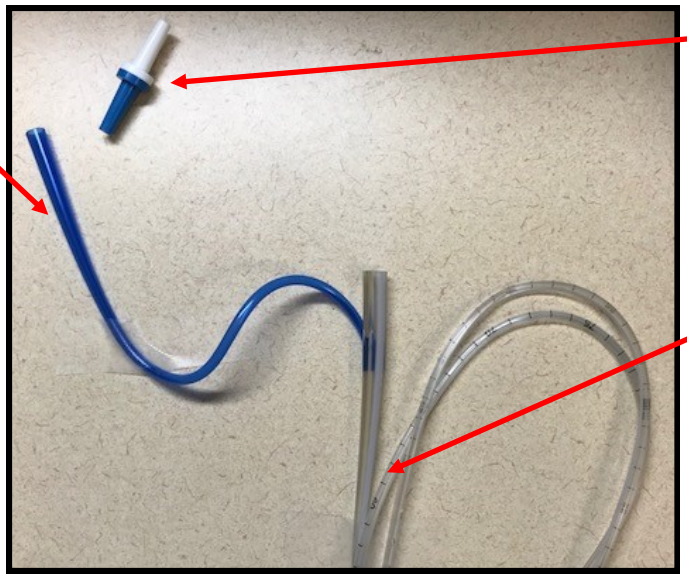
Blue/Air Vent Lumen: provides an air vent, preventing suctioning of gastric mucosa into holes along the distal tip of the tube

Flush every 2-4 hrs & PRN with 5-20 mls (based on pt size) of **AIR**

THIS LUMEN SHOULD ONLY BE FLUSHED WITH AIR!!

If the main lumen is flushed, the air vent lumen should be flushed afterwards.

Temporarily cap off this lumen when flushing the main lumen.



Anti-reflux valve:

Blue end of valve connects to **blue** air vent lumen

Can place white end of valve into main lumen to clamp off for transport.

Clear/Main lumen: connected to wall suction, for removal of gastric contents.

Flush every 2-4 hrs & PRN with 5-20 mls (based on pt size) of **NS or sterile H_2O**

- Both the **blue** air vent and the main decompression lumens should be flushed every 2-4 hours AND PRN to ensure patency. **Always** flush the main decompression lumen **FIRST**.
- If using an anti-reflux valve ensure correct placement: **blue** end of valve into **blue** air vent lumen. If placed the other way you are clamping off the air vent, rather than venting, which can cause harm to your patient!
- When flushing the main lumen, the **blue** air vent lumen should be temporarily capped. To do this, place the anti-reflux valve with the white end connected to the blue air vent lumen. **Remember to flip anti-reflux valve back so that the blue end of valve is connected to the end of the blue vent lumen after flushing**
- Maintain tube above the level of the stomach
- Suction should be set at 30-40 mm Hg for low continuous or intermittent suction per order
- The tube can be used without an anti-reflux valve but note that if fluid is backing up into the **blue** air vent lumen the tube is **NOT** functioning properly and you should trouble shoot by flushing both lumens as indicated above until cleared.
- Irrigation tray should be kept at bedside and replaced every 24 hrs
- Remember to account for the volume of NS or sterile H_2O you are flushing with in your I's and O's
- Salem sump tubes are NOT to be used for medication administration or feedings: if a patient requires medications and/or feedings through an NG tube, then a feeding tube should be placed (either to replace the Salem Sump or in conjunction with the Salem Sump)

References:

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Sterile Needleless Injection Port Change

