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***BRITISH COLUMBIA'S CHILDREN'S HOSPITAL
PEDIATRIC INTENSIVE CARE UNIT***

***MANAGEMENT GUIDELINES FOR VENTILATED
PEDIATRIC PATIENTS IN COMMUNITY HOSPITALS***

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Introduction

Although it is unlikely that a community hospital will be asked to care for a ventilated infant or young child with H1N1 infection and acute respiratory failure, basic care principles are included to assist with stabilization and care for as long as required until evacuation to a tertiary PICU. In the situation where a ventilated child remains in the community longer than simply waiting for the transport team and the stabilization period, it will be important to maintain regular and at least daily contact with BCCH ICU physician on call (**direct PICU line 604-875-2133**).

The following supplementary management guidelines are also included in the attached documents:

- Nursing care guidelines for the ventilated pediatric patient
- SBS / MAPS scoring system for assessment of sedation and analgesia
- Pain/sedation algorithm
- Bedside placement of nasojugal tube guidelines
- Provincial guidelines for empiric antibiotic use for children with H1N1 infection and suspected secondary bacterial infection
http://www.hls.gov.bc.ca/pho/pdf/antibiotic_therapy_guidance.pdf

Airway Guidelines	
<ul style="list-style-type: none"> ▪ Cuffed endotracheal tubes for all age groups (including neonates and infants) ▪ Oral intubation recommended, using neobars to secure ETT <ul style="list-style-type: none"> ▪ Nasal may be considered in neonates for ease of ETT securement ▪ End tidal CO₂ (ETCO₂) monitoring recommended to confirm all ETT placements ▪ Anesthesiology attendance during intubation recommended ▪ CXR immediately post intubation to confirm tube placement 	
<ul style="list-style-type: none"> ▪ Induction agents: 	Ketamine 1-2 mg/kg IV
	Rocuronium 1 mg/kg IV
	Atropine 20 mcg/kg IV (children < 6 years)

Respiratory Guidelines
<ul style="list-style-type: none"> ▪ ETCO₂ monitoring recommended to monitor PaCO₂ trends and minimize need for blood gases (adult interface devices have an excessive dead space) ▪ Prone positioning q4-6h for 1-2 hrs each time recommended ▪ Ventilator associated pneumonia prevention recommended (see Safer Health Care Now VAP Starter Kit) http://www.saferhealthcarenow.ca/EN/Interventions/VAP/Pages/gsk.aspx

Initial Ventilator Settings
<ul style="list-style-type: none"> ▪ Goal is to prevent ventilator induced lung injury from overinflation or atelectasis ▪ Target tidal volume for children with an acute lung injury is 6-8 cc/kg ▪ Inspiratory pressures should be titrated to achieve this goal (IP <30cmH₂O) ▪ Adequate PEEP to reduce F₁O₂ < 0.6 ▪ Ventilator settings are dependent on patient size and underlying disease process ▪ Bronchiolitic presentation typically involves clinical evidence of expiratory airflow obstruction, and hyperinflation on the chest radiograph ▪ Pneumonitis presentation typically involves decreased compliance and reduced lung volumes on chest radiograph with diffuse atelectasis and inflammatory changes

Usual Initial Ventilator Settings			
Parameter	Bronchiolitis infant (<12kg)	Pneumonitis infant with hypoxaemia(<12kg)	Pneumonitis in Pediatric patient (>12kg)
Mode	Pressure control ventilation for all patients		
Respiratory rate	25	25	20
Peak pressure	25	25	25
PEEP	5	Usually >6-8	Usually >6-8
Inspiratory time	0.7	0.7	1.0
FiO ₂	1.0	1.0	1.0

Typical Ranges for Ventilator Settings			
Parameter	Bronchiolitis infant (<12kg)	Pneumonitis infant (<12kg)	Pediatric patient (>12kg)
Respiratory rate	20-35	20-35	10-25
PEEP	5-8	5-12	5-15
Inspiratory time	0.6-0.9	0.6-1.0	0.8-1.2
I:E ratio	short	Approaches 1:1	Approaches 1:1

