



Guide to  
Management of Paediatric  
Medical Emergencies

**SickKids<sup>®</sup>**

**GENERAL APPROACH**

**BEDSIDEPEWS**

**ANAPHYLAXIS**

**HYPOGLYCEMIA**

**SEPSIS**

**ASTHMA SEVERE  
EXACERBATIONS**

**ALTERED LEVEL OF  
CONSCIOUSNESS**

**STATUS EPILEPTICUS**

**HYPERTENSION**

**HYPOCALCEMIA**

**HYPERKALEMIA**

**HYPONATREMIA**

**RAPID SEQUENCE  
INDUCTION**

**TRACHEOSTOMY**

**TETRALOGY OF FALLOT  
"TET" SPELL**

**ACUTE  
ABDOMINAL PAIN**



# GENERAL APPROACH

## ASSESSMENT:

Assess the situation and examine the patient. Consider patient moving the patient to a higher level of observation (i.e. resuscitation room, observation room). If you need urgent help call a **Code Blue** at any time. Please note, the following table is suggested starting points but should not be considered the only important things to consider for your patient; clinical judgment should be used.

|                    | Appearance                                                                                                                                                                                                                          | Examination                                                                                                                                                                                                                                   | Monitor                                                                                                                     |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>CIRCULATION</b> | <ul style="list-style-type: none"> <li>• Level of consciousness</li> <li>• Colour (cyanosis, pallor, mottling)</li> </ul>                                                                                                           | <ul style="list-style-type: none"> <li>• Heart rate, blood pressure, EKG rhythm</li> <li>• Pulses (central and peripheral)</li> <li>• Temperature</li> <li>• Capillary refill time</li> <li>• Heart sounds</li> </ul>                         | <ul style="list-style-type: none"> <li>• Shock</li> <li>• Hemodynamic instability</li> <li>• Pre-arrest state</li> </ul>    |
| <b>AIRWAY</b>      | <ul style="list-style-type: none"> <li>• Patient position</li> <li>• Respiratory effort (accessory muscle use)</li> <li>• Drooling</li> <li>• Do they have airway assistive device already in place? (tracheostomy etc.)</li> </ul> | <ul style="list-style-type: none"> <li>• Stridor</li> <li>• Voice quality</li> <li>• Cough quality</li> <li>• Tracheal position</li> <li>• Respiratory rate, Oxygen saturation (SpO<sub>2</sub>), Oxygen support (FiO<sub>2</sub>)</li> </ul> | <ul style="list-style-type: none"> <li>• Airway obstruction</li> </ul>                                                      |
| <b>BREATHING</b>   | <ul style="list-style-type: none"> <li>• Patient position</li> <li>• Respiratory effort (accessory muscle use)</li> <li>• Chest expansion</li> <li>• Abdominal distention</li> </ul>                                                | <ul style="list-style-type: none"> <li>• Breath sounds</li> <li>• Grunting, nasal flare, retractions</li> <li>• Wheeze, crackles, signs of consolidation</li> <li>• Crepitus</li> </ul>                                                       | <ul style="list-style-type: none"> <li>• Respiratory failure</li> <li>• Pneumothorax</li> <li>• Pleural effusion</li> </ul> |
| <b>DISABILITY</b>  | <ul style="list-style-type: none"> <li>• Level of consciousness</li> </ul>                                                                                                                                                          | <ul style="list-style-type: none"> <li>• Alert</li> <li>• Verbal</li> <li>• Painful stimuli</li> <li>• Unresponsive</li> <li>• Focal neurological signs</li> </ul>                                                                            | <ul style="list-style-type: none"> <li>• Seizures</li> <li>• Increased intracranial pressure</li> </ul>                     |
| <b>EXPOSURE</b>    |                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• Temperature</li> <li>• Rash, skin lesions</li> </ul>                                                                                                                                                 | <ul style="list-style-type: none"> <li>• Temperature instability</li> </ul>                                                 |

**AMPLE** history: **A**llergies, **M**edications, **P**ast medical history, **L**ast meal, **E**vents leading up to current situation.

## ESCALATE LEVEL OF CARE:

- Call for **help** as needed (senior resident/fellow/staff, nurse, respiratory therapist)
- Consider need and early involvement of **Critical Care Response Team (CCRT)**. Expect CCRT to arrive within 15 minutes of your call.
- If you need immediate assistance and/or emergency equipment call a **Code Blue**. Expect code team to arrive as soon as possible after your call.
- In all instances make sure the **Most Responsible Staff Physician (MRP)** is made aware of situation.

## COMMUNICATE:

Communicate issue effectively using **SBAR** method. Include **Bedside PEWS** level and change if known.

Example scenario

- S- Situation** 3 year old female with known seizure disorder just had a generalized tonic clonic seizure.
- B- Background** One dose of lorazepam has stopped seizure. Bedside glucose was normal. She appears to be post ictal at this point and on exam she still has a decreased level of consciousness. I am worried because she is snoring loudly and continues to do so despite trying to optimize her airway position. She has good air entry bilaterally and vitals are: ... Bedside PEWS has changed from 2 to 7.
- A- Assessment** I am concerned that she will not be able to maintain her airway during the post ictal state.
- R- Recommendation** I would like CCRT to come evaluate for possible transfer to ICU and for further advice on airway management.



# BedsidePEWS™

- Simple and easy-to-use documentation-based system of care that facilitates the quantification and display of a patient's illness severity over time
- Goal: to prevent near and actual cardiopulmonary arrest in children through the timely identification, review and treatment of sick patients
- Provides score matched care recommendations for clinical decision-making including the opportunity:

## For Individual Patients to:

- Identify a deterioration/clinical change by observing the trend
- Develop a shared mental model of the patient's condition
- Identify which components/sub-scores are causing the high-score
- Modify current treatment and plan pre-emptive management
- Plan for initial assessment and subsequent physician review

## For Groups of Patients to:

- Provide structure to clinical activities e.g., prioritize patients based on BedsidePEWS score → handover high score patients first, round on patients with higher scores first
- Develop a shared mental model of the team's acuity e.g., number of patients with high scores
- Plan for initial assessment and subsequent physician review to reduce workload

**Routine Call** to most responsible staff physician (MRP) at 22:00 to provide clinical updates and discuss emerging clinical questions for all patients with BedsidePEWS > 5, and specifically high score patients of concern. The Routine Call is a specific part of the SickKids implementation.

## How to use BedsidePEWS

In EPIC order "Vital Signs as per BedsidePEWS" with default frequency of q4h

## How to calculate score

Each cardinal clinical observation is scored from 0 to 4 based on age-specific normal ranges

### Clinical observation

HR  
RR  
BP  
Oxygen Saturation  
Oxygen Treatment  
Respiratory Effort  
Capillary Refill

### Age specific documentation

< 3 months  
3 - < 12 months  
1 - < 5 years  
5 - < 12 years  
≥ 12 years

## Score Matched Care Recommendations

| Score | VS Frequency<br>Initial &<br>Subsequent | Monitoring<br>Considerations<br>(continuous) | CSN/CSN<br>In-Charge Review |         | First Call<br>Physician Review |         | Senior<br>Medical Review |         |
|-------|-----------------------------------------|----------------------------------------------|-----------------------------|---------|--------------------------------|---------|--------------------------|---------|
|       |                                         |                                              | Initial                     | Subseq  | Initial                        | Subseq  | Initial                  | Subseq  |
| 0-2   | q4h                                     |                                              | Routine                     | Routine | Routine                        | Routine | Routine                  | Routine |
| 3-4   | q2-4h                                   |                                              | < 8 h                       | q8h     | < 8 h                          | q8h     | Routine                  | < 4 h   |
| 5-6   | q1-2h                                   | SaO <sub>2</sub>                             | < 4 h                       | < 8 h   | < 4 h                          | < 8 h   | < 4 h                    | q8 h    |
| 7-8   | q15-60min                               | SaO <sub>2</sub> , ECG<br>CCRT Consult       | < 2 h                       | < 4h    | < 2 h                          | < 4 h   | < 4 h                    | < 8 h   |
| > 8   | q15-60min                               |                                              | <15 min                     | < 2 h   | <15 min                        | < 2 h   | <15 min                  | < 4 h   |

Any clinical observation in **critical value** area immediately assess need for:  
CPR / Code Blue / CCRT Consultation + formal customized management plan if stays on ward  
Any increase in BedsidePEWS score STOP and THINK: Could this child have SEPSIS