Sterile Cap Change for Central Lines

I. Equipment:

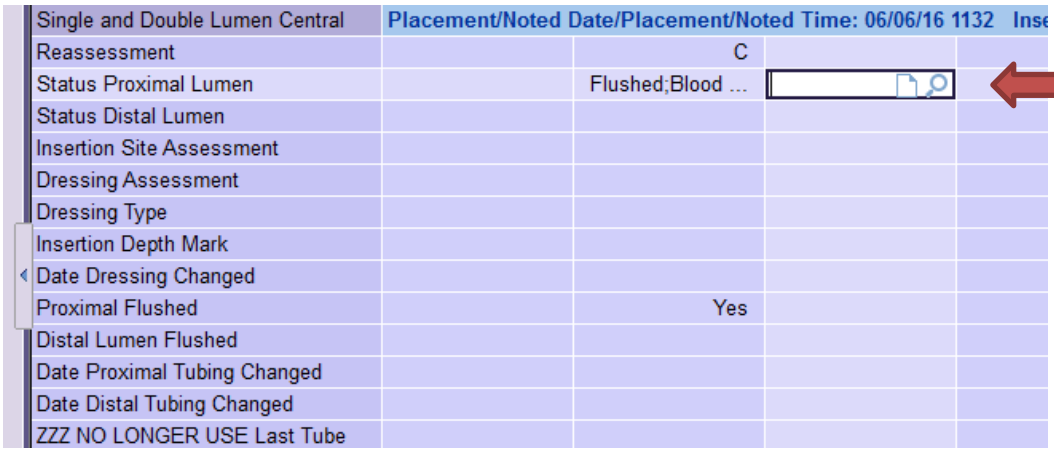
Procedural mask	Sani-Cloth wipes	Sterile Field
Clean gloves	Sterile Saline Flush(es)	4x4 gauzes
Sterile gloves	Chlorascrub Pads (CHG)	Needleless Injection Port(s)

II. Procedure:

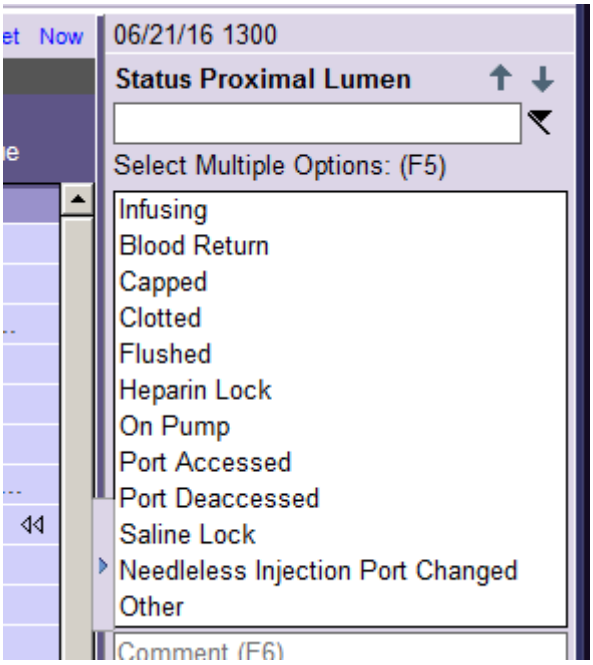
1. Gather supplies & equipment
2. Sanitize hands & apply non-sterile gloves
3. Clean work surface with Sani-cloth wipes
4. Remove gloves, sanitize hands & apply mask
   Always wear a mask when opening/accessing a line down to the HUB
5. Apply non-sterile gloves
6. Open all packaging and place on sterile field
7. Place a sterile 4x4 underneath central line hub, ensure line is clamped
8. Remove gloves, sanitize hands & apply sterile gloves
9. Connect needleless injection port(s) to sterile saline flush(es) and prime, remove cap(s) at end
10. Place primed needleless injection port(s) onto a sterile 4x4 gauze within sterile field
11. With a sterile gauze grab the end of the central line
12. With another sterile gauze disconnect old needleless injection port
    NOTE: Always use a new sterile gauze to handle line and old needleless injection port(s)
13. Scrub the hub with CHG for at least 5 seconds and allow to dry
14. Attach primed needleless injection port
15. Repeat steps 12 & 13 for each additional port
16. Unclamp line, flush and disconnect syringe from each port
17. Dispose of used supplies, remove gloves & mask, sanitize hands

If you are changing more than one cap at a time, make sure to add as many 4x4 gauzes, sterile saline syringes, needleless injection ports, and chloraprep pads to your sterile field for each cap change. You also have the option to gather separate supplies for each cap change if desired.

