Anaesthesia for Pediatric and APGAR Score

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What is the APGAR SCORE ?

- The Apgar score is a scoring system doctors and nurses use to assess newborns one minute and

  five minutes after they’re born.
- It is divided into five categories.
- Each category receives a score of 0 to 2points

What is the APGAR SCORE ?

	Indicators	0	1	2
A	Activity	**Absent** (No movements)	**Flexed arms and legs** (Flexed with little movements)	**Active** (spontaneous movement)
P	Pulse	**Absent** (No Pulse)	**Below 100 bpm per minute**	**Over 100 bpm per minute**
G	Grimace	**Absent** (Floppy , No Response to stimulation)	**Minimal Response to stimulation.** (facial movement only)	**Prompt response to stimulation** (pulls away, cough or sneeze, cry)
A	Appearance	**Blue, Pale** (blue, bluish-gray , or pale all over)	**Pink body Blue extremities** (Normal color but Hands and feet are bluish)	**Pink** (Normal color in all body with Hands and feet)
R	Respiration	**Absent** (No Breathing)	**Slow and Irregular** (Irregular RR , weak crying)	**Vigorous cry** (Normal respiratory movement and effort good cry)

Pediatric Age Group Classification :

Age Group	Classification
< 37 weeks	Premature infant
37-40 weeks	Full term infant
Birth to 1 month	Neonate or Newborn
1 month to 1 year	Infant
1 year to 12 years	Children
12 years to 16 years	Adolescents





Anatomy :

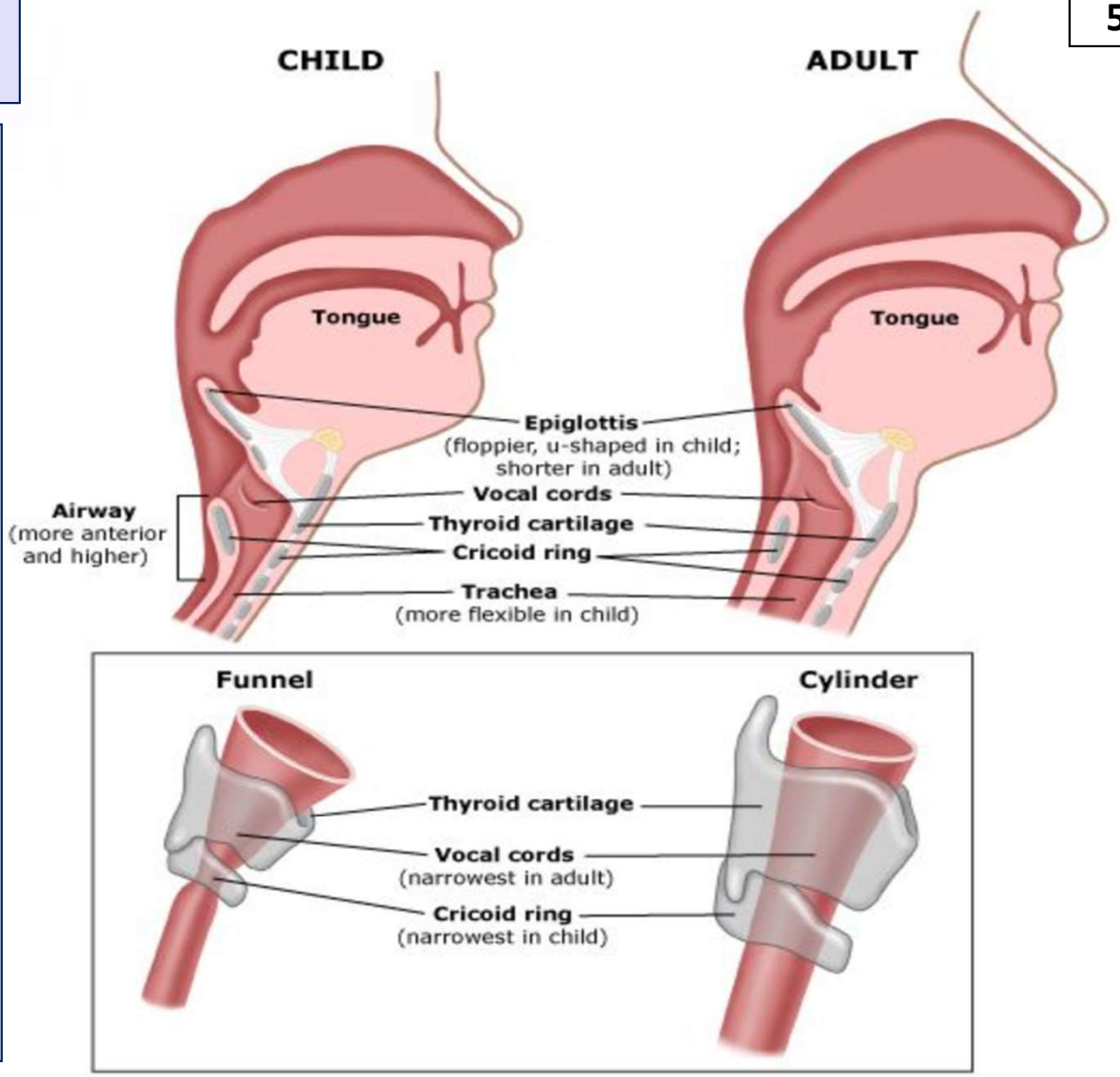
Airways :