**First Call Physician Review** refers to health providers: nurse practitioners, resident and/or fellow  
**Senior Medical Review** refers to MRP reviewing patient in person or by phone if not in house



# ANAPHYLAXIS

## Acute hypersensitivity reaction with involvement of $\geq 2$ systems

|                    |                                                                                                          |
|--------------------|----------------------------------------------------------------------------------------------------------|
| Skin/Mucosa        | Urticaria, itchiness, flushing, angioedema, swelling of lips-tongue-uvula                                |
| General/Neurologic | Fussiness, irritability, drowsiness, lethargy, reduced LOC                                               |
| Upper airway       | Stridor, hoarseness, sneezing, obstructing, rhinorrhea                                                   |
| Lower airway       | Dyspnea, tachypnea, wheeze-bronchospasm, coughing, respiratory arrest                                    |
| Cardiovascular     | Tachycardia, hypotension, dizziness, syncope, arrhythmias, diaphoresis, pallor, cyanosis, cardiac arrest |
| Gastrointestinal   | Nausea, vomiting, diarrhea, abdominal pain                                                               |

### Epinephrine 1:1000

0.01 mg/kg/dose IM/SC thigh q5-15min (0.01 mL/kg/dose)

Min 0.1 mg/dose (0.1 mL/dose)

Max 0.5 mg/dose (0.5 mL/dose)

Usual child dose 0.3 mg (0.3 mL)

Usual adult dose 0.5 mg (0.5 mL)

- Remove trigger if known
- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen to keep  $\text{SaO}_2 \geq 94\%$
- Establish IV/IO access
- Place patient supine with legs elevated or on side if vomiting or decreased LOC

Imminent cardiac arrest at any point?

### Epinephrine 1:10,000

0.1 mL/kg/dose IV Max 10 mL/dose

Signs of airway compromise or respiratory failure?

Prepare for Rapid Sequence Intubation  
See RSI algorithm

Give 0.9%NS 20 mL/kg bolus IV/IO  
Repeat as needed for hypotension

### Circulation

Signs of hemodynamic instability?

### Airway and Breathing

Signs of lower airway involvement  
Salbutamol 100 micrograms/puff or  
Salbutamol NEB in 3 mL NS  
< 20 kg: 4 puffs q15min x 3 or  
0.5 mL (2.5 mg)  
≥ 20 kg: 8 puffs q15min x 3 or  
1 mL (5 mg)

Signs of upper airway involvement  
Epinephrine 1:1000 NEB  
< 5 kg: 0.5 mg/kg/dose  
≥ 5 kg: 2.5 - 5 mg/dose

### Give second-line (adjunctive) therapy

**Diphenhydramine**  
(Benadryl)  
1-2 mg/kg/dose  
PO/IV/IM  
Max 50 mg/dose

**Ranitidine**  
1 mg/kg/dose IV  
Max 50 mg/dose  
or  
2 mg/kg/dose PO  
Max 300 mg/dose

### Steroids

**Prednisolone**  
1-2 mg/kg/dose PO  
Max 60 mg/dose  
or  
**Dexamethasone**  
0.6 mg/kg/dose PO  
Max 20 mg/dose

**Methylprednisolone**  
0.5-1 mg/kg/dose IV  
Max 60 mg/dose  
or  
**Hydrocortisone**  
5-10 mg/kg/dose IV  
Max 100 mg/dose

Re-assess frequently  
Consider repeat Epinephrine IM

If hypotension persists after 3rd dose of  
Epinephrine and repeated fluid boluses?

### Refractory Anaphylaxis

- Observe for minimum 4 to 6 hours for biphasic response
- Consider admission to hospital
- At discharge provide anaphylaxis education, epinephrine auto-injector training and prescription, allergist referral

- Call CCRT

### Epinephrine 1:10,000

Infusion 0.1 - 1 microgram/kg/min IV  
Max 10 microgram/min

- Start low and titrate dose to clinical response

If patient on beta-blockers consider **Glucagon**  
bolus then infusion



# HYPOGLYCEMIA (BEYOND NEONATAL PERIOD)

Blood Glucose [BG] < 3.5 mmol/L WITH Symptoms (altered LOC, confusion, seizures)  
OR  
[BG] < 2.8 mmol/L WITHOUT Symptoms

- Assess C&B's and LOC
- Attach monitors
- Establish IV/IO access
- If [BG] < 2.8 mmol/L send STAT critical labs\* before treating (but do not delay significantly)
- Call CCRT or Code Blue if clinically unstable

## Critical Labs \*

In order of importance:

- Serum glucose
- Insulin
- Beta-hydroxybutyrate
- Free fatty acid
- Growth hormone
- Cortisol
- Venous blood gas
- Urine Ketones

IV/IO Access Obtained

## Glucose Bolus

Dextrose (0.5 g/kg) - Rule of '50s' \*\*  
5 mL/kg D10W or  
2 mL/kg D25W or  
1 mL/kg D50W (if central access)

## Rule of '50s' \*\*

To provide 0.5 g/kg, the concentration of dextrose in fluid to be given multiplied by the volume to be given should equal 50. i.e.

- D10W = 5 mL/kg (10\*5 = 50)
- D25W = 2 mL/kg (25\*2 = 50)
- D50W = 1 mL/kg (50\*1 = 50)

## Glucose Infusion

D10W 0.9%NaCl infusion  
4-8 mL/kg/h (Glucose infusion rate (GIR)  
6.6 - 13.3 mg/kg/min)

Check [BG] in 15 min

[BG] ≥ 4 mmol/L

[BG] < 4 mmol/L

Check [BG] q30min x 2 hours

All [BG] ≥ 4 mmol/L

See Routine [BG]  
Monitoring &  
Discharge Safety

[BG] < 4 mmol/L

Increase GIR by  
Increasing RATE of infusion  
OR

Increasing Dextrose  
concentration to  
D12.5W 0.9%NaCl  
\*Max through PIV = D12.5

[BG] ≥ 4 mmol/L

[BG] < 4 mmol/L  
AND  
GIR ≥ 15 mg/kg/min

Consult Endocrinology AND Glucagon (1 Unit = 1 mg)  
< 20 kg: 0.02 mg/kg/dose IV/SC q20min  
Max 0.5 mg/dose  
> 20 kg: 1 mg/dose IV/SC q20min

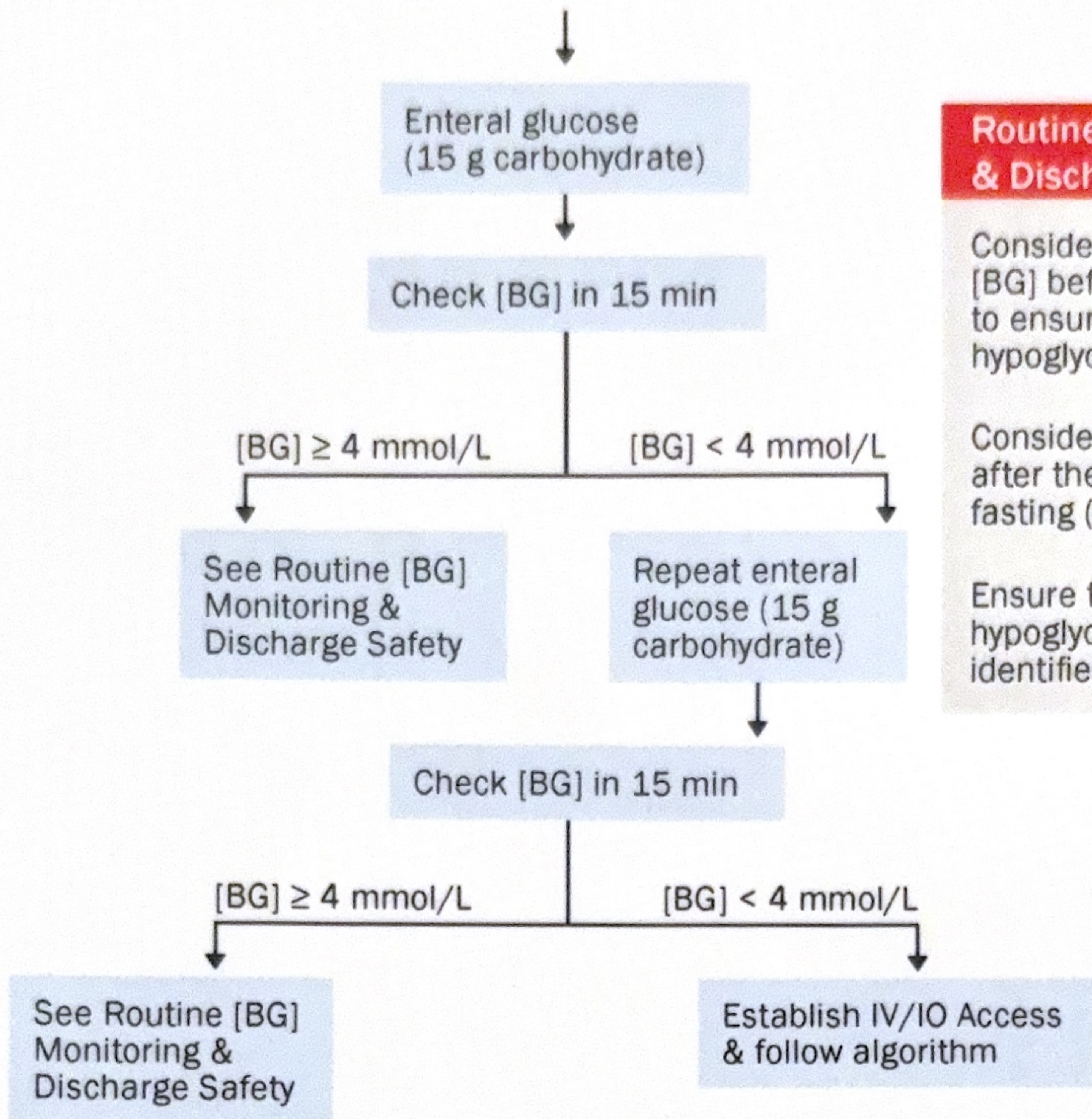
If [BG] increases with glucagon  
(suggestive of hyperinsulinism)  
infuse w/ glucagon 1 mg/24h