DOCUMENTATION OF NEEDLELESS INJECTION PORT CHANGE:



Click on the desired lumen status, then choose "Needleless Injection Port Changed"



Remember, needleless injection ports are changed with the tubing every 96 hours. If a medication or fluid requires a tubing change every 24 hours, such as Prograf or lipids, then the needleless injection ports are changed every 24 hours. All cap changes are to be completed using sterile

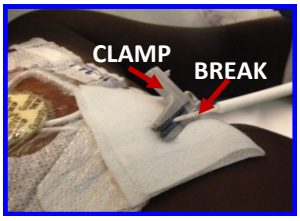
Broken Central Line: BROVIAC

What to do if the LINE BREAKS

1. *ALWAYS* use a *PADDED CLAMP*
Supply room: Oracle #116372

2. *NEVER* use these clamps

3. Clamp line *Proximal to break*



4. *Cover break* with transparent film

5. *Secure line* to prevent further trauma

6. *Notify Primary Service* that the line is broken

7. Peds Surgery APN will assess line for repair or replacement

TIPS TO AVOID CENTRAL LINE BREAKS

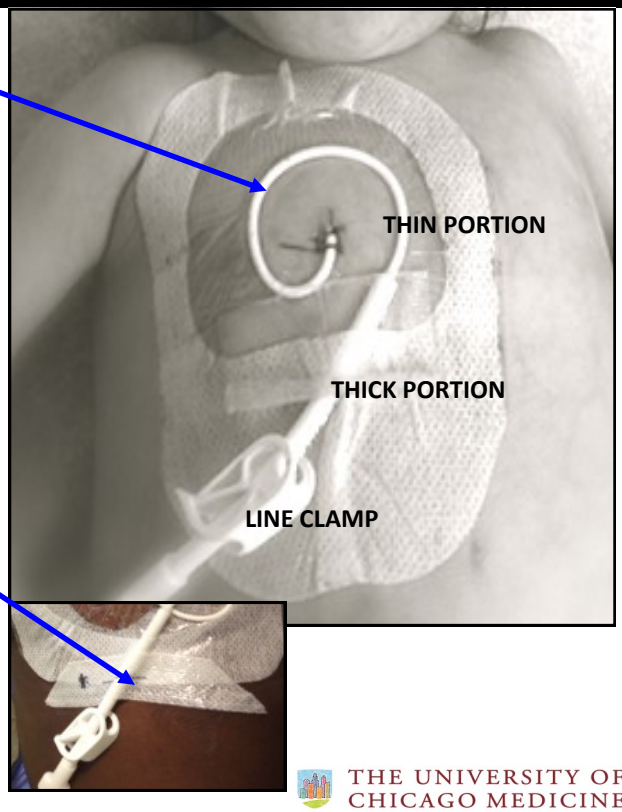
1. The central line should be kept ***coiled under the transparent***

2. Central line dressing should ***completely cover the proximal/***

3. The regular ***LINE CLAMP*** *should always be* ***placed on the DISTAL /***

4. *Secure the line* to:
- keep the cap clean

5. Consider an ***ACE wrap*** to secure the line around the chest

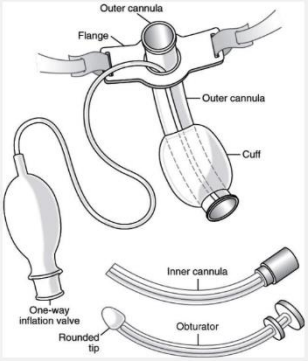


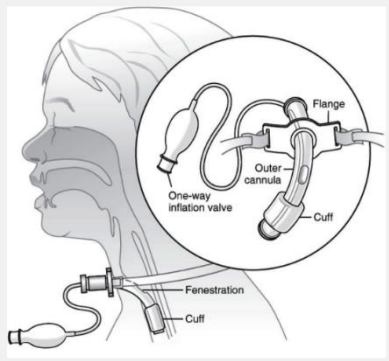
THE UNIVERSITY OF CHICAGO MEDICINE
Comer Children's Hospital
AT THE FOREFRONT OF KIDS' MEDICINE