- Large Head .
- Large Tongue .
- Nasal passages narrow
- Obligate nasal breathing until 5 months

Anatomy :

Airways difference :

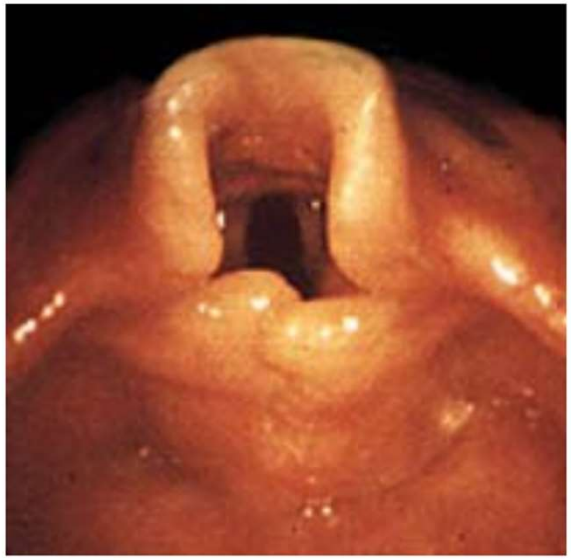
- Large tongue
- Epiglottis short
- Higher located larynx
- Angled vocal cords
- Narrowest portion is cricoid cartilage
- Infant's larynx is higher in neck (C2-3) compared to adult's (C4-5)



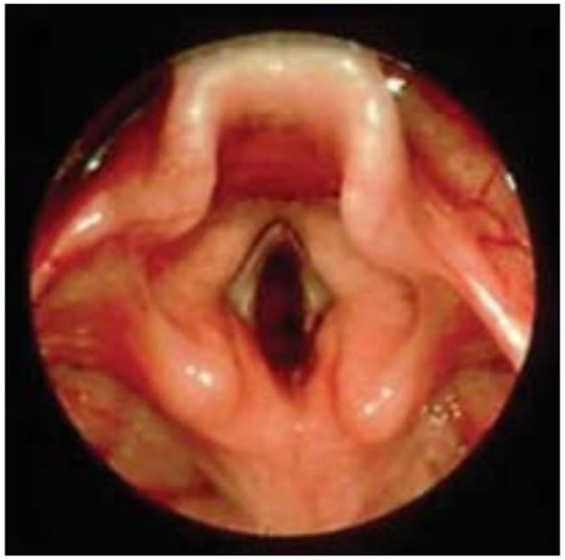
Anatomy :

- Larynx
  - Anterior
  - Cephalic
  - C 4 (cervical vertebra) level
- Epiglottis long & U shaped
- Trachea short
  - Neonates → 2 cm cords to carina
- Cricoid → Narrowest point until 10 yr.

Anatomy :



Infant



Toddler

Adult

Figure 4.