If [BG] does not increase with glucagon  
Consider central access for higher  
GIR infusion

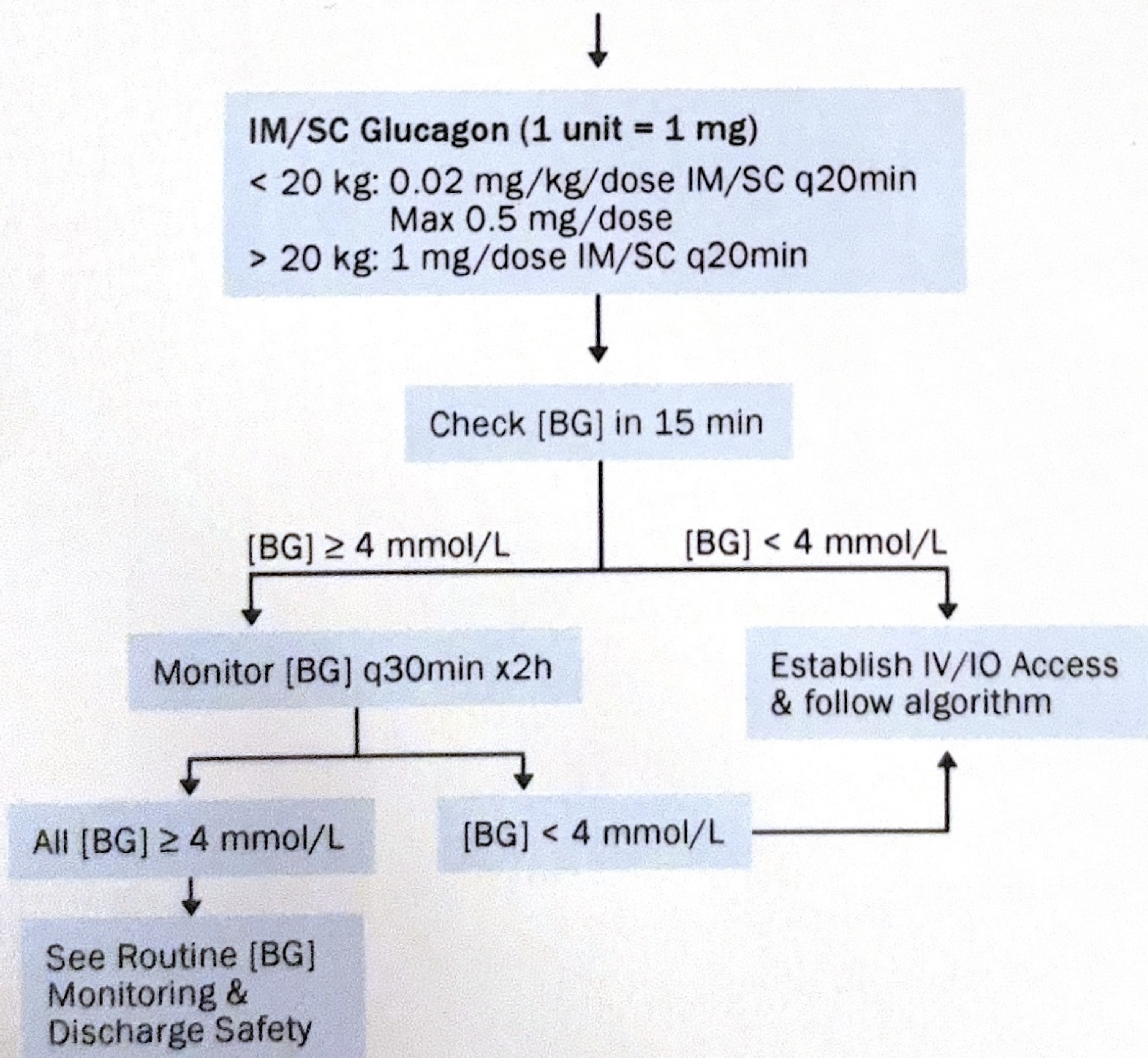


# HYPOGLYCEMIA (BEYOND NEONATAL PERIOD)

Blood Glucose [BG] 2.8 - 3.5 AND symptomatic AND alert



Unable to Obtain IV/IO Access  
and  
contraindication to enteral treatment  
(seizure, decreased LOC, aspiration risk)





# INPATIENT SEPSIS RECOGNITION TOOL

## Identifying Sepsis in Children

Sepsis is a potentially life-threatening response to infection that results from a dysregulated inflammatory response. Left untreated, this inflammatory response leads to widespread tissue injury and multi-organ dysfunction. It is a leading cause of child mortality and morbidity. Prompt recognition of sepsis, and reliable delivery of time sensitive care, leads to improved survival outcomes.

| Age             | Heart Rate | Resp. Rate |
|-----------------|------------|------------|
| 0 - <1 yr       | >180 bpm   | >60        |
| ≥1 yr - <5 yrs  | >150 bpm   | >40        |
| ≥5 yr - <12 yrs | >130 bpm   | >30        |
| ≥12 yrs         | >110 bpm   | >20        |

## Signs and Symptoms of Infection

For example:

- Temperature abnormality  $\leq 36^{\circ}\text{C}$  or  $\geq 38^{\circ}\text{C}$  AND/OR Abnormal WBC count
- Tachypnea, respiratory distress or cough
- Vomiting, diarrhea, abdominal pain
- Skin rash, petechiae/purpura, joint pain or swelling

## High Risk Criteria

For example:

- Age <3 months
- Surgery within past month
- Asplenia/Sickle Cell Disease (SCD)
- Complex chronic illness
- Neurologic impairment
- CVL/catheters/tubes/stents
- Immunocompromised e.g. Haem/Onc/BMT/ Solid organ transplant
- Immunodeficiency
- Genetic disorder associated with immune defect e.g. Trisomy 21

## STOP

Does child have clinical deterioration?  
e.g. an increase in BPEWS score

Does child have heart rate abnormality?  
i.e. BPEWS heart rate in critical zone

Does child have temperature abnormality?  
and/or  
Does child have signs and symptoms of infection?

## THINK

Could this child have SEPSIS?

Does child have a high risk condition?



## ACT

Get HELP!

Notify CSN immediately

Request MD/NP to assess child within 10 minutes

Document assessment, follow BPEWS score matched care recommendations

## REVIEW

Complete Sepsis Assessment!

Does child have perfusion abnormality?  
and/or

Does this child have hypotension?

and/or

Does child have change in mental status?

