PAEDIATRIC ANAESTHESIA EQUIPMENT

A. Endotracheal tube (ETT)

UNCuffed ETT

AGE	WT(KG)	*ID(MM)	**ORAL LENGTH(MM)	**NASAL LENGTH(MM)
neonate	< 1	2.5	5.5	7
neonate	1- 3	3.0	6- 9	7.5- 11
neonate	> 3.5	3.5	9	11
3/12	6	3.5	10	12
6/12	8	4.0	10	13
12/12	10	4.5	11	14

Although there are many guidelines available, it is the usual practice to prepare, in addition, ETTs that are half a size larger and smaller than the estimated size. The tube should not fit tightly, a small leak is advisable. Always test for leak by holding a sustained pressure of about 15 cm H_2O. After intubation, always listen in both axillae and epigastric areas.

* ID internal diameter ** estimated depth of insertion

In general, the following formulae can be used for uncuffed ETTs in children:

ETT size (ID) : age(yrs)/4 + 4.5 for patients >2 years

Insertion Depth

For children over 1 year of age:
Insertion depth (cm) for orotracheal intubation= age/2+13
Insertion depth (cm) for nasotracheal intubation= age/2+15

For children under 1 year of age:
Insertion depth for orotracheal intubation= weight/2+8
Insertion depth for nasotracheal intubation=weight/2+9

Alternatively, ETT insertion depth can be guided by the depth marker on the ETT (located at the distal end of the ETT).
The ETT should be inserted until the depth marker (dense black line) is at the level of the vocal cords. The length of the ETT at the upper incisor or nostril is then noted as the depth of insertion.

Cuffed Paediatric ETT

Cuffed ETT are recommended for children >8yrs.
Under special circumstances, we may choose to use cuffed endotracheal tubes in infants and small children. These patients often require the presence of a cuffed tube to allow adequate ventilation in the face of high airway resistance and peak ventilating pressures. It is recommended to measure cuff pressure regularly (20-30cm H_2O)
We currently have cuffed ETTs from size 3-0mm ID.

In general, the following formula can be used for cuffed ETT in children:

ETT size (ID): age/4 + 3.5 (except neonates)

Microcuff ETT is a specially designed paediatric tube with a high volume low pressure cuff. They afford lower risk of airway trauma and mucosal tissue injury.

Microcuff ETT

Recommended Sizing for Children (Halyard health):

Microcuff ETT ID (mm)	Age
3.0	Term ≥ 3 kg- < 8 months
3.5	8 months- < 2 years
4.0	2 years- < 4 years
4.5	4 years- < 6 years
5.0	6 years- < 8 years
5.5	8 years- < 10 years
6.0	10 years - < 12 years
6.5	12 years- < 14 years
7.0	14 years- < 16 years

B. Laryngeal Mask Airway (LMA)

Recommended sizes are:

Size	Weight (kg)	Max cuff inflation vol (ml)
1	5	up to 4
1.5	5 - 10	up to 7
2	10 - 20	up to 10
2.5	20 - 30	up to 14
3	30 - 50	up to 20
4	50 - 70	up to 30
5	70 - 100	up to 40

Cuff recommended to be inflated up to maximum of 60 cm H_2O

ProSeal LMA

ProSeal LMA is available for use in well fasted patients with no risk of regurgitation or aspiration. Choose size as for regular LMAs.

Intubation via LMA

Patients can be intubated via LMAs.
The largest ETT & FOB that can be used with each LMA is given in the table below.

Recommended LMA , FOB and ETT Size (mm) for intubation:

LMA Size	Maximum FOB Size	Maximum ETT size
1	2.8mm	3.5mm Uncuffed
1.5	3.0mm	4.0mm Uncuffed
2	3.5mm	4.5mm Uncuffed
2.5	4.0mm	5.0mm Uncuffed
3	5.0mm	6.0mm Cuffed
4	5.0mm	6.0mm Cuffed
5	5.5mm	7.0mm Cuffed

*FOB : FiberOptic Bronchoscope

Our dept has FOB in the following sizes:

1. 2.2mm
2. 2.8mm
3. 3.6mm

The table below indicates the smallest ETT & LMA that can be used with each FOB.

FOB	Diameter(mm)	Smallest ETT	Smallest LMA
paed	2.8	3.5*	1.0
neonatal	2.2	2.5*	1.0

* snug fit- must remove ETT blue connector before railroading over FOB. FOB must be well lubricated with silicon spray.