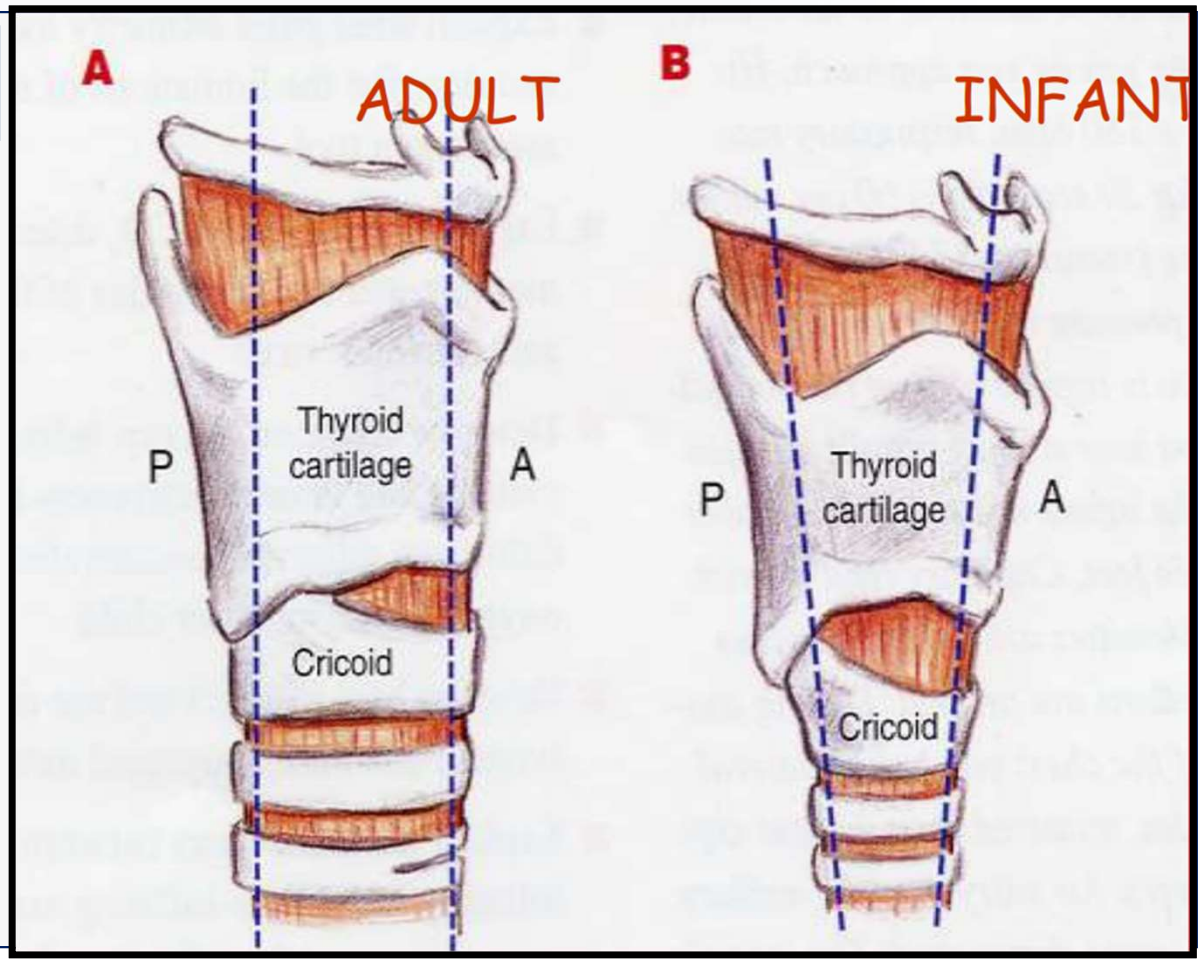
The infant larynx differs markedly from the adult in size, shape, composition and position. As the infant grows, the epiglottis changes from short and omega-shaped to elongated and spade-shaped.

All images courtesy of the author.

Anatomy :

Funneled shape larynx :

- Narrowest part of infant's larynx is the undeveloped cricoid cartilage, whereas in the adult it is the glottis opening (vocal cord)
- Tight fitting ETT may cause edema ,strider and trouble upon extubation
- Uncuffed ETT preferred for patients < 8 years old
- Fully developed cricoid cartilage occurs at 10-12 years of age



Anatomy and physiology :

CVS :

In neonates Myocardium less contractile causing the ventricles to be less compliant & less able to generate tension during contraction

- Limits the size of stroke volume
- Cardiac output therefore rate dependent
- Infant behaves as with fixed cardiac output state

Anatomy and physiology :

CVS :

Vagal parasympathetic tone is most dominant which makes neonates & infants more prone to bradycardias

- **Bradycardia:**
  - Associated with reduced cardiac output
  - If Associated with hypoxia, should be treated with O2 & Ventilation initially
  - Cardiac compression will be required in neonate with HR 60 or less 60-80bpm with adequate ventilation

Anatomy and physiology :

Renal System :

Decreased glomerular filtration rate :

- Decreased creatinine clearance .
- Decreased sodium excretion.
- Decreased glucose excretion.
- Decreased bicarbonate resorption.
- Decreased diluting capability.
- Decreased concentrating ability.

Anatomy and physiology :

Renal System :

- **Dehydration :**
  - Poorly tolerated
  - Premature infants have increased insensible losses as they have large surface area relative to weight
  - There is larger proportion of ECF in children (40% BW as compared to 20% in adult)
- **Conclusion :**
  - Newborn kidneys has limited capacity to compensate for Volume EXCESS or Volume DEPLETION

Anatomy and physiology :

Glucose management :

High glucose utilization
  – Neonates 3-4 mg/kg/minute
- Low glycogen stores
  – Predisposes to hypoglycemia
- Neonates < 30 mg/dl
- Infants < 40 mg/dl
  – Increased risk with prematurity
- Options at maintenance rate
  – D5LR, D5 ½ NS, D5 ¼ NS

Anatomy and physiology :

Thermoregulation :

- Greater heat loss
  - Thin skin
  - Low fat content
  - High surface area/weight ratio
- No shivering until 1 yrs.
- Thermogenesis by brown fat
- More prone to iatrogenic hypo/hyperthermia
- Optimal ambient temp to prevent heat loss:
  - Premature infant: 34^{0}C
  - Neonates: 32^{0}C
  - Adults: 28^{0}C

Volatile anesthetics :