NO

YES

Child may have early signs of Sepsis

Turnover for organ dysfunction assessment pathway

Sepsis Alert!  
Start Early Management Pathway

Turnover for management pathway

## Communicate concerns using SBAR:

**S:** "I am concerned this child may have sepsis"

**B:** Provide brief summary

**A:** Provide assessment

**R:** "Based on our sepsis recognition pathway, the child requires your medical assessment within 10 minutes"

## Perfusion Abnormalities

| Cold Shock                  | Warm Shock                 | Age            | Systolic BP                 |
|-----------------------------|----------------------------|----------------|-----------------------------|
| Cool/mottled extremities    | Warm/flushed extremities   | 0 - <1 mth     | <60 mmHg                    |
| Delayed cap refill (>3 sec) | Flash cap refill (<1 sec)  | ≥1 mth - 1 yr  | <70 mmHg                    |
| Decreased peripheral pulses | Bounding peripheral pulses | ≥1 yr - ≤9 yrs | <70 mmHg + 2 X (age in yrs) |
| Narrow Pulse Pressure       | Wide pulse pressure        | ≥10 yrs        | <90 mmHg                    |

\*Hypotension NOT necessary, and is often a late finding!

## Sepsis Pathway: Initial Antibiotic Selection by Patient Population

| Inpatient Population                                                                                                    | Initial Antibiotics      |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Immunocompetent                                                                                                         |                          |
| Age < 1 month                                                                                                           | ampicillin + cefoTAXime  |
| Age ≥ 1 month                                                                                                           | cefTRIAXone + vancomycin |
| Immunocompromised                                                                                                       |                          |
| * For patients with indwelling CVL, or MRSA colonized                                                                   | add vancomycin           |
| * For Sepsis acquired in ICU, recent post-surgical patients, and patients with a tracheostomy or urinary catheter/stent | add tobramycin           |

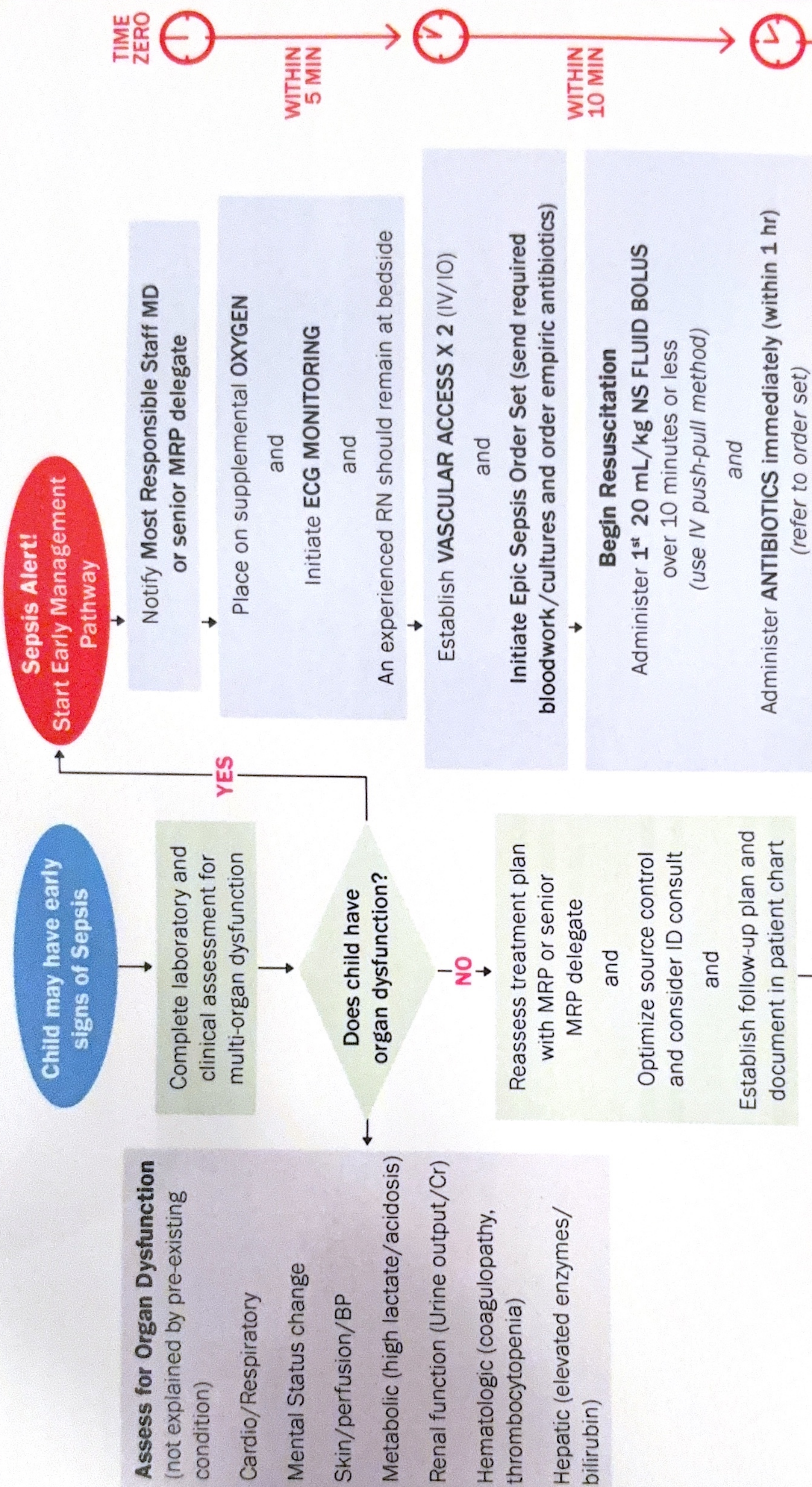
**Immunocompromised patients: refer to specific guidelines for Haem/Onc/BMT patients**

\* Refer to SickKids eformulary for further information

(See: Antimicrobial Guideline - Empiric Antibiotic Therapy in Children)



# SEPSIS/SEPTIC SHOCK INITIAL MANAGEMENT





Turnover  
and return to  
Recognition Pathway

Continue close monitoring  
& assessment of child  
as per BedsidePEWS

YES

Is child fluid  
responsive?

NO

Continue close monitoring  
& assessment of child  
as per BedsidePEWS

Administer 2<sup>nd</sup> and 3<sup>rd</sup> 20 mL/kg NS FLUID BOLUSES  
as needed, up to and over 60 mL/kg may be required  
until perfusion/blood pressure improves

**STOP** if signs of fluid overload develop!

If 3<sup>rd</sup> bolus is required: consult CCRT

and

prepare vasoactive drug for infusion

WITHIN  
60 MIN

YES

Continue close monitoring  
& assessment of child  
as per BedsidePEWS

Is child fluid  
responsive?

NO

**Fluid Refractory Shock**

Initiate vasoactive drug,  
titrate to correct hypotension and  
poor perfusion  
and

Arrange transfer to Critical Care

Critical Care Team to provide  
further management

**Vascular access:**

- STAT call for IV TEAM as needed
- Consider IO placement if 2 failed attempts or > 5 minutes lapse

**Signs of fluid overload:**

- Increasing respiratory distress
- Developing rales/crackles
- Gallop rhythm
- Hepatomegaly

**Resuscitation goals  
include improvement of:**

- Vital signs
- Mental status
- Urine output
- Perfusion
- Serum lactate





# ASTHMA SEVERE EXACERBATIONS

- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen to keep  $\text{SaO}_2 \geq 94\%$
- Establish IV/IO access
- Consider blood gases, electrolytes
- Consider chest x-ray if alternative diagnosis or complications

## Initial Treatment (1st hour)

### Bronchodilator

#### Aerochamber

#### Salbutamol

100 mcg/puff

< 20 kg: 4 puffs  
q15min x 3  
≥ 20 kg: 8 puffs  
q15min x 3

PLUS

#### Ipratropium Bromide

20 mcg/puff

4 puffs q15min x 3

OR

### Nebulization

in 3 mL NS

#### Salbutamol

50 mg/10 mL

< 20 kg: 0.5 mL (2.5 mg)  
q15min x 3  
≥ 20 kg: 1 mL (5 mg)  
q15min x 3

PLUS

#### Ipratropium Bromide

0.25 mg/mL

1 mL (0.25 mg)

q15min x 3

- Mixed with salbutamol

PLUS

### Corticosteroids

#### Prednisolone/Prednisone

1-2 mg/kg/dose PO daily  
Max 60 mg/day

OR

#### Dexamethasone

0.6 mg/kg/dose PO daily  
Max 20 mg/dose

OR

#### Hydrocortisone

4-6 mg/kg/dose IV q4-6h  
Max 100 mg/dose

OR

#### Methylprednisolone

0.5-1 mg/kg/dose IV q6h  
Max 60 mg/dose,  
240 mg/day

Re-evaluate patient in 1 hour  
Monitor for hypokalemia, tachycardia  
Consider adding  $\text{K}^+$  to IV fluids

NOT IMPROVING

IMPROVING

Salbutamol continue q15min

#### Magnesium Sulfate ( $\text{MgSO}_4$ )

25-50 mg/kg/dose IV/IO over 20 min  
Max 2500 mg/dose

- Can repeat dose 1 hour after end of first infusion

NOT IMPROVING

Signs of airway compromise or  
impending respiratory failure?

