Procedures

www.gaumard.com

www.laerdal.com

www.rch.org.au

ekja.org
NRP

HR: Palpate UV Auscultation
O2 Sat: R arm Pre-ductal
PPV: BVM T-piece
PEEP: 5-7cm H2O PIP: 20cm H20 (May need higher)

Target Sats

RR: 40 – 60 bpm HR: 120 – 140
3:1 ratio - 120 events Compressions: ventilations
Epinephrine: 0.1ml/kg IV 1:10000 1ml/kg ETT 1:10000

Epinephrine: 0.1ml/kg IV 1:10000
1ml/kg ETT 1:10000
Useful reminders...

Corrective ventilation steps:

**MR SOPA**
- Mask adjustment
- Reposition head
- Suction mouth & nose
- Open mouth
- Pressure ↑
- Alternate airway

Team skills:
- Know your environment
- Anticipate the plan
- Assume the leadership role
- Communicate effectively
- Delegate workload optimally
- Allocate attention wisely
- Use all information
- Use all resources
- Call for help
- Be professional
The neonatal airway

- Smaller
- More anterior
- Epiglottis is floppier
- Larger tongue (proportionally)
- Larger occiput
- Narrowest portion of airway is cricoid

Anatomy and positioning

Figure 1 - View of the olottic area via direct laryngoscopy

Figure 3 - A) Illustration of the axes (oral, pharyngeal and tracheal); B) alignment of these axes with correct positioning; C) viewing the glottic fold with a straight blade

http://www.slideshare.net/oerafrica/newborn-care-skills-workshop-neonatal-resuscitation
Indications for intubation

• In delivery room
  – Apnea
  – Cardio-respiratory instability
  – Meconium, depressed infant
  – Surfactant administration (prematurity)
  – Congenital malformations (CDH, neck mass)

• In NICU
  – Apnea(s)
  – Unable to protect airway
  – Respiratory failure (hypercarbic / hypoxic)
  – Other therapeutic indication
Endotracheal tube measurements

ETT length
7 – 8 - 9 (cm) rule for 1- 2- 3- kg infants
or
Tip-to-lip: 6 + weight (kg)

<table>
<thead>
<tr>
<th>Tube size (internal diameter in mm)</th>
<th>Weight (grams)</th>
<th>Gestational age (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>&lt; 1000</td>
<td>&lt; 28</td>
</tr>
<tr>
<td>3.0</td>
<td>1001 – 2000</td>
<td>28 – 34</td>
</tr>
<tr>
<td>3.5</td>
<td>2001 – 3000</td>
<td>34 – 38</td>
</tr>
<tr>
<td>3.5 – 4.0</td>
<td>&gt; 3000</td>
<td>&gt; 38</td>
</tr>
</tbody>
</table>

Neonatal resuscitation. AAP, CPS.
Indications: drainage of large or symptomatic a) Pneumothorax b) Pleural effusion
Umbilical vessel catheterization

McMaster Pediatrics
2016
Anatomy - umbilical arterial catheter

ductus arteriosus

sup mes artery
celiac trunk
renal artery

internal iliac artery

umbilic artery line
Anatomy – umbilical venous catheter
Equipment

- Scalpel
- Cleaning solution
- Umbilical tape
- Drape
- Needle driver
- Vessel dilators
Catheter set up

UVC
Pressure tubing

UAC
3 way stop cock
Clean the cord
Use umbilical tape to tie the base
Cut cord
Place sterile drapes
Identify the vessels

Vein
Artery
Artery
Gently dilate vessels and insert catheter
Umbilical line position

Umbilical artery catheter (high) cm:

\[ 3 \times \text{weight (kg)} + 9 \]

Umbilical venous catheter cm:

\[ \frac{1}{2} \times \text{UAC measure} + 1 \]

www.mypacs.net

radiographics.rsna.org
Umbilical line insertion complications

- Hemorrhage
- Perforation (peritoneal cavity, urachus, pericardium)
- Hepatic laceration
- Thrombi/emboli
- Retained broken off fragment
- Calcification portal vein/umbilical vein
- Catheter associated infection

Peripheral IV insertion

McMaster Pediatrics

2016
Anatomy of the vein

- Tunica Intima (endothelial cells)
- Tunica media (smooth muscle)
- Tunica Adventitia (loose fibrous connective tissue)
- Elastin
- Valve
Veins hand & upper extremity
Veins of the lower extremities
veins of the lower extremity & foot
Veins on the scalp
Commonly used..
Direction of insertion
Video of catheter insertion