- Minute ventilation to FRC ratio increased
- Blood flow to vessel rich groups increased.
  - Rapid rise in alveolar anesthetic concentration
- Blood-gas coefficients lower in neonates
- Inhalation induction rapid
  - BP of neonates and infants more sensitive to hemodynamic effects of volatile agents.
  - Caution against overdose

IV or IM anaesthetics :

1- Thiopentone Sodium :

- Lower dose in neonates than in infants
- Neonates- 3-4 mg/kg
- Infants - 5-6 mg/kg

2 - PROPOFOL :

- Children required larger dose of propofol
  - Large vol of distribution
  - Shorter elimination half life
  - Higher plasma clearance
  - 2- 3 mg / kg

Preoperative considerations :

History and physical

- Comorbid illness
- Recent URI
- Murmur
  - Innocent
  - New
  - Symptomatic
- Anesthia problems
- Labs → none routine

Preoperative considerations :

URI : Upper Respiratory Infection :

Symptoms new or chronic?

Infectious vs allergic

Viral infection within 2 - 4 weeks of GA with intubation increases perioperative risk

Wheezing risk increased 10x

Laryngospasm risk increased 5x

Hypoxemia, atelectasis, recovery room stay, admissions and ICU admissions all increased

If possible, delay no emergent surgeries

Premedication :

Sedative premedication is generally omitted for neonates and sick infants.

NPO

- Clears → 2 h
- Breast milk → 4 h
- Formula milk → 6 h
- Solid food → 8 h

Breathing and Ventilation :

- Jackson-Rees modification to Ayres T piece or Mapleson F circuit
- Simple, lightweight, has an open ended bag which can be occluded to apply CPAP and PEEP
- Better for children <20kg (varies with anaesthetist) because easier to assess tidal volume and lung compliance, has low resistance and dead space
- Disadvantage is pollution and anaesthetic gas wastage

Breathing and Ventilation :

Mapleson F (Jackson Rees Modification)

Ayres – 1937

JR - 1950

- The Mapleson F or Jackson Rees modification of the Ayres T Piece is a basic system for use with very small patients.
- It is a big disadvantage that you cannot remove waste gases safely.

Face masks :

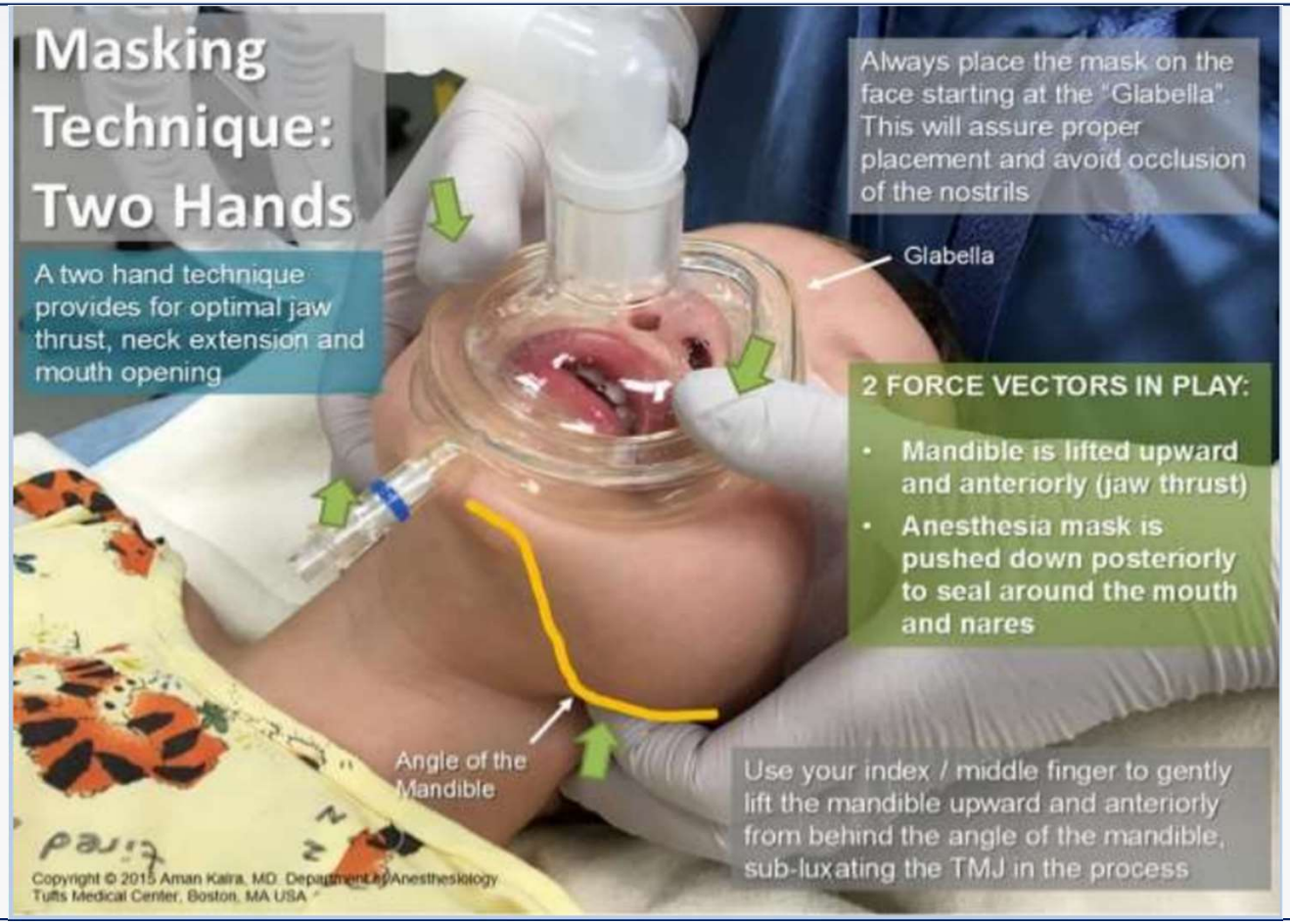
Position :