Prepare for Rapid Sequence Intubation  
See RSI algorithm

- Call CCRT

#### Salbutamol 5 mg/5 mL

Bolus 5-10 mcg/kg/dose IV over 20 minutes then  
infusion 1 mcg/kg/min and increase by 1 mcg/kg/min q15min as required  
Max 10 mcg/kg/min

- Stop inhaled salbutamol when infusion started



# ALTERED LEVEL OF CONSCIOUSNESS

**Glasgow Coma Scale (GCS) < 15 or  
Not Alert on Alert-Verbal-Pain-Unresponsive (AVPU) scale**

- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen
- Establish IV/IO access
- Check temperature, blood glucose (BG) via glucometer
- Consider cervical-spine immobilization if known or suspected trauma then place patient on their side
- Re-assess GCS/AVPU frequently

## Circulation

Signs of hemodynamic instability?

Give **0.9%NS** 20 mL/kg bolus IV/IO  
Repeat as needed for hypotension

## Airway and Breathing

Signs of airway compromise or impending respiratory failure?  
e.g. poor effort, low RR for age,  
SaO<sub>2</sub> < 92% despite 100% oxygen  
or GCS ≤ 8

Prepare for Rapid Sequence Intubation  
see RSI algorithm  
• Avoid rise in ICP

## Disability

Perform a rapid focused neurological examination

- Fontanelle
- Pupillary light response
- Fundi
- New focal neurological signs
- Suggestive history
- Re-assess GCS/AVPU frequently
- Consider urgent CT Scan

If abnormal neurological examination

- Cushing's Triad:
  - bradycardia
  - hypertension
  - irregular respirations (RR and effort)
- Bulging Fontanelle
- Dilated or absent pupillary light response
- Papilledema

## Suspected Increased ICP

- Elevate head of bed to 30 degrees (If not hypotensive)
- Give IV fluids to maintain normal to high systolic BP
- Consider vasopressors
- Avoid hypotonic solutions

## Decrease Cerebral Edema

If hypotensive and/or [Na<sup>+</sup>] < 155 mmol/L  
**3%NS**  
3 mL/kg/dose bolus IV/IO over 10-20 min

OR If [Na<sup>+</sup>] ≥ 155 mmol/L  
**20% Mannitol**  
0.25 - 1 gram/kg/dose bolus IV/IO over 10-20 min  
• Consider **0.9%NS** 20 mL/kg bolus with mannitol  
• Avoid if patient hypotensive

## Seizures

See Status Epilepticus algorithm  
Manage seizures aggressively

## Hypoglycemia

If Blood Glucose [BG] < 3.5 mmol/L WITH Symptoms (altered LOC, confusion, seizures)  
OR  
[BG] < 2.8 mmol/L

## Treat Hypoglycemia

See Hypoglycemia algorithm

## Narcotic Overdose

If pinpoint pupils, respiratory depression (low RR) and suggestive history of narcotic overdose

## Naloxone

< 5 yo or ≤ 20 kg: 0.1 mg/kg/dose IV/IO/ETT q5-10min  
≥ 5 yo or > 20 kg: 0.2 mg/kg/dose IV/IO/ETT q5-10min  
2 mg/dose Max

## Exposure

### Temperature

If hypothermic → re-warm slowly  
If febrile → treat with antipyretics and cooling



# PROLONGED SEIZURE AND STATUS EPILEPTICUS (>1 MONTH OLD)

Continuous or intermittent seizures lasting over 5 min without full recovery of LOC between seizures

OR

Two or more discrete seizures without a return to baseline LOC

OR

Continuous generalized tonic-clonic seizure activity with loss of consciousness for longer than 30 min

## IV Access

- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen
- Establish IV/IO access
- Check temperature, blood glucose via glucometer [BG]
- Consider CBC, electrolytes, calcium, magnesium, phosphate, blood culture, anti-epileptic drug levels

- Monitor closely for airway compromise, respiratory failure, hypotension or cardiac arrhythmias
- Check for history of drug allergy or hypersensitivity reaction (high-risk of cross-reactivity between phenytoin, phenobarbital, and carbamazepine)

|                  | No Access                                                                                                                    | IV Access                                                 |
|------------------|------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>Lorazepam</b> | 0.1 mg/kg PR/SL/Buccal<br>Max 4 mg/dose                                                                                      | 0.1 mg/kg IV<br>Max 4 mg/dose                             |
| <b>Diazepam</b>  | 0.5 mg/kg PR<br>Max 20 mg/dose                                                                                               | 0.3 mg/kg IV<br>Max < 5 y: 5 mg/dose<br>≥ 5 y: 10 mg/dose |
| <b>Midazolam</b> | 0.2 mg/kg Intranasal Max 5 mg (1 mL/nostril)<br>0.5 mg/kg Buccal Max 10 mg/dose (2 mL)<br>0.3 mg/kg IM Max 10 mg/dose (2 mL) |                                                           |

5 minutes ↓

Repeat above step  
Continue attempts to establish IV/IO access

5 minutes

## IV Access

**Fosphenytoin** (Phenytoin Equivalents, PE)  
20 mg/kg/dose IV  
in NS or D5W over 5-10 min  
Max < 50 kg: 1000 mg PE/dose  
> 50 kg: 1500 mg PE/dose

OR

**Phenytoin**  
(if Fosphenytoin not available)  
20 mg/kg/dose IV in NS only over  
20-30 min

OR

**Phenobarbital** (1st line in neonates)  
20 mg/kg/dose IV undiluted over  
5-10 minutes  
Max 1000 mg  
MD must be present to monitor  
cardiorespiratory

## No IV Access

**Fosphenytoin** (Phenytoin Equivalents, PE)  
20 mg/kg/dose IM  
Max < 50 kg: 1000 mg PE/dose  
> 50 kg: 1500 mg PE/dose  
Max 3 mL/site IM  
If > 30 kg requires multiple IM sites

IV Access Obtained

5 minutes

**Phenobarbital or  
Fosphenytoin/Phenytoin**  
depending on what was used first

10 minutes

## Additional Therapeutic Options

**Levetiracetam**  
20-40 mg/kg/dose IV in NS or D5W  
diluted to concentration of 15-50 mg/mL  
given over 5-15 min

**Valproate**  
30 mg/kg/dose IV diluted 1:1 in  
0.9%NS over 5 min then  
Bolus 10 mg/kg/dose if status  
not controlled within 10 minutes

## Refractory Status Epilepticus

- Call CCRT and Neurology consult

**Midazolam**  
Bolus 0.15 mg/kg/dose IV then  
Infusion 2 micrograms/kg/min  
Increase by 2 micrograms/kg/min q5min  
as required  
Bolus 0.15 mg/kg with each increase in  
infusion rate  
Max 24 micrograms/kg/min



# HYPERTENSION

## Severe Acute Hypertension

sBP or dBP > 95th percentile + 30 mmHg for age, sex and height

- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen
- Establish IV/IO access
- Confirm BP manually with appropriate cuff size
- Consult Nephrology

Assess for signs of end-organ dysfunction/ischemia?

