Paediatric Difficult Airway

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We know

- The incidence of difficult airway in healthy children is low
  - Most common physical finding in childer with difficult airway and independent risk factor for adverse events during airway management is short thyromental distance or micrognathia

- Unexpected difficult bag-mask ventilation 2,8…7%
  - Only significant risk factor is decreasing age

- Most difficult airways are rarely unanticipated
  - Craniofacial syndromes, dysmorphic features

Jagannathan N et al. Difficult airway management: children are diferent from adults, and neonates are diferent from children! BJA, 126 (6): 1086-1088 (2021)

Classification

- Normal difficult or difficult normal airway
- Normal impaired or impaired normal
- Real difficult or challenging

Table 1: Syndromes in children associated with difficult airways with key airway features observed	
Syndrome	**Airway Features**
Pierre Robin sequence	Micrognathia; glossoptosis (backward displacement of tongue); airway obstruction at rest; and improves with age
Treacher Collins	Micrognathia; limited mouth opening; airway obstruction at rest; and worsens with age (in spite having mandibular distraction)
Goldenhar syndrome	Micrognathia; hemifacial macrosomia; occipitalization of atlas; and limited mouth opening
Mucopolysaccaridoses (Hunter's and Hurler's syndromes)	Accumulation of mucopolysaccharides in various tissues, including airway; short, immobile neck; cervical instability, airway obstruction at rest; difficult mask ventilation and tracheal intubation; and worsens with age
Apert syndrome	Midface hypoplasia; possible choanal stenosis; progressive calcification of cervical spine; and airway obstruction
Down syndrome	Macroglossia; atlantoaxial instability; and pharyngeal hypotonia
Crouzon syndrome	Midface hypoplasia; maxillary hypoplasia; short neck; and restricted neck movement
Pfeiffer syndrome	Midface hypoplasia and airway obstruction
Klippel-Feil syndrome	Fusion of variable number of cervical vertebrae and limited neck movement
Beckwith-Wiedemann syndrome	Macroglossia
Freeman-Sheldon syndrome	Circumoral fibrosis and microstomia

Huang et al. Management of the difficult paediatric airway. Indian Journal of Anaesthesa/63/6/2019

Normal difficult

- Unexpe
- No obv
- Extrem
  paediat

Classification

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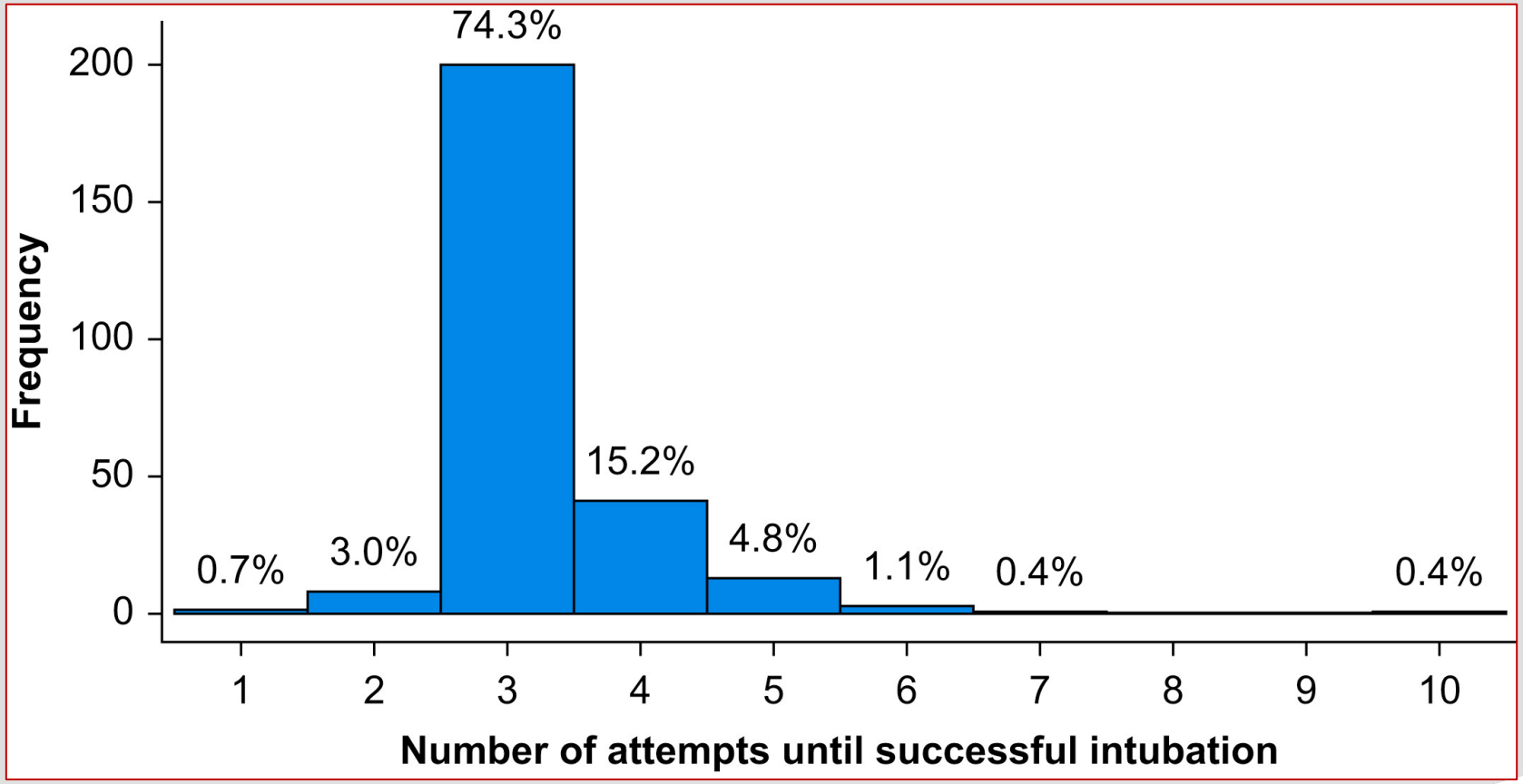
NECTARINE

