Managing the unexpected difficult paediatric airway

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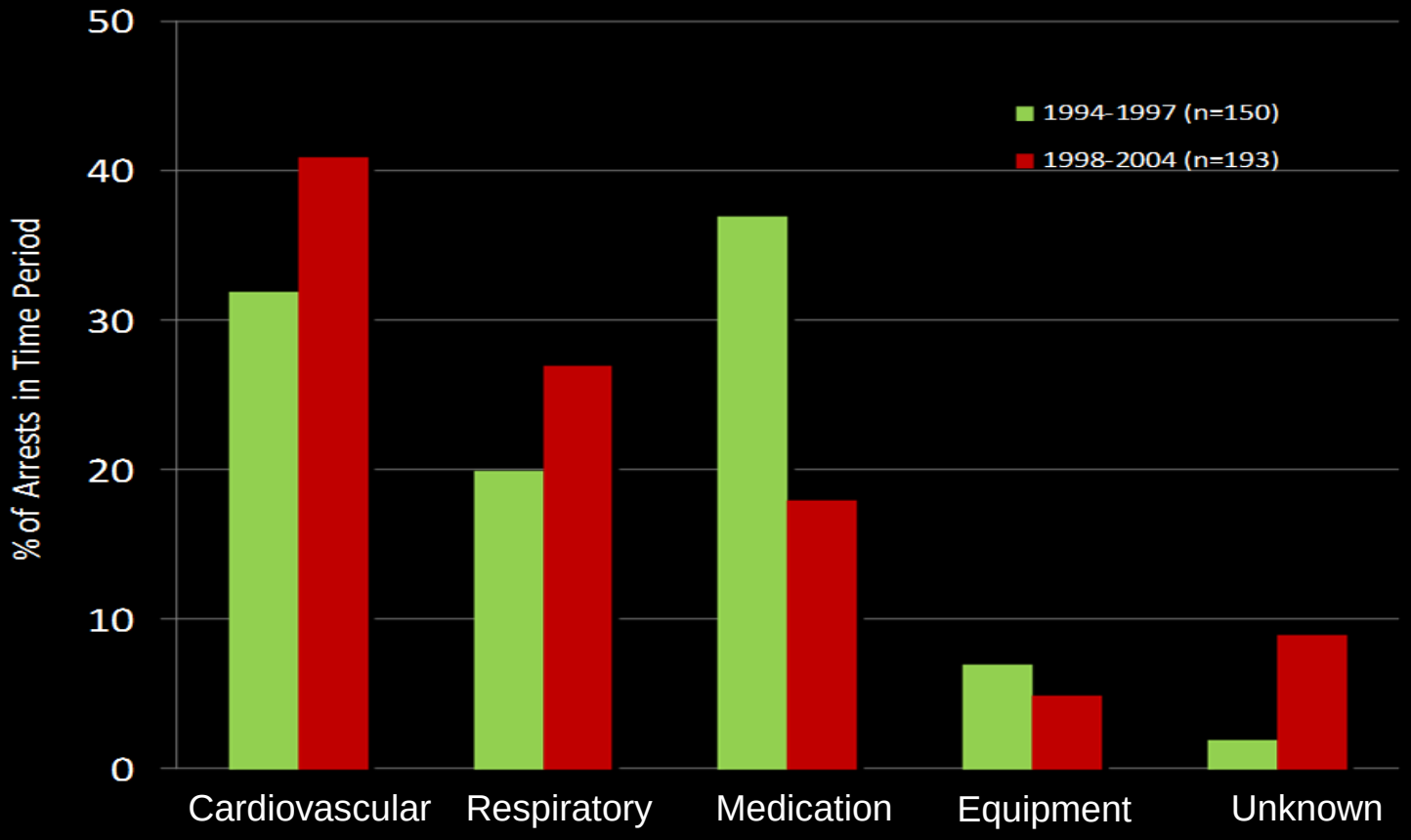
Managing the unexpected airway

Outline

- Epidemiology
- Classification and recognition of difficult airway
- Airway obstructions
- ‘Must-haves’ equipment
- What if…