### Asymptomatic

#### Hypertensive Urgency

- Re-assess BP at least q30min

#### Hydralazine

0.1-0.2 mg/kg/dose IV  
Max 10 mg/dose  
Can repeat dose q30min to  
Max 20 mg q4-6h

OR

#### Nifedipine

0.17 mg/kg/dose PO q4h prn  
Min 1.25 mg/dose  
Max 10 mg/dose  
Can repeat dose q4h to  
Max 2 mg/kg/day

### Symptomatic

#### Mild

- Nausea, vomiting
- Headache
- Flushing

#### Severe

- Heart failure
- Renal failure
- New focal neurological signs
- Visual changes
- Seizures
- Encephalopathy

#### Hypertensive Emergency

- Consult CCRT
- Re-assess BP q5min

#### Re-assess BP frequently

- If BP drops too far below target
  - Decrease anti-hypertensives
  - Give volume expansion with crystalloids

Able to Reach Target

### START ONE ORAL MEDICATION

#### Amlodipine

0.1-0.2 mg/kg/dose PO once daily

OR

#### Metoprolol

0.5-1 mg/kg/dose/dose PO q12h

#### Treatment Goal

BP reduction by max 20%  
or to 95th percentile within  
8 hours, whichever is  
lesser reduction

Unable to Reach Target

### START IV INFUSION

#### Labetalol

1-3 mg/kg/dose IV over 1 hour then  
1 mg/kg/hour IV infusion  
Titrate q30min to  
Max 3 mg/kg/hour

AND/OR

#### Nitroprusside

0.5 mcg/kg/min  
Titrate q5min to  
Max 10 mcg/kg/min

AND/OR

#### Esmolol

100-500 mcg/kg/dose IV/IO  
over 1 minute then  
50-300 mcg/kg/min



# HYPOCALCEMIA

**Total Calcium [Ca] < 2 mmol/L and Ionized Calcium [iCa] < 0.9 mmol/L**

- Assess CAB's and LOC
- Attach monitors
- Establish IV/IO access
- Consider blood gas, Ca, iCa, albumin, magnesium, phosphate, BUN, creatinine, ALP, lipase, PTH, 25(OH) Vitamin D, urine Ca/Creatinine, urine microscopy
- ECG

## Hypoalbuminemia

- Consider Hypocalcemia secondary to Hypoalbuminemia
- Corrected [Ca] =  
 $\text{Total [Ca]} - (\text{Albumin}/40) + 1$

## Hypomagnesemia

- Consider correction of hypomagnesemia [Mg] < 0.4 mmol/L with  $\text{MgSO}_4$
- Hypomagnesemia associated with Hypocalcemia but rarely sole cause

## Assess for acute symptoms of hypocalcemia

### Asymptomatic

#### Elemental Calcium

50-100 mg/kg/day PO divided QID

- Oral Calcium/Nutritional correction preferred
- Most mild hypocalcemia can be managed without IV calcium

### Moderate Symptoms

#### Neuromuscular

- Chvostek
- Trousseau
- Paresthesia
- cramps

#### Gastrointestinal

- Nausea
- Vomiting

### Severe Symptoms

#### Neuromuscular

- Broncho/laryngospasm

#### Neurologic

- Apnea
- Seizures

#### Cardiac

- Prolonged QT
- ST segment changes

### Calcium Gluconate 2%

0.05 mmol/kg/hour IV infusion  
Max 0.34 mmol/min (5.86 mL/min)

### Calcium Gluconate 2%

0.1 mmol/kg/hour IV  
Max 0.34 mmol/min (5.86 mL/min)

PLUS

### Elemental Calcium

50-100 mg/kg/day PO divided QID

Check [Ca] every 4-6 h  
after initiating infusion  
and adjust accordingly

### Monitor

- Bradycardia
- Hypotension
- Vomiting
- Infusion site extravasation and inflammation
- Consider early central access (PICC/CVL)

- Consult Endocrinology
- Determine and treat underlying cause

### Calcium Gluconate 2% Dilution

10 mL Calcium Gluconate 10%  
+ 40 mL 0.9%NaCl

= 50 mL Calcium Gluconate 2%  
(Elemental Ca 0.046 mmol/mL)

### Cautions

- DO NOT GIVE IM/SC
- DO NOT GIVE IV BOLUS
- Calcium Gluconate incompatible with Sodium Bicarbonate ( $\text{NaHCO}_3$ ) and ceftriaxone (consult pharmacy)
- Caution giving IV Calcium in hyperphosphatemia



# HYPERKALEMIA

Potassium [K<sup>+</sup>] > 6 mmol/L

## TRUE

- Assess CAB's and LOC
- Attach monitors
- Stop K<sup>+</sup> infusions, TPN and supplements
- Establish IV/IO access
- Consider blood gases, electrolytes, calcium, magnesium, phosphate, CPK, urine [K<sup>+</sup>], urine osmolarity (to calculate transtubular gradient)

## SPURIOUS

- Specimen hemolyzed?
- Consider repeat [K<sup>+</sup>] STAT

### STAT ECG

Most important test to assess severity of hyperkalemia

ECG changes present?

- peaked T waves
- prolonged PR
- flattened or absent P waves
- widened QRS
- shortened QT
- arrhythmias

Abnormal ECG

### Calcium Gluconate 10%

50 - 100 mg/kg/dose IV/IO bolus over 30 min (0.5 - 1 mL/kg/dose)

Max Rate 20 mg/min (Dilute to 20 mg/mL)

Max 3 g/dose

- May repeat q10-20min if ECG changes persistent

No ECG changes

### Shift Potassium Into Cells

**Salbutamol**  
100 mcg/puff

< 20 kg: 4 puffs  
q15min x 3

≥ 20 kg: 8 puffs  
q15min x 3

#### Hyperventilate

- If difficult access and awaiting meds

If pH < 7.3 then consider  
**Sodium Bicarbonate 8.4%**  
(1 mmol/mL)  
1 mL/kg/dose IV over 30 minutes

- After adequate ventilation

### Eliminate Potassium From Body

**Sodium polystyrene sulfonate (Kayexalate)**

1 g/kg/dose PO q6h  
1 g/kg/dose PR q2h  
Max 30 g/dose

Usual adult starting 15 g/dose

**Furosemide**

0.5 - 2 mg/kg/dose IV/IO/IM  
Max 80 mg/dose

Check [K<sup>+</sup>]  
60 min after initiating any treatment

- Call CCRT, Consult Nephrology
- Check [K<sup>+</sup>] q60 min

### Regular Human Insulin

0.1 Units/kg in 5 mL/kg D10W IV over 30 min

- If central access dilute in 1 mL/kg D50W IV over 30 min

**Hyperkalemia refractory to therapy**

**Dialysis**



# HYPONATREMIA

Sodium  $[Na^+] < 135 \text{ mmol/L}$

- Assess CAB's and LOC
- Attach monitors
- Establish IV/IO access
- Assess volume status
  - Signs of dehydration or fluid overload
  - Hyponatremia is most often due to excess free water
- Consider critical urine sample: urinalysis, urine  $Na^+$ , urine creatinine, urine osmolarity

Assess for acute symptoms of hyponatremia

Asymptomatic

- No indication for 3%NaCl
- Check  $[Na^+]$  q4h
- Method of  $Na^+$  correction depends on volume status and etiology of hyponatremia
- $Na^+$  correction rate should not exceed 10-12 mmol/L/24 hours

Symptomatic

- Seizures
- Altered LOC

- Treat seizures  
See Prolonged seizure algorithm
- 3%NS**  
5 mL/kg/dose IV over 10-15 min  
(1 mL of 3%NaCl has 0.5 mmol of  $Na^+$ )
- If symptoms continue then repeat dose after 15 min
- Check  $[Na^+]$  after 1 hour



# RAPID SEQUENCE INDUCTION (RSI)

## 1. Plan

### Indications

- GCS < 8 +/- hypoventilation
- Anatomic airway obstruction
- Excessive work of breathing
- Impending respiratory failure

### Contraindications to RSI

- Cardiac arrest (no need to pre-medicate)
- Major facial or laryngeal trauma/distortion
- Upper airway obstruction

## 2. Prepare

### AMPLE History

- **A**llergies
- **M**edications
- **P**ast medical history
- **L**ast meal
- **E**vents leading up to need for intubation

### Equipment SOAP ME

- **S**uction
- **O**xygen
- **A**irway\*
- **P**ersonnel + **P**harmacology (including reversal agents)
- **M**onitoring
- **E**quipment

### Airway Equipment\*

- Bagmask
- Laryngoscope
  - < 25 kg: Straight blade Size 1
  - > 25 kg: Curved blade Size 3
- ETT: Usually cuffed & Stylet
- CO<sub>2</sub> detector & Tape