POSITIONING INFANTS AND TODDLERS FOR AIRWAY MANAGEMENT
Nose - Chin Axis
Wide Open
Anterior
Neck Space

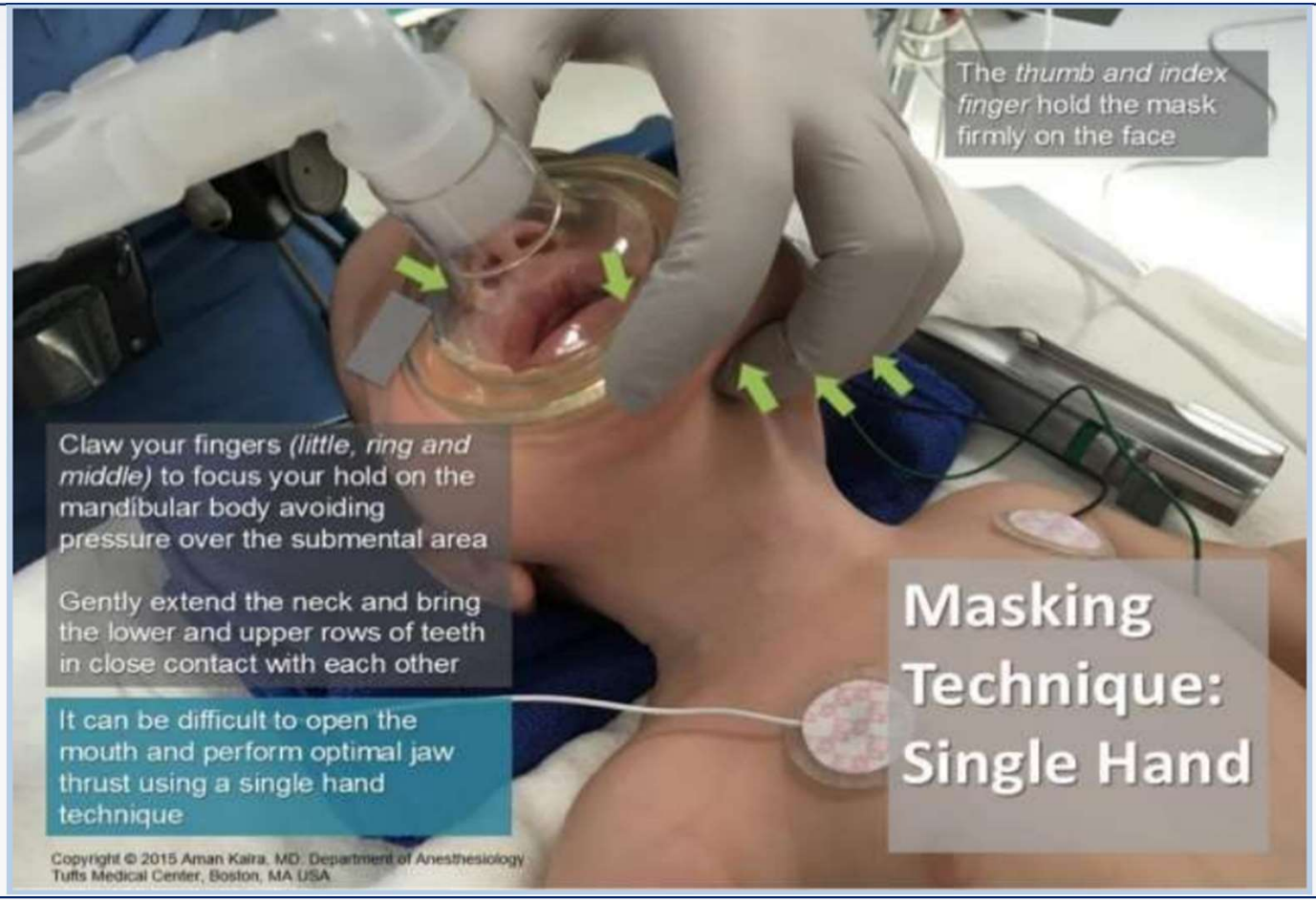
Position :


