


Special Airway Challenges
Paediatrics

Part of Airway Management Module
Airway Module: A4-1

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Introductions



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Very quick round the room to assess stage of professional development for each participant.

General Aims

- Learn in a team setting
- Blend clinical skills with team skills
- Reflect critically on practice

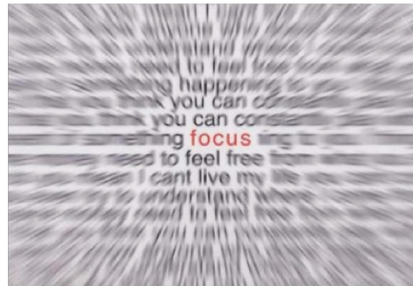
Ground Rules

- Participation
- Privacy
- Confidentiality
- Disclaimer
- Debriefing
- Mobile phones

Session Objectives

- Preparation and planning in predicted difficult airway management
- To recognise potential airway compromise
- To co-ordinate team to manage potentially difficult
- To recognise need for senior specialist help early
- To management patients in the context of available resources

Patients don't die from failure to intubate.....they die from failure to oxygenate.



DON'T GET FIXATED ON THE PLASTIC

September
2012



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Oxygenation is an absolute priority and in most cases can be achieved with simple airway manoeuvres, positioning and BVM ventilation.

This is of most importance in the RSI. The events of the Bromley case in the United Kingdom remind us of the need for situational awareness, a plan A/B and C and the need to work together in teams with effective communication to prevent poor clinical outcomes.

Emergency Department Airways

- Assessment
 - History
 - Examination
 - Look
 - Listen
 - Feel
 - Difficulty
 - BOOTS
 - LEMON
 - Available Skills
- Management Options
 - Simple airway maneuvers
 - Nasal Prongs
 - Oxygen Masks – variable and fixed
 - Airway Adjuncts
 - Bag Valve Masks
 - Non-Invasive Ventilation
 - Laryngeal Masks
 - Intubation – 7 P's
 - Surgical Airway

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This slide reviews the principles of A1, A2 and A3 which should be re-iterated in this module as a further reminder to assess the airway for difficulty, and use simple management options where required.

A reminder of the need for assessment of difficulty and the steps of the 7 P's of intubation is brief but should be given during this presentation.

— ED Intubation Checklist —

Team	Patient	IVI/Drugs
<ul style="list-style-type: none"> <input type="checkbox"/> ED Consultant aware of RSI? <input type="checkbox"/> Out-of-hours, if difficulty anticipated, anaesthetics contacted? <input type="checkbox"/> All members introduced by name & role and each briefed in turn by TL <input type="checkbox"/> Difficult intubation plan briefed? <input type="checkbox"/> Difficult airway trolley at hand? <input type="checkbox"/> Anticipated problems – does anyone have questions or concerns? 	<ul style="list-style-type: none"> <input type="checkbox"/> Pre-oxygenation optimal? <ul style="list-style-type: none"> <input type="checkbox"/> Add nasal prongs or NIV <input type="checkbox"/> Patient position optimal? <input type="checkbox"/> Patient haemodynamics optimal? <ul style="list-style-type: none"> <input type="checkbox"/> Fluid bolus? <input type="checkbox"/> Pressor? <input type="checkbox"/> Does it look like it might be difficult: <ul style="list-style-type: none"> <input type="checkbox"/> Difficult BVM? <input type="checkbox"/> Difficult laryngoscopy? <input type="checkbox"/> Difficult cricothyroidotomy? 	<ul style="list-style-type: none"> <input type="checkbox"/> Fluids connected, runs easily? <input type="checkbox"/> Spare IVC? <input type="checkbox"/> Monitor: ECG, BP, SaO₂. <input type="checkbox"/> RSI drugs drawn up, doses chosen? <input type="checkbox"/> Post-intubation anaesthesia plan - drugs drawn up? <p style="text-align: center;">Equipment</p> <ul style="list-style-type: none"> <input type="checkbox"/> Suction working? <input type="checkbox"/> BVM with ET/CO₂ connected <input type="checkbox"/> OPA and NPA available? <input type="checkbox"/> 2 x laryngoscopes working? Correct blade size? <input type="checkbox"/> Tubes chosen, cuff tested <input type="checkbox"/> Bougie or stylet in tube? <input type="checkbox"/> Tube tie or tapes ready? <input type="checkbox"/> Ventilator circuit available? <input type="checkbox"/> LMA sized & available?