## 3. Pre-Oxygenate

### 100% via non-rebreather mask and/or bag-mask ventilation

- Duration: 3-5 minutes

## 4. Pharmacology for RSI

- See tables

## 5. Procedure

### Procedure

- Insert laryngoscope sweeping tongue to side
- Pass the ETT +/- cricoid pressure
- Confirm placement: auscultate for equal air entry bilaterally & over stomach, monitor saturations, HR and patient (chest rise), change in CO<sub>2</sub> detector colour, mist in ETT
- Secure ETT

## 6. Plan for ongoing Sedation + Ventilation

- Morphine and/or Muscle relaxant (pancuronium or rocuronium)



# RAPID SEQUENCE INDUCTION (RSI)

**Increased ICP  
Head trauma  
Status epilepticus**

- Normotensive → Propofol
- Hypotensive → Fentanyl

**Shock  
Hypovolemic  
Cardiogenic**

- Ketamine  
Use with caution in prolonged shock (few days);  
could be direct cardio depressant & cause tachyphylaxis

**Asthma**

- Ketamine and/or
- Midazolam

**Neonates**

- Atropine
- Succinylcholine
- Fentanyl

**3,2,1 Rule**

- 3 mcg/kg Fentanyl
- 2 mg/kg Ketamine
- 1 mg/kg Rocuronium
- Dose adjusted depending on clinical condition of patient; consider lower dose of fentanyl

**Ketamine**

1-2 mg/kg IV  
Max 4 mg/kg  
Duration: 30-60 min

- Side effects
- Hallucinations – avoid in psychosis
  - Laryngospasm – avoid in tracheal anomalies

**Propofol**

1-3 mg/kg IV  
Duration: 3-10 min

- Side effects
- Hypotension
  - Avoid in Shock

**Midazolam**

0.05-0.1 mg/kg IV

- Side effects
- Hypotension
  - Avoid in Shock

**Fentanyl**

2-5 micrograms/kg IV  
Do not bolus, give slowly  
Duration: 30-60 min

- Side effects
- Apnoea
  - Chest wall rigidity
  - Consider Naloxone for reversal

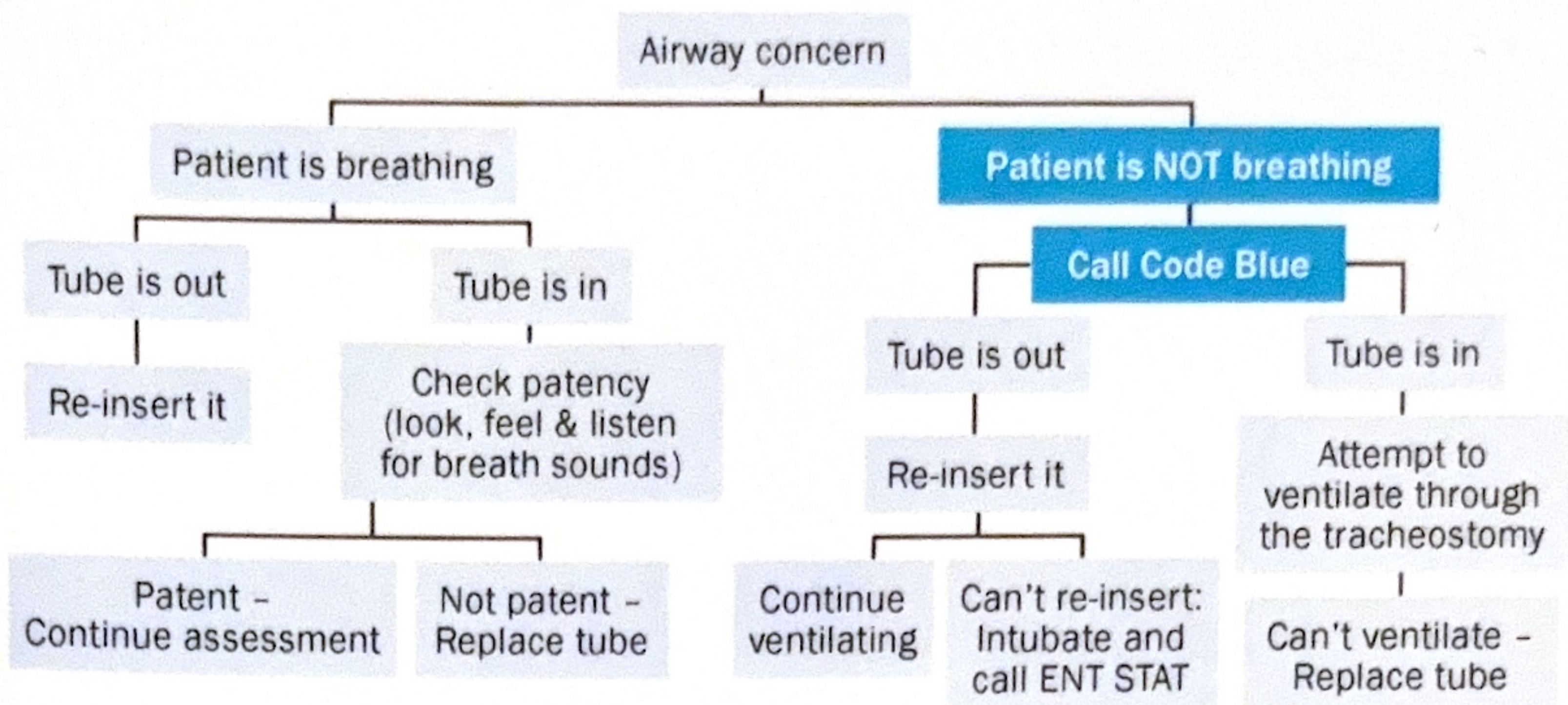
**Rocuronium**

1 mg/kg IV  
Rapid onset  
Duration: 30-60 min

- Rocuronium preferred over Succinylcholine as paralyzing agent. Less side effect