POSITIONING INFANTS FOR AIRWAY MANAGEMENT
Nose - Chin Axis
Wide Open
Anterior
Neck Space
Head Rest
Shoulder Roll

Mask Technique :



Mask Technique :



Perioperative fluid replacement :

1 - Maintenance :

- First 10 kg → 4 cc/kg/hr
- Second 10 kg → 2 cc/kg/hr
- > 20 kg → 1 cc/kg/hr
- D5 ½ NS or D5 ¼ NS

2- Calculate preoperative deficit (Fasting Hours x Maintenance) :

  - Replace 50% first hour
  - Replace 25% second hour
  - Replace 25% third hour

- Ringer Lactate better than NS

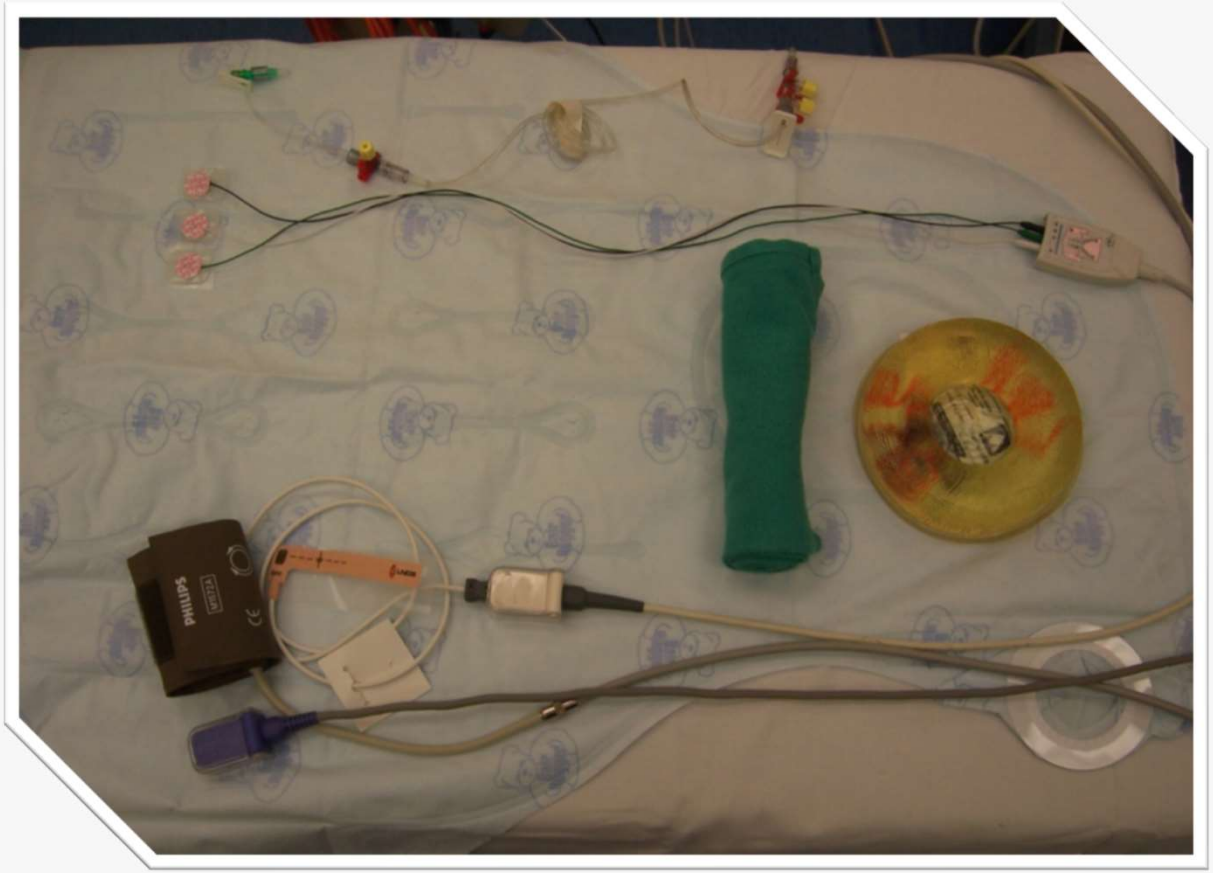
3 – Third Space Loss (Insensible Loss) :

- Minor surgery → additional 2 cc/kg/hr
- Major surgery → up to additional 10 cc/kg/hr

Essential Equipment :

Table :

- Bair Hugger
- Shoulder Roll
- 3 lead EKG
- Pulse Oximeter
- Appropriate sized BP cuff
- Special cable for neonatal cuffs



Essential Equipment :