Questions? Pediatric Surgery APN Pager #4156

AT THE FOREFRONT OF KIDS' MEDICINE
UChicago Medicine
Comer Children's

Tracheostomy Care





Emergency Equipment at the bedside at all times **(Documented at each shift their presence)**

- AMBU bag and mask
- Nipple adapter (green Christmas tree)
- Suction Catheters
- Two extra tracheostomy tubes with obturators:
  - **one same size and brand**
  - **one step down size tube of the same brand**
- Obturator for current tracheostomy tube
- Water based lubricant
- Scissors
- Tracheostomy ties

**Tracheostomy care and tie change are performed to preserve skin integrity, decrease the risk of infection, and maintain airway security. **

Trach Skin Care **(q shift & prn)**

- Checks medical order form for any special instructions regarding tracheostomy site care
- Obtains help from another nurse or caregiver as needed and use standard precautions
- Cleanse skin with soap and water if established/ healed (Sterile water ONLY if stoma not fully healed)
- Rinse with clean water and ensure skin dries
- Assess for breakdown/ document skin integrity

Trach Tie Change (q 24 hours & prn)

- Cut appropriate size trach ties or prepare Velcro ties.
- Identifies 2nd person to assist with the procedure
- Have the second person hold the trach tube in place while removing the old ties on the side opposite of the new ties.
- Assess skin for breakdown
- If doing skin care and tie change: Cleanse the back and the sides of child's neck with warm, soapy water, then dry thoroughly. ***NEVER LET GO OF THE TRACH TUBE***
- Thread the new ties through the neck plate or tracheostomy tube flange. Bring the ties around the neck and thread the bottom tie through the opposite hole in the neck plate.
- Ensure that you are able to place **only one finger** between the ties and the child's neck. Tighten as needed.
- Monitor patient's respiratory and cardiopulmonary status and pulse oximetry for response to procedure
- Monitors patient's skin for irritation at pressure points of trach

Documentation

- Respiratory assessment Q3-4 unless ordered more frequently by Provider
- Documentation presence of emergency equipment at the beginning of each shift

Review Elsevier Skills

- Tracheostomy Tube: Change (Pediatrics)-CE
- Tracheostomy Tube: Stoma Care and Tie Change (Pediatrics)-CE

References:

Tracheostomy Tube: Stoma Care and Tie Change (Pediatric). (2020). In *Clinical Skills.* Retrieved from https://point-of-care.elsevierperformancemanager.com/skills/758/notes?skillId=CCP_010

Trialysis Catheter

***Red* and *Blue* Ports**

- Triple lumen central line
- Red and blue port for dialysis, not to be used for infusions/ blood draws/medications – dialysis team will flush, should be capped off
- Pediatrics: **Heparin-locked with 1000 units heparin/mL concentration with amount listed on catheter** (shown here, 2.0 cc per lumen) by Dialysis team
- Can be used in an emergency, just make sure to pull the heparin out of the line

***Purple* Port**

- Third lumen of the Trialysis catheter
- Purple power injectable lumen, up to 5mL/sec
- CAN be used for medications, blood draws, fluids, blood products, and power injection
- Pediatrics: **heparin lock with 10unit/mL concentration of heparin** – 3mL volume
- <u>Nurses perform dressing changes on all dialysis catheters</u> every 7 days on Sundays and when soiled/unocclusive.
- Clave change per policy PC230 (with tubing change q24-96 hours or q96 hours if heplocked)