Epidemiology- Morbidity & Mortality

- Facts
  - Significant cause for peri-operative cardiac arrests

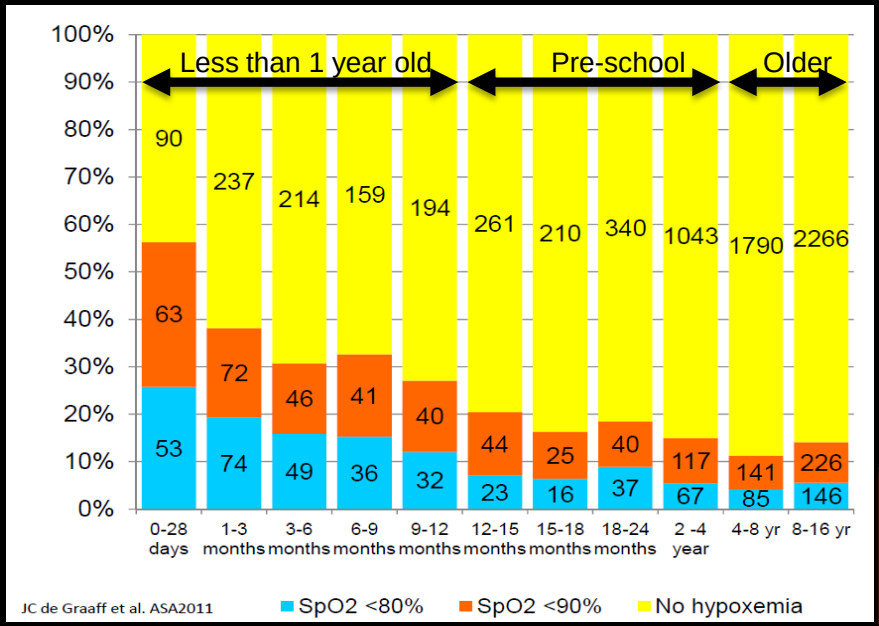


Anesth Analg 2007; 376:773

Epidemiology- Morbidity & Mortality

- Facts
  - Significant cause for peri-operative cardiac arrests
  - Younger children are at higher risk

	Problems in the OR			Problems in the PACU		
Age (n)	0-1 yr (3,681)	1-7 yr (12,495)	8-16 yr (6,867)	0-1 yr (3,681)	1-7 yr (12,495)	8-16 yr (6,867)
Bronchospasm	5	2	0.5	1	0.8	0.7
Hypercapnia	2	0.8	0.1	1.3	0.4	1
Desaturation	15	7	3	5.7	2.7	2
Inhalation	0.5	0.3	0.5	0.2	0.4	0.4
Laryngospasm	4.6	2.3	1.3	0.2	0.4	0.5
Pulmonary edema	0	0	0.3	0.3	0.7	1
Respiratory depression	-	-	-	3	1.3	1.4
Cardiac arrest	1	0.1	0.3	0	0	0
Bradycardia	3	0.7	1.4	*Paediatr Anaesth 2004; 14:158*		



Anaesthesia information management system (AIMS): 8277 non-cardiac records 1999- 2005 (Utrecht)

Epidemiology- Morbidity & Mortality

- Facts
  - Experience counts

Airway management
LMA 60 %
Tracheal tube 31%
Face Mask 9%

Bronchospasm	Univariate						Multivariate (n=9256)	
	Yes		No		RR (95% CI)	p value	RR (95% CI)	p value
	Total	Value	Total	Value				
Anaesthesia								
Airway managed by registrar	6219	171 (3%)	3078	22 (1%)	3·85 (2·47–5·98)	<0·0001	..	..

Laryngospasm	Univariate						Multivariate	
	Yes		No		RR (95% CI)	p value	RR (95% CI)	p value
	Total	Value	Total	Value				
Anaesthesia								
Airway managed by registrar	6219	290 (5%)	3078	61 (2%)	2·35 (1·79–3·09)	<0·0001	..	..