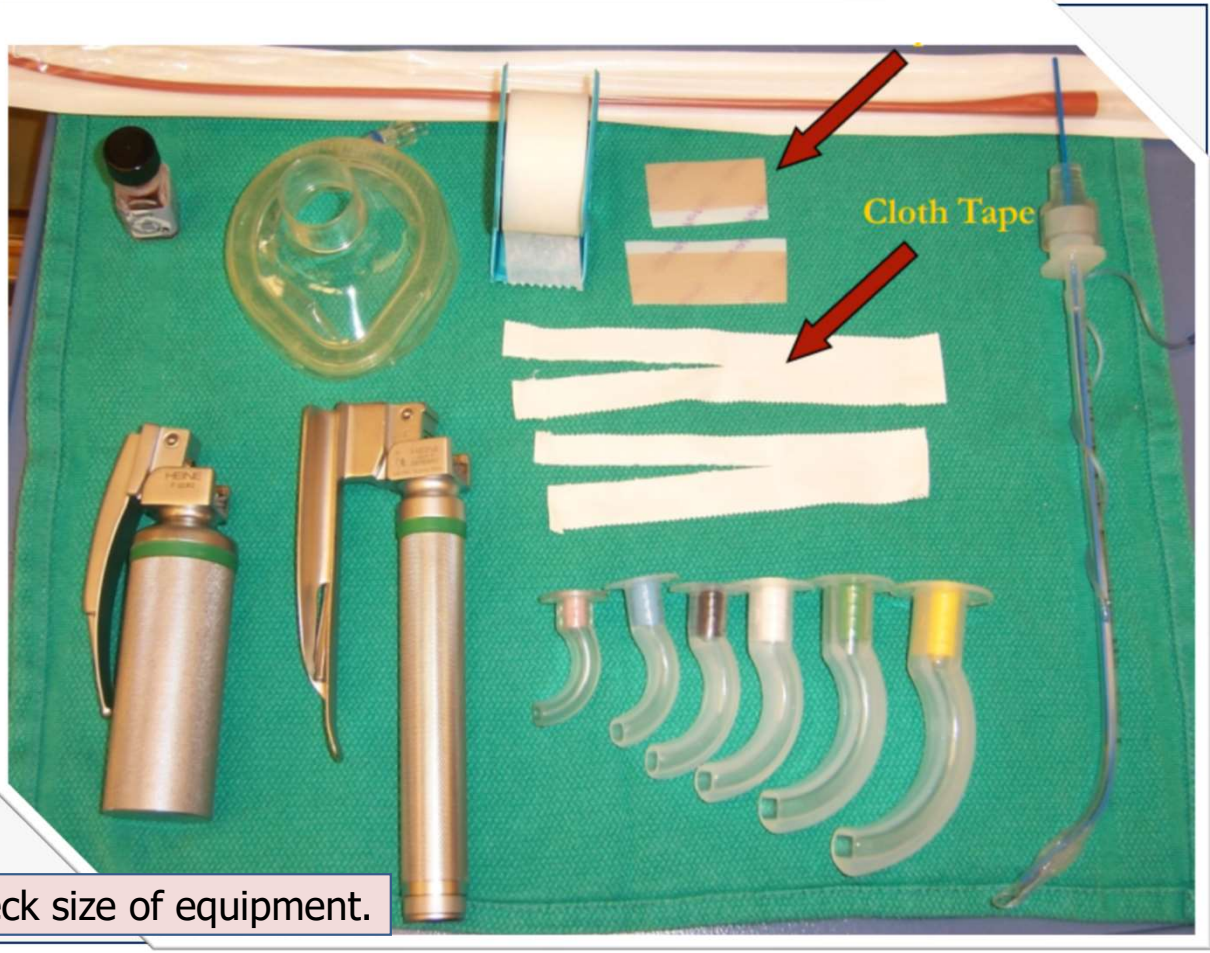
Monitors :

- **Pulse oximeter**
  - ► Avoid index finger to minimize corneal abrasions post op.
  - Toes are great ! .

Essential Equipment :

Airway :

- **ETT (3 different size) .**
  - One half size bigger and one half size smaller
  - Appropriate size stylet .
- **Two laryngoscope blades & handles .**
- **Oral airways.**
- **Face mask.**
- **Cloth white tape to secure ETT** with Two Y-strips .
- **Red rubber for suction .**
- **Eye tape .**



Note : While RN places monitors, double check size of equipment.