5,8%

2/3 unexpected

98%



Difficult tracheal intubation in neonates and infants. British Journal of Anaesthesia, 126 (6): 1173e1181 (2021)

NECTARINE

Table 4 Specification of intervention for difficult intubation.

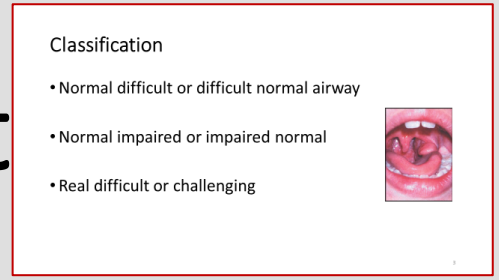
	n (%)
Change of laryngoscope blades	117 (43.2)
Help from otolaryngologist or second senior anaesthesiologist	89 (32.8)
Use of stylets or bougie	87 (32.1)
Use of video-assisted intubation	35 (12.9)
Use of fibreoptic bronchoscopy	13 (4.8)
Blind intubation	12 (4.4)
Rigid bronchoscopy	3 (1.1)
Use of air-track	3 (1.1)
Other	10 (3.7)

8% bradycardia

40% SpO2<90%

Difficult tracheal intubation in neonates and infants. British Journal of Anaesthesia, 126 (6): 1173e1181 (2021)

Normal difficult- neonates and infant



- Incidence of difficult tracheal intubation is higher in neonates and infants than in older children (3,5…5% vs 0,06…1,1%)
- Unexpected difficult intubation may occur more frequently than in older children
- Incidence of hypoxaemia associated with tracheal intubation is higher than in older children
- Success rate of tracheal intubation for the first attempt with conventional direct laryngoscope is extremely low (3%)

Jagannathan N et al. Difficult airway management: children are diferent from adults, and neonates are diferent from children! BJA, 126 (6): 1086-1088 (2021)

Guidelines for infants?