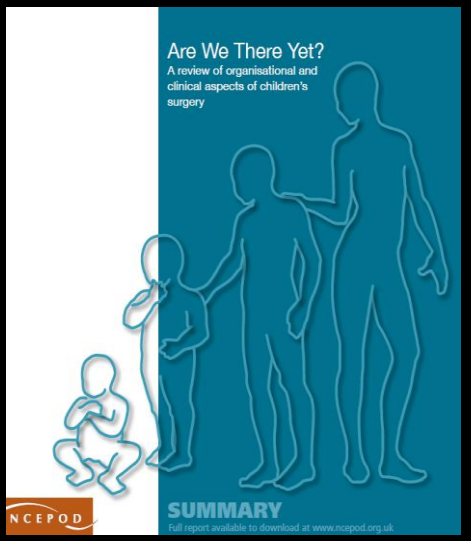
Lancet 2010; 376:773

Epidemiology

- Recent relevant UK studies
  - NAP 4
    - Largest database of airway problems
    - Children limited (13 reports, 3 deaths)
    - Unknown denominator

http://www.rcoa.ac.uk/nap4

Epidemiology



- Recent relevant UK studies
  - NAP 4
  - NCEPOD
    - Limited information of airway M&M
    - Only mentioned in specific care reviews – NEC
    - NEC -responsible for 1/3 of all deaths (597 over 2 years, England)
    - Airway related problems identified in room for improvement:

http://www.ncepod.org.uk/2011sic.htm

APRICOT

Anaesthesia Practice In Children Observational Trial

Epidemiology of severe critical events

JOIN THE NETWORK

Visit us at the booth

ESA Clinical Trial Network

Euroanaesthesia 2013

research@esahq.org

European Society of Anaesthesiology ESA

Epidemiology

Elsewhere in a place near you …

Adverse events in 39% of all patients

Endotracheal intubation in the pediatric emergency department

Elliot Long[1,2,3], Stefan Sabato[2,4] & Franz E. Babl[1,2,3]

1 Department of Emergency Medicine, Royal Children's Hospital, Parkville, Vic., Australia

Table 3 Success rate by intubator specialty and seniority for each intubation attempt *n* (%)[a]

	Success rate for intubation attempt no. 1	Success rate for intubation attempt no. 2	Success rate for intubation attempt no. 3
ED Consultant	12/17 (71)	5/6 (83)	2/2 (100)
ED Fellow	4/6 (67)	1/1 (100)	0
ED Registrar	18/22 (82)	1/2 (50)	0
ICU Registrar	17/22 (77)	1/4 (25)	2/2 (100)
Anesthetic Consultant	1/1 (100)	1/1 (100)	0
Anesthetic Registrar	2/3 (67)	1/2 (50)	1/1 (100)

Table 5 Adverse events during tracheal intubation

Adverse event	*n* (%)
Hypotension	15 (21)
Desaturation	10 (14)
Bradycardia	5 (7)
Second dose paralytic	3 (4)
Esophageal intubation	1 (1)
Endobronchial intubation	1 (1)
Equipment failure	1 (1)
Medication error	1 (1)
Vomit with aspiration	1 (1)

Pediatr Anesth 2014; 24:1204

Classification

Suggested classification to approach

- Unexpected — Difficult normal airway
- Suspected — Impaired normal airway
- Expected — Known difficult airway