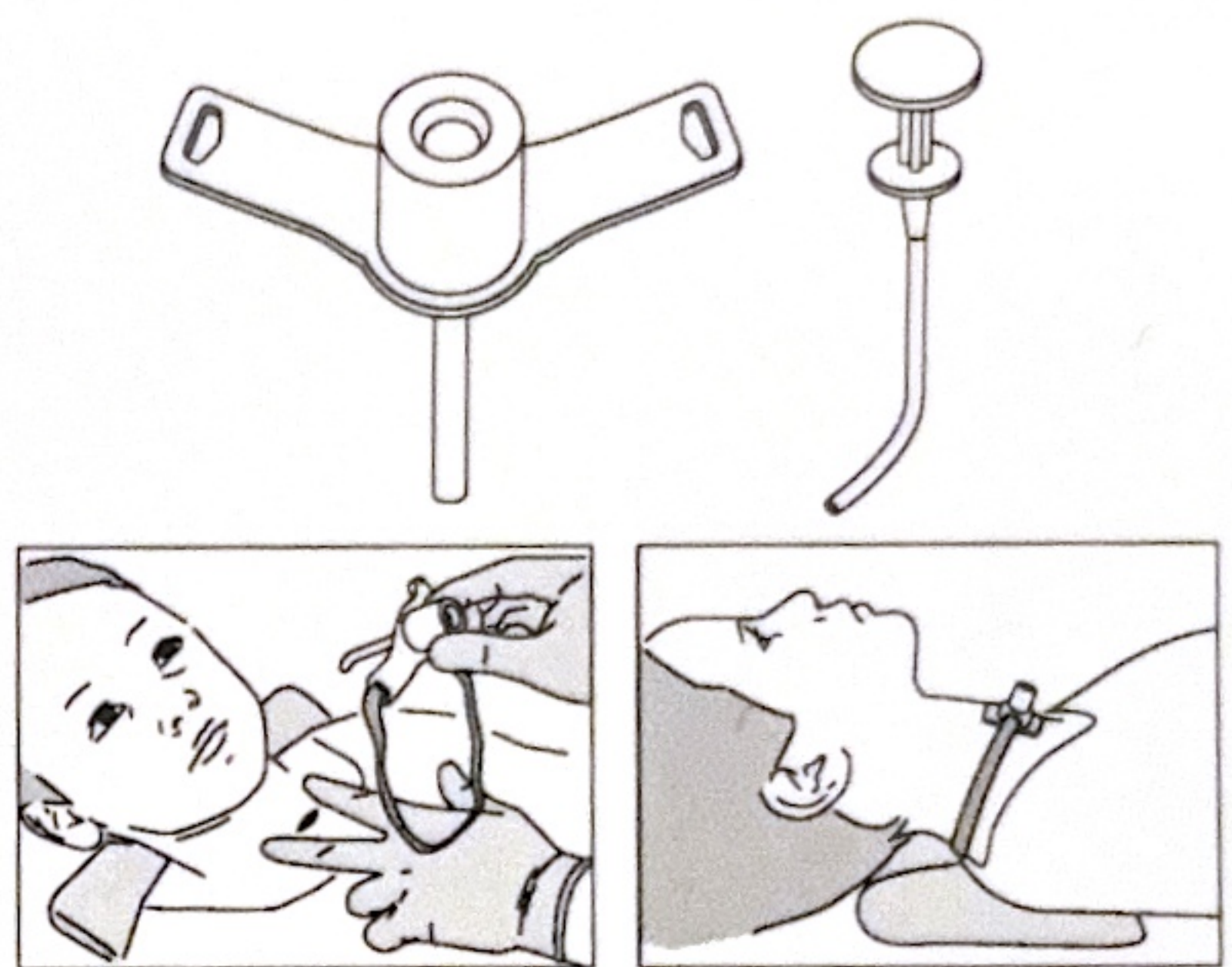


# TRACHEOSTOMY



## Equipment for Tube Replacement:

- New tracheostomy tubes with ties attached  
- same size and 1 size smaller
- Blunt-nose scissors
- Towel or blanket to roll under child's shoulders
- Resuscitation bag
- Mask
- Tape
- Lubricant (optional)
- Assistant



## Replacement Procedure in Acute Setting

Check condition of tube & verify size (ensure you have one smaller size available)  
 Attach ties before putting tube in (if patient stable)  
 Towel under shoulders  
 Insert obturator into new tracheostomy tube  
 Insert by pushing back & down in arching motion  
 Remove obturator immediately while holding tube in place with fingers  
 Assistant fasten ties

## Suctioning through tracheostomy

Ensure machine is on and working  
 Suction depth = length of cannula (just beyond the trach tip)  
 Check colour & smell of secretions – consider sending for culture  
 Ensure adequate humidity

## Indications to consult ENT

Concerns for systemic illness? Tracheitis  
 Significant respiratory distress  
 Active bleeding/pink secretions or sentinel bleed  
 Difficult changing tracheostomy  
 Can't replace tube  
 Can't ventilate  
 Fresh tracheostomy site

## Pearls

**To provide effective bag-mask ventilation ensure stoma is sealed**

- Use sterile gauze or gloved finger

**Ensure there is adequate humidity**

- May cause blocked tube by crusting or mucous plug
- Consider instillation of saline drops prior to suctioning

**Ensure ties are not loose**

- May cause tube to be pulled out

**Pressure ventilator alarms**

- High-pressure alarm = check for blocked tube or kinked connectors
- Low-pressure alarm = check ventilator connection and leaks in cuffed tube



# TETRALOGY OF FALLOT "TET" SPELL

- Can occur in Tetralogy of Fallot and other cardiac defects with pulmonary/subpulmonary stenosis and a ventriculoseptal defect (VSD)

## Signs

- Worsening cyanosis
- Significant drop in baseline saturation
- Hyperpnea
- Irritability

## Rare Presentations

- Limpness
- Syncope
- Seizures
- Stroke
- Death

## Triggers

- Tachypnea
- Tachycardia
- Hypovolemia
- low systemic vascular resistance: feeding, defecation, exercise, prolonged crying, agitation, fright

## Non-Pharmacologic Management

- Assess CAB's and LOC
- Attach monitors
- Give 100% oxygen via least distressing method (e.g. blow-by or hood)
- Establish IV/IO access
- Setting: calm, quiet room, do not distress patient
- Position: knees-to-chest (squatting), in arms of parent
- Consult Cardiology in-house physician

## Pharmacologic Management - Ward

### Morphine

0.05 - 0.1 mg/kg/dose IV/IO/SC  
• Consider SC dose prior to establishing IV access

### 0.9%NS

20 mL/kg bolus IV/IO  
• Repeat as needed for hypotension

### Sodium Bicarbonate 8.4%

(1 mmol/mL)  
1 - 2 mL/kg/dose IV over 30 min

Refractory TET Spell

Call CCRT

## Pharmacologic Management

### Phenylephrine

5 micrograms/kg IV/IO loading dose then  
0.1 - 0.4 mcg/kg/min infusion

### Esmolol

100 - 500 micrograms/kg IV/IO bolus over 1 min then  
100 - 300 micrograms/kg/min infusion

### Propanolol

0.05 - 0.1 mg/kg IV/IO over 10 min

### Ketamine

1 - 3 mg/kg IV/IO (If already Beta-blocked)



# ACUTE ABDOMINAL PAIN – RULE OUT APPENDICITIS (GENERAL SURGERY)

- Assess CAB's and LOC
- Attach monitors
- Establish IV/IO access
- NPO
- Consider CBC + differential, electrolytes, urea, creatinine, glucose, CRP, blood culture
- Consider urinalysis and  $\beta$ -hCG if postmenarchal female
- Re-assess GCS/AVPU frequently

## AMPLE History

- Allergies
- Medications
- Past medical history
- Last meal
- Events leading up to need for intubation

## Circulation

Signs of hemodynamic instability?  
e.g. hypotension, delayed capillary refill

Give 0.9%NS 20 mL/kg bolus IV/IO over 30 min  
Repeat as needed for hypotension  
Consider Sepsis (see Sepsis algorithm)

Start Maintenance IV fluids of D5W 0.9%NS  
Consider adding 20 mmol/L KCl if prolonged NPO and adequate urine output  
Correct electrolyte abnormalities if present

## Analgesia (Pain Management)

- Re-assess and manage pain frequently pre- and post-operatively

### Acetaminophen

15 mg/kg/dose PO/PR q4h prn  
Max 75 mg/kg/day or 4 g/day

### Morphine

0.05-0.1 mg/kg/dose IV/IO/SC q2-4h prn  
Max 7.5 mg/dose

## Diagnostic Imaging – Pediatric Appendicitis Score (PAS) /10

| Finding           | Points | Finding                       | Points |
|-------------------|--------|-------------------------------|--------|
| Nausea/vomiting   | 1      | RLQ tenderness                | 2      |
| Anorexia          | 1      | Hopping/percussion tenderness | 2      |
| Fever             | 1      | Leukocytosis > 10,000         | 1      |
| Migration of pain | 1      | Neutrophilia > 7,500          | 1      |

PAS ≤ 3

Consider alternative diagnosis  
Advise close follow-up if symptoms persist

PAS ≥ 4

**Negative for appendicitis**

Ultrasound

Positive Ultrasound for appendicitis

Assess for signs of perforated appendicitis

- Symptoms > 24h in < 5 yo
- Fever
- Tachycardia
- Diarrhea
- Markedly elevated CRP

## Perforated Appendicitis (suspected)

### Ampicillin

50 mg/kg/dose IV q6h Max 2000 mg/dose

### Tobramycin

9 mg/kg/dose IV q24h Max 800 mg/dose

### Metronidazole

10 mg/kg/dose IV q8h Max 4000 mg/dose

## Non-Perforated Appendicitis

### CeFOXitin (> 1 month old)

30 mg/kg/dose IV q8h

Max 2000 mg/dose

If CeFOXitin allergic:

### Tobramycin + Metronidazole

- See Perforated Appendicitis for dosing

## Post-Operative Management

### Diet

Advancing diet:  
clear fluids → full fluids → DAT

### Circulation

Continue Maintenance IV fluids: D5W 0.9%NS with 20 mmol/L KCl  
Wean IV fluids as diet tolerated

### Analgesia (Pain Management)

#### Acetaminophen

15 mg/kg/dose PO/PR q4h prn  
Max 75 mg/kg/day or 4 g/day

#### Ketorolac

0.5 mg/kg/dose IV q6-8h prn  
Max 15 mg/dose if < 16 yo  
Max 30 mg/dose if ≥ 16 yo

### Discharge Criteria

- Afebrile 24 hours
- Tolerating DAT
- Pain adequately controlled with PO analgesics
- Ambulating
- Incision clean, dry and intact



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We would like to acknowledge the previous editors and contributors, without which this guide would not be possible.

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