Version 1.2
Developed by T Fogg, J Kennedy and J Vassiliadis, RNSH ED 20/04/2012



It is vital that during your preparation and planning phase, the whole team is aware of what will happen during the intubation attempt and what the back up plans are if there are any problems.

A good way to do this, is to have a team member go through a checklist prior to intubation.

The one illustrated here has been developed and used at RNSH. The nurse scribe reads out the above list and the medical and nursing members of the team confirm aloud to all the team members the answer to each of the above questions.

We would recommend that ED resuscitation room doctors use a checklist like the above one prior to each intubation.



The Paediatric Airway

A4.1 Special Airway Challenges



The Paediatric Airway

- Spectrum of infancy, child to adulthood
- Anatomical and physiological differences
- Increased clinician anxiety in management of the child
- Difficulty secondary to acute insults or congenital abnormalities
- Failed airway situations are very rare

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By the age of 8 yrs the paediatric airway resembles the adult, but before there are significant anatomical and physiological differences which make the airway management more challenging.

Emergency department challenges include the infrequency of performing RSI in paediatrics, the heightened anxiety in performing this procedure, the non fasted and emergent nature of the ED RSI and the challenge of involving the parents in the resuscitation process.

There is a spectrum of change which occurs from infancy through to childhood then adulthood. The difficult airway in paediatrics is a result of these anatomical and physiological challenges, acute insults such as infection, anaphylaxis or trauma or underlying congenital anomalies –known and anticipated or unanticipated precipitating an unexpected failed intubation situation (the incidence is 0.095% in all children <16 yrs with a higher incidence of 0.25% in the under 1 yr old).

In managing the acutely deteriorated paediatric airway consider the underlying cause and the treatments which may be available that may avoid the need for intubation or provide time for improved preparation and planning – an example of this is the use of dexamethasone and adrenalin nebulisation in croup.

Infants

Anatomy & physiology

- Large head, short neck & big tongue
- Large U shaped floppy epiglottis
- Cricoid narrowest at C3-4
- Carina at T4 with main bronchi at equal angles
- Lower FRC & higher VO₂

Clinical consequence

- Need stabilisation & prone to obstruction under GA
- Straight blade scope over epiglottis
- ET with leak – cuff or uncuff
- Care to avoid endobronchial intubation
- Desaturate quickly

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Here is the time to point out how the anatomical and physiological differences between the infant and adult impact on the airway management.

Anatomical differences:

Large head to body ratio- rolls around during airway manipulation- can stabilise with shoulder roll or rolls either side of head.

Large occiput, large tongue, increased soft tissue and flexible trachea - means that obstruction due to tongue falling back or causing neck flexion and tracheal obstruction occurs more readily and is remedied by Oro-pharyngeal (which should be put in with a tongue depressor the correct way and NOT turned on the soft palate) or Naso-pharyngeal airway.

The large tongue makes intubation more tricky, moving tongue out of way when placing scope on right hand side of mouth will improve the view.

Floppy U shaped epiglottis and anterior larynx means a straight blade over epiglottis is technique of choice when intubating babies.

Cricoid narrowest at C3-4 means to use uncuffed or cuffed ET with leak around this area is best. The conical shape of the larynx affects the airway based on the Hagen-Poiseuille law of flow proportional to the fourth power of the radius – such that any swelling in a small cylinder has major implications for flow. (Hagen-Poiseuille law states that $Flow = \frac{P \times r^4}{8 \times \eta \times L}$ viscosity x length of tube.) Therefore airway odema in a small tube has much more significant implications than in a larger tube. Consider the effect of the virus causing croup on the paediatric airway and cough vs that of the adult with the same virus.