Current Opinion Anesthesiology 2012; 25: 326

Approaches – unexpected

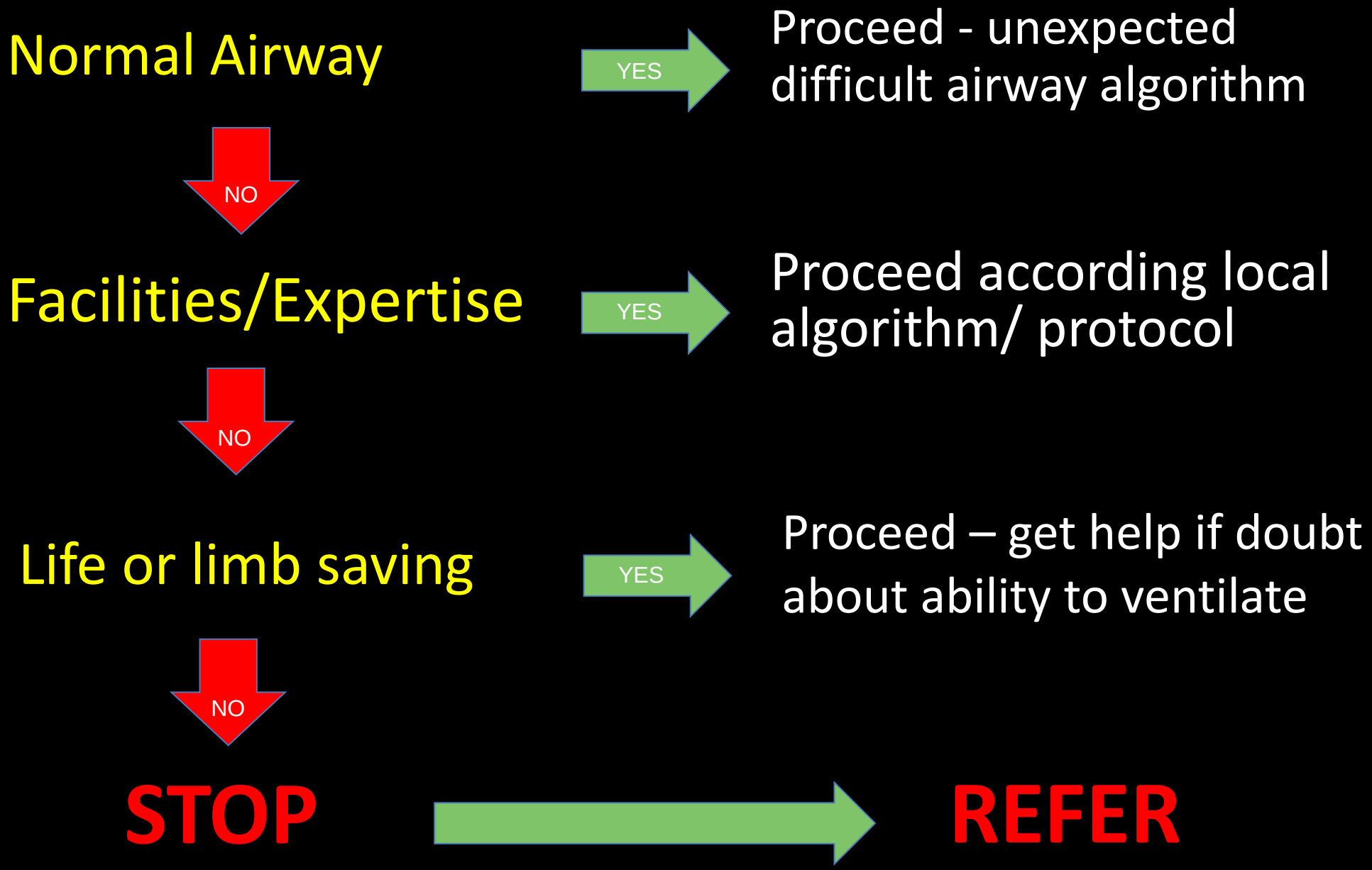
- Encountered on a daily basis
- Usually healthy children, no sign & symptoms
- Time critical – ‘reflex’ like approach
- Algorithm required – ‘open box’

Approaches - suspected

- Less common
- Pathology
  - Infectious
  - Allergic
  - Mechanical (foreign body, bleeding tonsil)
- Most children tolerate a certain delay to allow
  - Resuscitation
  - Organisation and preparation

Approaches - expected

- Rare
- Usually elective
- Pathology
  - Congenital (syndromes)
  - Acquired (scars, burns)
- Only in specialized hospitals with appropriate expertise
  - Long list of special tricks (no evidence base)
  - ENT help for expected/ compromised ventilation problems