Blood gas goals			
Parameter	pH	PaCO ₂	SpO ₂
Goal	≥ 7.25	45-65	≥ 88%

Central Nervous System Management	
<ul style="list-style-type: none"> ▪ Goal is to have a cooperative, pain free child who is rousable with minimal stimuli ▪ Analgesia <ul style="list-style-type: none"> ▪ Morphine infusion 0-40 mcg/kg/hr IV ▪ Morphine bolus 0.05 – 0.1 mg/kg/dose IV prn ▪ Sedation <ul style="list-style-type: none"> ▪ Midazolam infusion 0-120 mcg/kg/hr IV ▪ Midazolam bolus 0.05 – 0.1 mg/kg/dose IV prn ▪ Muscle relaxation (intermittent) <ul style="list-style-type: none"> ▪ Rocuronium 1 mg/kg/dose IV prn may be required for children who are persistently difficult to ventilate despite adequate sedation and analgesia (most common with bronchiolitic patients) 	

Gastrointestinal Management	
<ul style="list-style-type: none"> ▪ Enteral feeds preferred, initiate within 24 hours of intubation if patient is stable ▪ Place nasojejunal tube may be required in addition to a nasogastric tube if: <ul style="list-style-type: none"> ▪ BiPAP or CPAP is needed (allows NG to vent stomach) ▪ Patient has a history of aspiration with gastric feeds (these patients require elevation of the head of bed to 30°) ▪ Feeding tolerance is monitored by fluid balance, bloodwork, abdominal distension, stooling pattern, weight, and nausea/vomiting <ul style="list-style-type: none"> ▪ Do not monitor bowel sounds, gastric residuals, or abdominal girth, as they are unreliable predictors of feed intolerance ▪ Consider early bowel protocol: <ul style="list-style-type: none"> ▪ Lactulose 7.5 ml ng od (pediatric starting dose) ▪ Docusate 2.5 mg/kg/dose given bid 	

Nutritional Management Guidelines			
	< 10 kg	10-30 kg	> 30 kg
Formula	Breast milk (EBM); Similac advanced if EBM not available	Pediasure with fibre	Isosource HN with fibre
Initiation	2 ml/hr	5 ml/hr	10 ml/hr
Advancement	2 ml/hr q6h	5 ml/hr q6h	10 ml/hr q6h
Goal	75 ml/kg/day	55 ml/kg/day	25 ml/kg/day

Vascular Access

- Routine use of ultrasound for deep vessel cannulation recommended
- Early use of PICC lines recommended, especially for small babies
- Aseptic technique for central line placement and maintenance (see Safer Health Care Now VAP Starter Kit)
<http://www.saferhealthcarenow.ca/EN/Interventions/CLI/Pages/gsk.aspx>

Genitourinary Guidelines

- Routine indwelling urinary catheter discouraged
- IV fluid maintenance initially 80% of usual maintenance (should always be isotonic initially) and adjusted based on patients handling of prescribed salt and water
 - Neonate D10W / 0.9%NaCl
 - Infant, child, adolescent D5W / 0.9%NaCl
- Aim for neutral daily fluid balance
 - IV Furosemide 0.5 – 1 mg/kg/dose to assist diuresis

Bloodwork

- Minimal volumes for all bloodwork
- Daily CBC, electrolytes, capillary bloodgas
- Capillary bloodgas with all ventilator changes initially; once stabilized on ventilator, blood sampling may be reduced using capnography

Hematological Management

- Maintain hemoglobin > 70 for stable patients
- Maintain hemoglobin > 90 for unstable patients requiring FiO₂ > 0.8

Bacterial Infections and H1N1 Infection

- Most children requiring critical care present with either viral pneumonia or bronchiolitis
 - A small subset present with a clinical picture of septic shock
- Most children who have become critically ill has occurred in children with known co-morbidities including chronic lung disorders and immunodeficiency
- If bacterial infection is suspected, culture blood, ETT aspirate and urine (not bag)
- Scenarios that warrant initiating broad spectrum antibiotics:
 - presentation with shock syndrome
 - initial presentation (negative viral nasopharyngeal wash; high WCC, clinical suspicion)
 - hospitalized child with clinical/radiologic suspicion that a ventilator associated pneumonia has developed
- Vancomycin should be considered if:
 - Patient is known MRSA positive
 - High incidence of MRSA in the community
 - High incidence of resistant Streptococcus pneumoniae in the community
- Macrolides are not indicated as initial therapy, but should be considered if there is a high suspicion of atypical bacterial pneumonia (based on local prevalence rates)
- See provincial antibiotic guidelines for children with suspected bacterial pneumonia http://www.hls.gov.bc.ca/pho/pdf/antibiotic_therapy_guidance.pdf