If cuffed endotracheal tube used, it is half a size smaller than the uncuffed, the cuff

Airway Differences

Figure 26: Pediatric Airway
Anatomy of pediatric airway

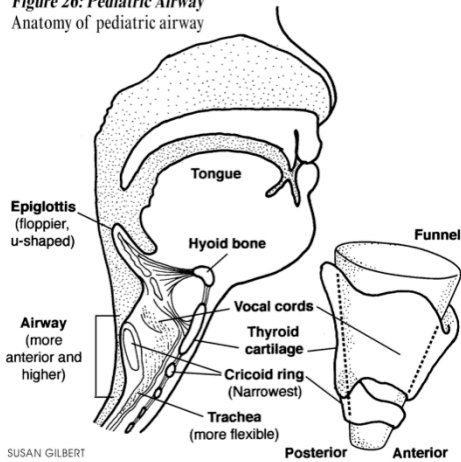
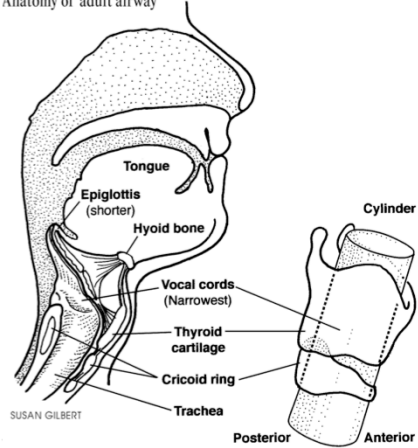


Figure 27: Adult Airway
Anatomy of adult airway



This is a diagram which helps to explain some of the above points on the anatomical differences.

Equipment



- Sizes are age specific
- Consider using formula to calculate or aids
- Broselow charts and trolley increase speed of preparing equipment

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It is important to remember that there are different sizes of equipment for different size children. There are charts such as the Broselow chart which can aid in quickly identifying the equipment required for paediatric resuscitation.

1. Masks - current clear masks with cushion to allow good seal, clear is preferable as can see misting, lip-colour, secretions and vomit .Size up on child prior to commencement of induction.

2. Laryngoscopes - miller straight blade vs macintosh curved blade. There are different techniques for each blade. Straight blade goes over top of epiglottis and lifts it for view of larynx vs macintosh goes in vallecula of epiglottis and lifts.

in summary of blades suitable for diff ages:

Age	Wt(kg)	Blade
Prem-newborn	1-3	Miller 0
1 month-2yrs	3.5-12	Miller 1
3-6	15-20	Miller 2 & Mac 2 (>5yrs)
6-12	20-35	Miller 2 or Macintosh 2-3

The Paediatric Airway

- Preparation and Planning
 - Appropriate Staff available
 - Articulate Plan A, B and C
- Pre-oxygenate and Position
 - Consider the anatomical variations
- Paralyse and Place ETT
- Post Intubation Care
- Don't forget the PARENTS!
- Disposition – early NETS involvement