Normal Airway
YES
Proceed - unexpected difficult airway algorithm
NO
Facilities/Expertise
YES
Proceed according local algorithm/ protocol
NO
Life or limb saving
YES
Proceed – get help if doubt about ability to ventilate
NO
STOP
REFER

Prediction of a difficult paediatric airway

Mallampati X

Cormack-Lehane X

Mouth opening
Soft tissues
Thyro-mental distance
Shape and size
Flexion/extension

ALWAYS SOMETHING

Prediction of a difficult paediatric airway

- Mouth opening
- Soft tissues
- Thyro-mental distance
- Shape and size
- Flexion/extension

Prediction of a difficult paediatric airway

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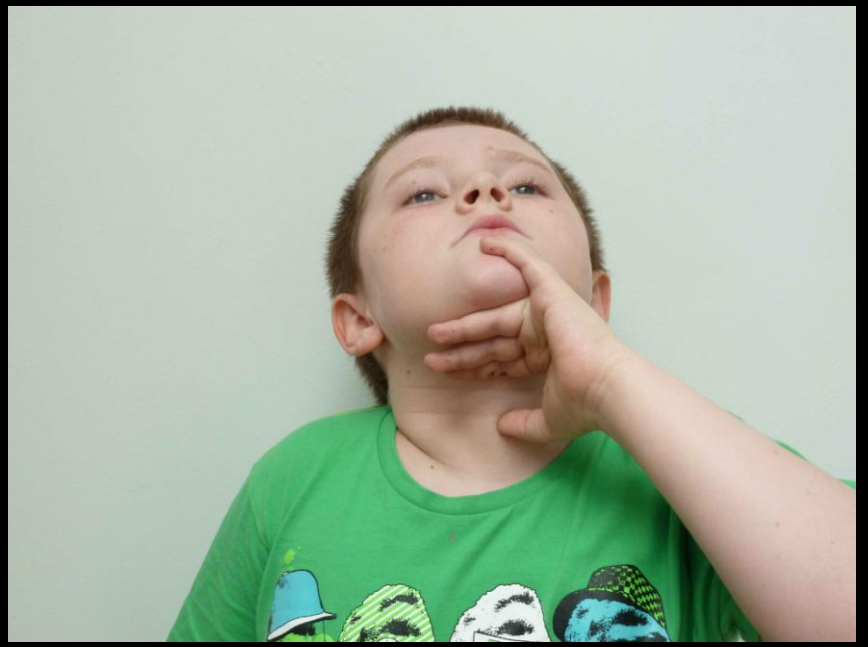


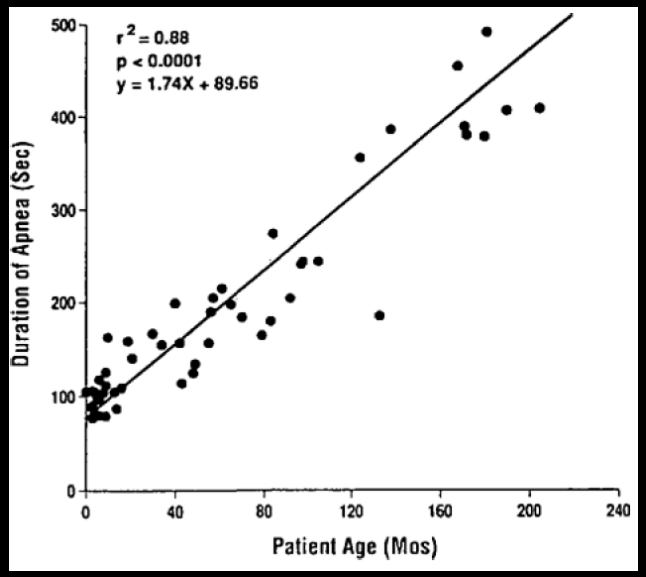
Shape and size (maxilla and mandibula)