- http://corpweb/workfiles/education/autoguard%20prod%20vid.swf
Neonatal Intubation

Indications:
1. Ventilation/oxygenation failure with mask airway management
2. Prolonged resuscitation
3. Meconium aspiration
4. Administration of surfactant
5. Apneas (premature infants)
6. Congenital or structural airway anomalies
7. Respiratory support in neonatal sepsis/necrotizing enterocolitis
8. Pre- or post-operative respiratory support

Potential complications:

<table>
<thead>
<tr>
<th>Acute</th>
<th>Prolonged</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trauma (pharyngeal, esophageal, tracheal)</td>
<td>1. Nosocomial respiratory infection/Ventilator associated pneumonia</td>
</tr>
<tr>
<td>2. Cardiorespiratory instability during intubation attempts</td>
<td>2. Erosion of nares/septum</td>
</tr>
<tr>
<td>3. Intubation of right main-stem bronchus</td>
<td>3. Palatal groove formation/acquired cleft palate</td>
</tr>
<tr>
<td></td>
<td>4. Subglottic stenosis</td>
</tr>
</tbody>
</table>

Equipment:
1. Laryngoscope with appropriate sized blades
   a. 00 for extreme preterms
   b. 0 for preterms
   c. 1 for terms
2. Appropriate size endotracheal tube (ETT)

<table>
<thead>
<tr>
<th>Weight (g)</th>
<th>ETT internal diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1000</td>
<td>2.5</td>
</tr>
<tr>
<td>1000-2000</td>
<td>3.0</td>
</tr>
<tr>
<td>2000-3000</td>
<td>3.5</td>
</tr>
<tr>
<td>&gt;3000</td>
<td>3.5-4.0</td>
</tr>
</tbody>
</table>

3. Stylet
4. Suction catheter (+/- meconium aspirator)
5. Magill’s forceps
6. Carbon-dioxide detector
7. Stethoscope
8. Bag (flow-inflating/self-inflating) with compressed gas source and blender
9. Equipment to secure ETT (tape/scissors)
10. Monitoring equipment (cardiorespiratory and saturation)
11. Pre-medications (Atropine, Fentanyl, muscle-relaxant)
12. Naso- or orogastric tube

FAQs:
1. Why straight blade (instead of curved)?
a. Straight blade can lift epiglottis (which can be relatively large and floppy in neonate)

2. Insertion depth?
   a. Black line of ETT at level of vocal cords
   b. If oral intubation: 6 cm + weight (in kg)
   c. If nasal intubation: 7 cm + weight (in kg)

3. When to give pre-medications?
   a. “All newborn infants...should receive analgesic premedication for endotracheal intubation except in emergency situations” – CPS statement on Premedications
   b. Patients with potential difficult airway should not receive pre-medications

Pearls/Tips:
1. Ensure appropriate bagging technique (may mitigate need for intubation)
   a. Mask adjustment
   b. Reposition airway
   c. Suction
   d. Open mouth
   e. Pressure (need to increase)
   f. Alternate airway

2. Ensure bed height appropriate/comfortable for you

3. Roll/towel under infant’s shoulder may help

4. Give fentanyl slowly (1-2 min) due to risk of chest wall rigidity

5. Ensure head stabilized during intubation (may assign someone to hold head)

6. Consider going deep with laryngoscope blade then withdraw slowly until vocal cords in view

7. Can use 5th finger of laryngoscope hand to give cricoid (or may assign to someone else)

8. Assign someone to pass suction/Magill’s/Meconium aspirator

9. Once vocal cords in view, don’t take eyes off until ETT through

10. If cannot see vocal cords, consider the following
   a. Is neck hyper-extended?
   b. In laryngoscope blade too deep? Too shallow?
   c. Laryngoscope blade inappropriate size?
   d. Airway too anterior → need cricoid
   e. Secretions/Meconium blocking view → suction

11. If End-tidal CO2 monitor does not change consider, consider whether cardiovascular compromise as cause rather than improper ETT placement

Laryngeal mask airway:
For use when mask ventilation not effective and ETT not feasible or difficult