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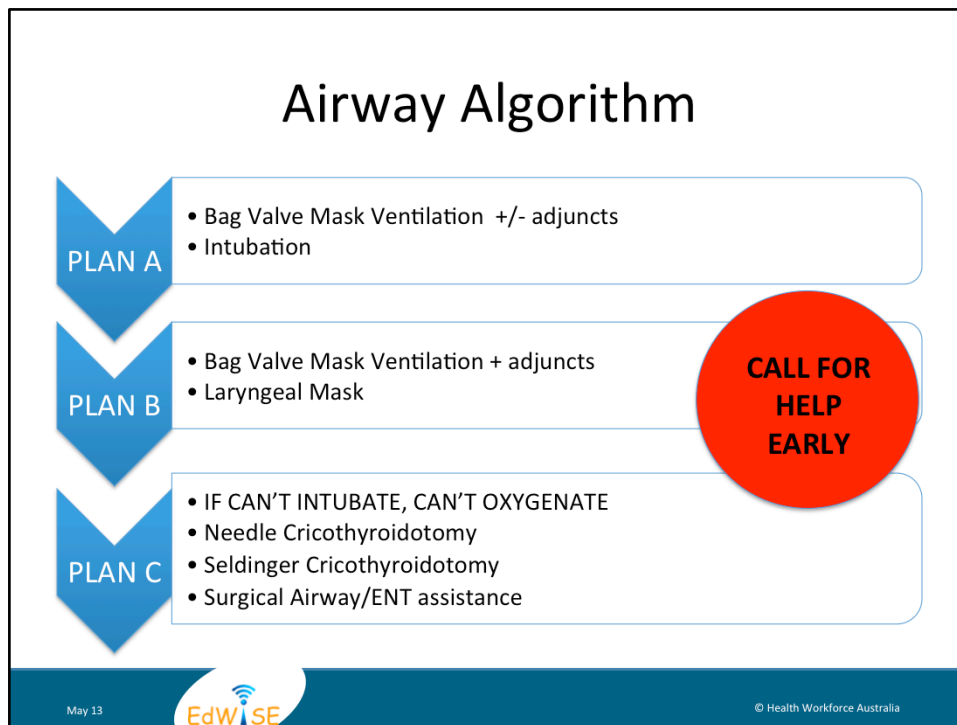
The 7 P's of intubation apply in the paediatric population, with the addition of the parents who should be considered in the context of any paediatric case management.

It remains important to articulate the failed intubation drill and prepare the equipment for any failure of this procedure.

In the event of failed intubation, Plan B is commonly to attempt insertion of a laryngeal mask (LMA) if this fails then jet insufflation may be performed in children over 8 years of age, a surgical cricothyrotomy is preferred in all ages but in neonates and small children a surgical incision of neck followed by a cannula cric may be the least damaging.. (note the reference which is different from the APLS guidelines)

Pre-oxygenation should be performed again for nitrogen wash out, being aware that these children can wriggle and be distressed with this and may require a small dose of sedation to perform this in the emergency department. If adequately breathing then can also use 15l/min via NRB.

The drug doses which are required in children should be calculated on a weight based formulae. Suxamethonium is the paralytic of choice in the emergency department and a higher dose of 2mg/kg is required. If needed a repeat dose can be used but often itself causes bradycardia and atropine administered preemptively. Other medications including atropine and normal saline boluses should be available in case of bradycardia or hypotension during the procedure. Sedatives are given based on local practice and familiarity often fentanyl, midazolam, thiopentone, ketamine or



1. It is important to highlight the need for basic interventions and the call for help early in all paediatric airways.
2. All Plans should be articulated to the team during the pre-RSI brief and the location and availability of both back up and equipment confirmed.
3. If the next step in the progression is not able to be performed it is essential to take a step back and use the previous component that worked – ie if BVM worked go back to that.
4. It is important to note that Preparation and planning are the most important steps in the prevention of unexpected difficulty and if there is anticipated difficulty then expert help should be rapidly requested.

PLAN A:

BVM ventilation

Difficult ventilation in paediatrics is very unusual, in the order of 0.02% (compared with adults of up to 0.15%).

When performing BVM ventilation, ensure that adequate anaesthesia and paralysis have occurred and the correct size mask is used, if having difficulty

Give 100% and call for help then do following steps:

Step 1 - optimise head position (Shoulder roll if <2, neutral >2yrs)+ airway opening manouvers, check equipment and ensure adequate depth of anaesthesia. Use 2 person BVM.

Summary

- Paediatric Airway management should be rehearsed regularly
- Weight based sizes and doses can be quickly found in charts and tables
- Oxygenation can be achieved through adequate positioning and adjuncts
- Preparation and Planning are paramount to rapid sequence induction

References

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- Advanced Paediatric Life Support Manual, 5th Edition
- Emergency Airway Management, 4th Edition, Published by Lippincott Williams and Wilkins, Ron M Walls and Michael F. Murphy editors 2012
- The Difficult Airway Society Guidelines on Difficult Paediatric Airway, 2012

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