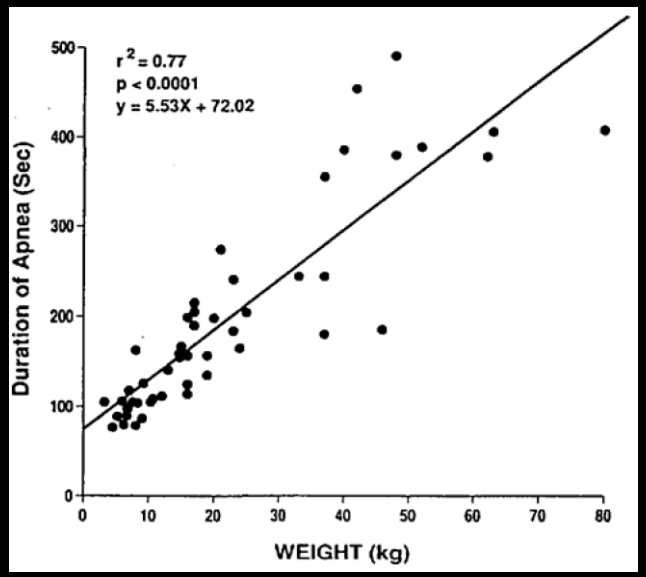
- Congenital abnormalities
  - Mandibular /midface hypoplasia
  - Hemifacial abnormalities
  - Craniosynostosis
  - Ear anomalies

Prediction of a difficult paediatric airway

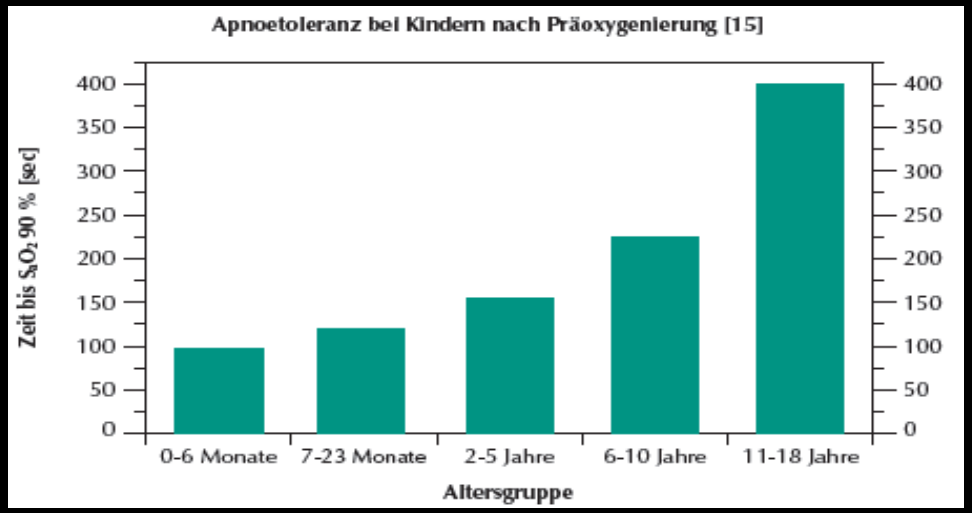
- Mouth opening
- Soft tissues
- Thyro-mental distance
- Shape and size
- Flexion/extension