Essential Equipment :

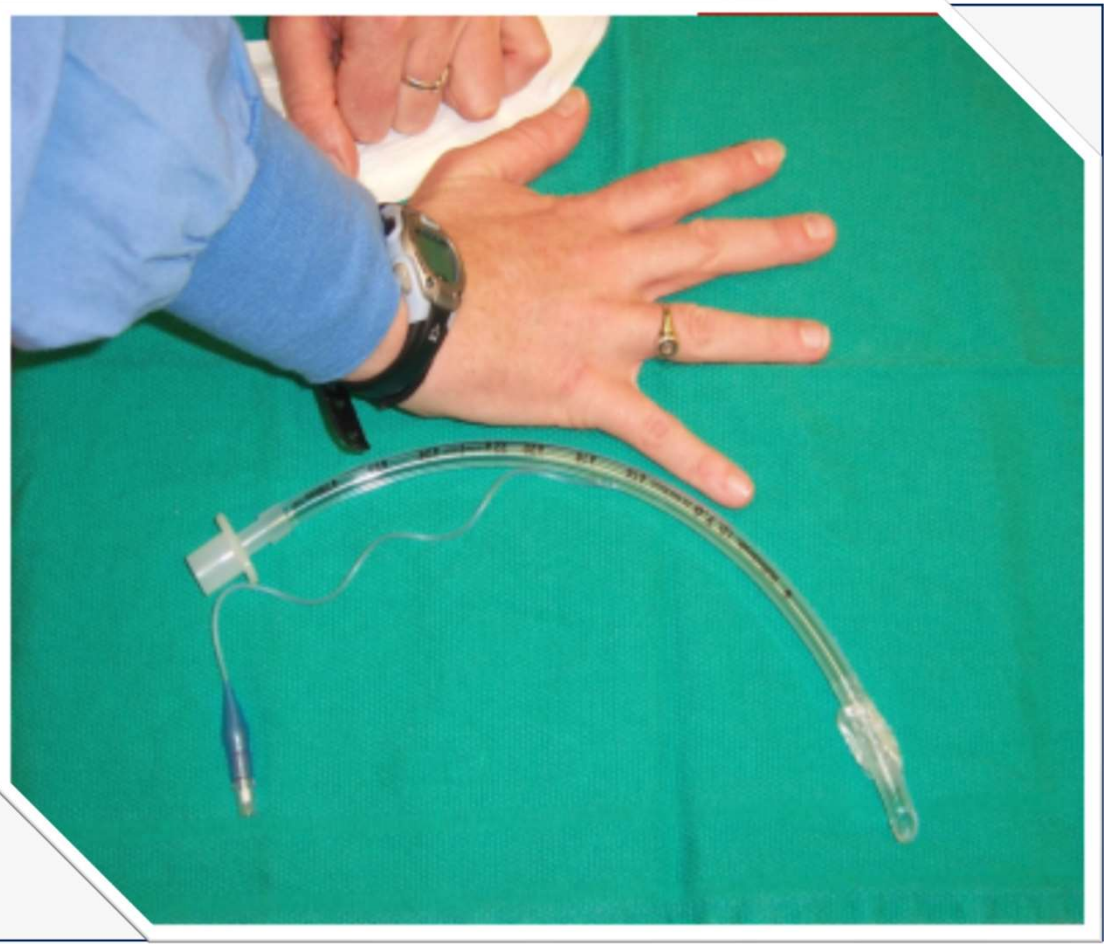
Airway / ETT :

Size :

- (uncuffed) : Age/4 + 4
  - Size down by ½ if cuffed
- (cuffed) : Age/4 + 3
- Have one half-size smaller and larger available
- ETT depth:

Age/2 + 12 (or tube size × 3)—oral tube

Age/2 + 15—nasal tube.



Essential Equipment :

Laryngoscope blades :

- Neonate to 3 months: Miller 0
- 3 months to 18 months: Miller 1
- 18 month- 3 years: Miller 1.5, * Mac 1,
- 3-5 years: Miller 1.5, Mac 2,
- >5 years: Miller 2, Mac 2-3

* Mac : Macintosh Laryngoscope blade

Essential Equipment :

Macintosh Laryngoscope blade

Miller Laryngoscope blade

Selection of laryngoscope blade:

Miller vs. Macintosh

Miller blade is preferred for infants and younger children

- Facilitates lifting of the epiglottis and exposing the glottic opening
- Care must be taken to avoid using the blade as a fulcrum with pressure on the teeth and gums
- Macintosh blades are generally used in older children
- Blade size dependent on body mass of the patient and the preference of the anesthesiologist

Cuff vs Uncuffed Endotracheal Tube :

- Uncuffed ETT recommended in children < 8 yrs old to avoid post-extubation stridor and subglottic stenosis

- For “short” cases when ETT size >4.0, choice of cuff vs uncuffed probably does not matter • Cuffed ETT preferable in cases of: high risk of aspiration (ie. Bowel obstruction), low lung compliance (ie. ARDS, pneumoperitoneum) etc.

Essential Equipment :

Airway / LMA :

Table 34.8 Estimating the size of LMA in paediatrics

Size of LMA	Weight (kg)	Cuff volume (mL)
1	0–5	2–5
1.5	5–10	5–7
2	10–20	7–10
2.5	20–30	12–14
3	>30	15–20

Essential Equipment :

Difficult Airway Equipment :

- Glide scope
- Storz CMAC system
- Olympus FOB