C. One Lung Ventilation in Children (Anesth analg 1999;89;1426-9)

Recommended sizes of OLV devices in children of different age:

Age(yr)	ETT(mm)	Fogarty(F)	Arndt(F)	DLT(F)
0.5-1	3.5- 4	3		
1-2	4- 4.5	3		
2-4	4.5- 5	3	5	
4-6	5- 5.5	4- 5		
6-8	5.5- 6	4- 5		
8-10	6 cuff	4- 5	7	26
10-12	6.5 cuff	4- 5		26- 28
12-14	6.5- 7 cuff	5- 6		32
14-16	7 cuff	5- 6		35
16-18	7- 8 cuff	7	9	35

Fogarty Catheter- balloon Inflation volume & diameter

Size(F)	3	4	5
Inflation vol (ml)	0.25	0.5	0.75
Diameter (mm)	8	9	10

D. Laryngoscopes

- Straight blade (Miller and Seward): for use in neonates and those younger than 3 months old.
- Small curved blade (Magill) can be used for those older than 3 months old.
- VideoLaryngoscopes:
  Glidescope- recommended stat sizes for children

STAT Size	Body Weight
stat 0	< 1.5 kg
stat 1	1.5- 3.6 kg
stat 2	1.8- 10 kg
stat 2.5	10- 28 kg

E. Breathing Systems

Ayre's T- piece (Jackson Rees modification, Mapleson F)
Advantage: low resistance (no valves), minimal dead space and lightweight.
A pressure gauge should be used to measure ventilating pressures when ventilating on a T piece circuit.

Fresh gas flow (IPPV) :
1000 ml + 100 ml/kg BW/min for $PaCO_2$ of 36-40 mmHg
or
1000 ml + 200 ml/kg BW/min

Circle system
Advantage: conserve moisture and heat, lower gas flows may be used. More economical when using expensive inhalational agents e.g. Sevoflurane.
Can be used for spontaneous respiration or IPPV. Small diameter tubing can be used for IPPV down to neonatal patients.

F. Invasive Monitoring Lines

Disposable transducer sets are used – please let the Anaesthesia nurses know if you require a double or triple transducer set.
The following are general recommendations based on an average sized child. If the patient is smaller or larger than expected, up or downsize as appropriate.

- RADIAL Arterial lines :
  Up to 3/12 or weight<5kg :24G terumo venula
  > 3/12 or weight >5kg :22G terumo venula
  > 10yr :20G terumo venula

- FEMORAL Arterial lines:
  Leaderflex catheters are available in 22G 4cm for children < 20kg
  Leadercath catheters are available in 20G & 18G 8 cm for children >20kg

***Check lower limb perfusion after cannulation of femoral vessels*

- CENTRAL Lines

Single lumen (leadercath)

Preterm neonate	<2kg	22G 4 cm
Term neonate	2-4kg	20G 8 cm
Child		20G, 18G, 8 cm

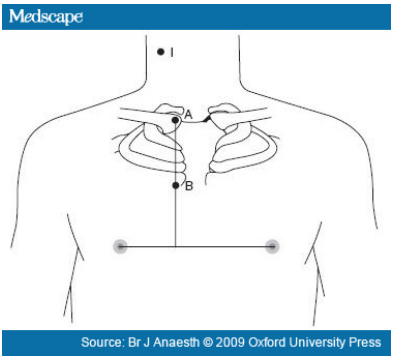
Double lumen

0-6 months	< 10 kg	4Fr, 5cm

Triple lumen

0-6 months	<10kg	4.5Fr,6cm
6 months - 12yrs	20-40kg	5.5Fr, 5cm, 8cm, 13cm
>12yrs	>40kg	7Fr, 16cm

Method for determining insertion depth of CVL



CVL tip should be positioned at junction of SVC & RA; level of carina on CXR

Two points are marked on the patient's skin during the IJV catheterization. Point A is marked at the sternal head of the right clavicle, most prominent point. Point B is marked at the midpoint of the perpendicular line from Point A to the line connecting both nipples. Point I is the insertion point of the needle. Distance from Point I to Point A and from Point A to Point B is measured. The depth of CVC is determined by adding the two measurements and subtracting 0.5 cm from this.

Practical Anatomic Landmarks for Determining the Insertion Depth of Central Venous Catheter in Paediatric Patients. H. S. Na et al. BJA 2009;102(6):820-823.

References :

- Froese AB, Rose DK. A detailed analysis of T-piece systems. In: Steward, DJ (ed.) Aspects of Paediatric Anaesthesia. Amsterdam: Excerpta Medica, 1982; 101-136.
- Lindhal SGE, Hulse MJ, Hatch DJ. Ventilation and gas exchange during anaesthesia and surgery in spontaneously breathing infants and children. Br J Anaesth 1984; 56: 121-129.
- Lisa Leong, A E. Black. The design of pediatric tracheal tubes. Paediatric Anaesthesia Vol 19, Issue supplement s1, 38-45
- Michelle C White, T Cook, P. Stoddart. A critique of elective paediatric suproglottic airway devices. Paediatric Anaesthesia Vol 19, Issue Supplement s1
- One lung ventilation strategies for infants and children undergoing video assisted thorascopic surgery. Indian J Anaesth. 2013 July-Aug; 57(4): 339-344