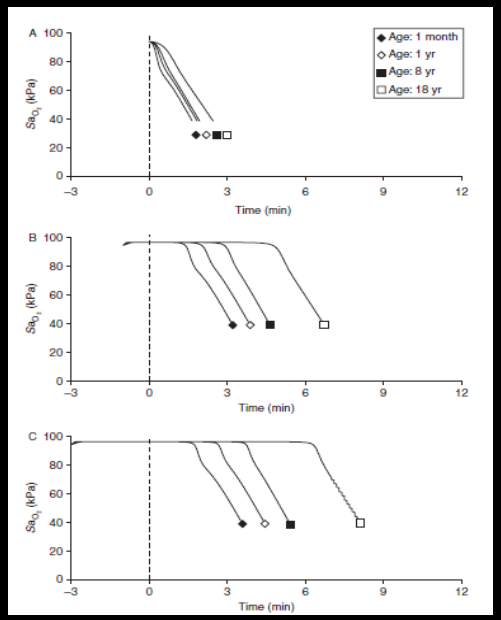
Airway obstructions

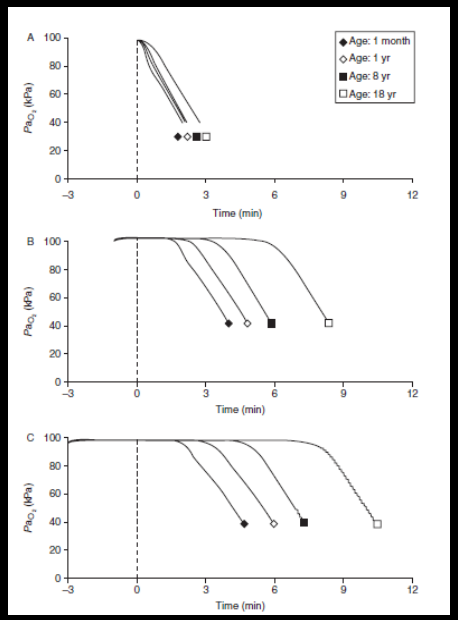




Can J Anaesth 1994; 41:771







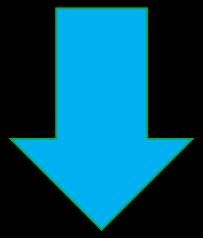
Br J Anaesth 2006; 97:564

Airway obstructions

Anatomical

Causes

- Inadequate head position
- Poor facemask technique
- Large adenoids/ tonsils/ obesity
- Secretions



SKILL

Functional

Causes

- Inadequate anaesthesia
- Laryngospasm
- Muscle rigidity
- Bronchospasm

DRUGS

Airway obstructions

Anatomical

Causes

- Inadequate head position
- Poor facemask technique
- Large adenoids/ tonsils/ obesity
- Secretions

Treatment

- Repositioning/ re-opening/ Guedel
- Two-hand/ two person technique
- Suction

Functional

Causes

- Inadequate anaesthesia
- Laryngospasm
- Muscle rigidity
- Bronchospasm

Treatment

- Deepen anaesthesia
- Muscle relaxation
- Epinephrine

Airway obstructions

Functional Airway Obstructions

Causes

- Inadequate anaesthesia
- Laryngospasm
- Muscle rigidity
- Bronchospasm

Treatment

- Deepen anaesthesia
- Muscle relaxation
- Epinephrine

'Even if it was not part of the initial airway management strategy, if CICV occurs and waking the patient up is not an option, a muscle relaxant should be given before determining the need to proceed to a surgical airway.'

Airway obstructions

Really difficult airway in normal children

- Difficult face mask ventilation
  - 2/8,836 (Tong, 2007)
  - 2/19,50[illegible] (Schmitt, 2008)

Extremely rare (and usually predictable)

PARALYZE

GOOD NEWS

Never impossible to oxygenate and ventilate !

Classification

Suggested classification to approach

- Unexpected — Difficult normal airway
- Suspected — Impaired normal airway
- Expected — Known difficult airway

Anatomical and functional airway obstructions occur in all situations

Current Opinion Anesthesiology 2012; 25: 326

Managing the unexpected airway

‘Must-haves’ equipment

- Scarce resources
- Safe paediatric anaesthetic practice ≠ expensive
- ‘Scaled down versions’
- Equipment chosen based on algorithms (open-box)
- Dedicated and sealed, regularly checked, training

Managing the unexpected airway

What if…

Managing the unexpected airway

Consider this:

Trachea is small, elastic, moves and collapses on palpation

- > Trachea is difficult to localize and compressible

And now this:

Managing the unexpected airway

Really difficult airway in normal children

- Difficult face mask ventilation

  2/8,836 (Tong, 2007)

  2/19,500 (Schmidt, 2008)

Extremely rare (and usually predictable)

Never impossible to oxygenate and ventilate !

Recognize and treat: Anatomical and functional airway obstructions

Take Home Messages

- Airway problems in children are common and carry significant morbidity and mortality
- Distinction:

  Anatomical versus Functional airway obstructions
- Experience/ training counts

Thanks to

Markus Weiss, Zurich

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