Examples:
- Congenital anomalies of mouth/lip/palate
- Anomalies of pharynx/neck making intubation difficult
- Small mandible/large tongue

Limitations:
- Cannot be used to suction meconium
- Need for high pressures can cause leak and cause gastric inflation
- Cannot give intra-tracheal medications reliably
- Cannot use is VLBW babies (i.e. > 1,500 grams only)
Needle thoracostomy procedure check list:

Indications:
Pneumothorax
Pleural fluid (different landmark)

A. Needle aspiration:
   Equipment:
   1. 23/25 G butterfly needle, 22G/24 G IV catheter
   2. 10/20 ml syringe
   3. 3 way stopcock

   Procedure:
   1. Attach the butterfly needle/catheter to the syringe fitted with a 3 way stop cock.
   2. Confirm side with reviewing X ray/ clinical exam
   3. Prepare the overlying skin with antibacterial solution
   4. Identify the 2nd intercostal space in the mid clavicular line
   5. Insert the needle firmly into the intercostal space, just above the top of the 3rd rib (below the clavicle, minimizes chances of laceration to the intercostal vessels)
   6. Have an assistant apply continuous suction as the needle is inserted
   7. Rapid flow of air will occur once the needle enters the pleural space.
   8. Once in the space stop advancing needle (reduce risk of puncturing the lung)
      • Continuous air leak can be aspirated while a chest tube is inserted
      • Technique can be used in emergency situations

Potential complications:
Mal-placement
Hemorrhage, cardiac tamponade
Lung perforation
Phrenic nerve injury
Insertion of umbilical vein and umbilical artery catheters

Procedure checklist:

A. Umbilical artery catheter:

Indications:
1. For invasive blood pressure monitoring
2. For frequent monitoring of arterial blood gases, other labs
3. For exchange transfusion (withdrawal)

Contraindications:
1. Abdominal wall defects ex. Omphalocele
2. Peritonitis

Complications:
1. Vascular accident, clot
2. Infection
3. Hemorrhage

Equipment:
1. Umbilical catheter: 3.5 Fr
2. Cleaning solution
3. Umbilical tape
4. Drapes
5. Scalpel
6. Iris forceps
7. Straight clamps
8. Needle driver
9. Suture
10. 3 way stop cock
11. 10 cc syringes

Procedure:
1. Determine catheter insertion length
2. Ensure line and stop cock are flushed with saline, no air is in the system as negative intrathoracic pressure can cause air embolism
3. Clean umbilical stump
4. Place cord tie
5. Cut umbilical cord
6. Place sterile drape
7. Stabilize cord with a forceps/hemostat
8. Identify 2 arteries
9. Open tip of iris forceps inserted into the vessel and gently dilated
10. Insert catheter into the vessel till calculated length
11. Check for blood flow.
12. X rays to confirm position (above the diaphragm)
13. Suture and secure with tapes/bridge
14. Documentation: size of catheter, length it is inserted to and any complications
   *** document any adjustments ***
15. Order heparin infusion (NICU protocol)

Problems:
1. Catheter may not pass into the abdominal aorta
2. The catheter may pass into the aorta but loop caudad back into the contralateral iliac artery
3. Persistent cyanosis, blanching, poor distal extremity perfusion

B. Umbilical venous catheter:

Indications
1. Emergency vascular access in a resuscitation (insert 4-5cm until blood return)
2. Exchange transfusions (infuse)
3. Central venous access
4. Preferable route for inotrope administration
5. As a stable route for infusion of parenteral fluids (concentrated solutions)

Complications:
1. Malposition
2. Infection
3. Perforation

Equipment:
Same as UA: 3 way stop cock not required; attach appropriate tubing connector

Procedure
Steps 1-7 same as above
Catheter size: 3.5 Fr for <1500g, 5 Fr for >1500g
8. Identify Umbilical vein
9. Thread catheter to determined length
10. Confirm blood flow back in the catheter
11. In emergency situations insert catheter till blood flow is obtained, at 4 -5 cm
12. Secure line (suture, bridge as above)
13. X ray to confirm position (above the diaphragm, not in the heart)
14. Document as above
15. Only isotonic solution to be infused till tip position is confirmed on X ray

Formulae:
Umbilical artery catheter (high) cm: $[3 \times \text{weight (kg)}] + 9$
Umbilical venous catheter cm: $\frac{1}{2} \times \text{UAC measure} + 1$