Weight (kg)	THRIVE flow rates
0–12	2 L/kg/min
13–15	30 L/min
16–30	35 L/min
31–50	40 L/min
>50	50 L/min

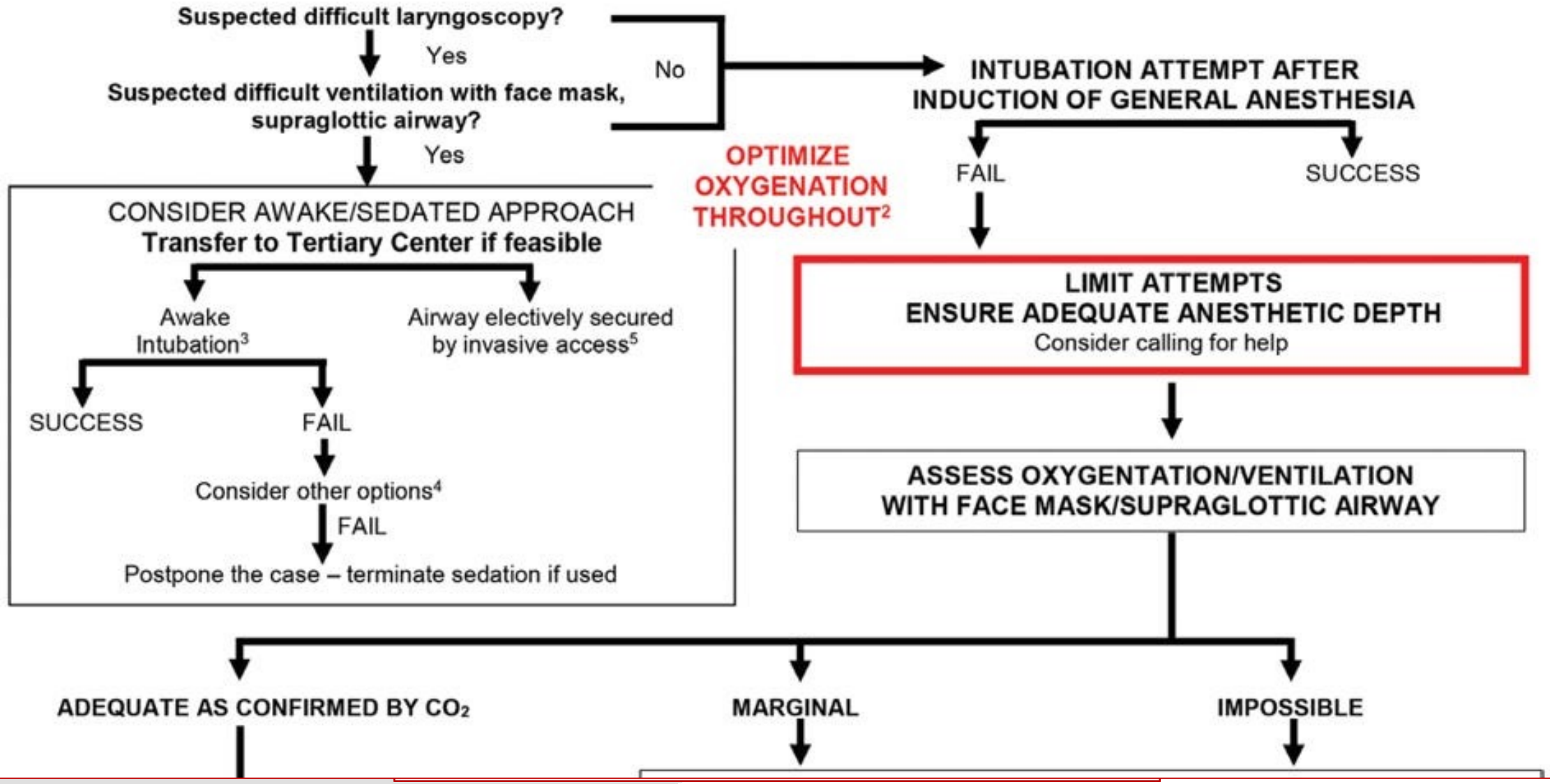
THRIVE, transnasal humidified rapid-insufflation ventilatory exchange.

- Management strategies are the same
- Videolaryngoscopy
  - In adults success rate at the first attempt is high (90.99%)
  - In small children 30% at the first attempt, with 70% eventual success
- Increased risk of oxygen desaturation
  - Forses to abandon intubation attempts—multiple attempts—increasing risk of additional complication
  - Apnoeic oxygenation (HFNC/THRIVE) to minimise interruption
    - Apnoeic oxygenation techniques should be standardized in all anticipated and unanticipated intubation difficulties in paediatrics

Transnasal Humidified Rapid Insufflation Ventilatory Exchange in children requiring emergent intubation (Kids THRIVE): A protocol for a randomised controlled trial. BMJ Open, 2019, 9

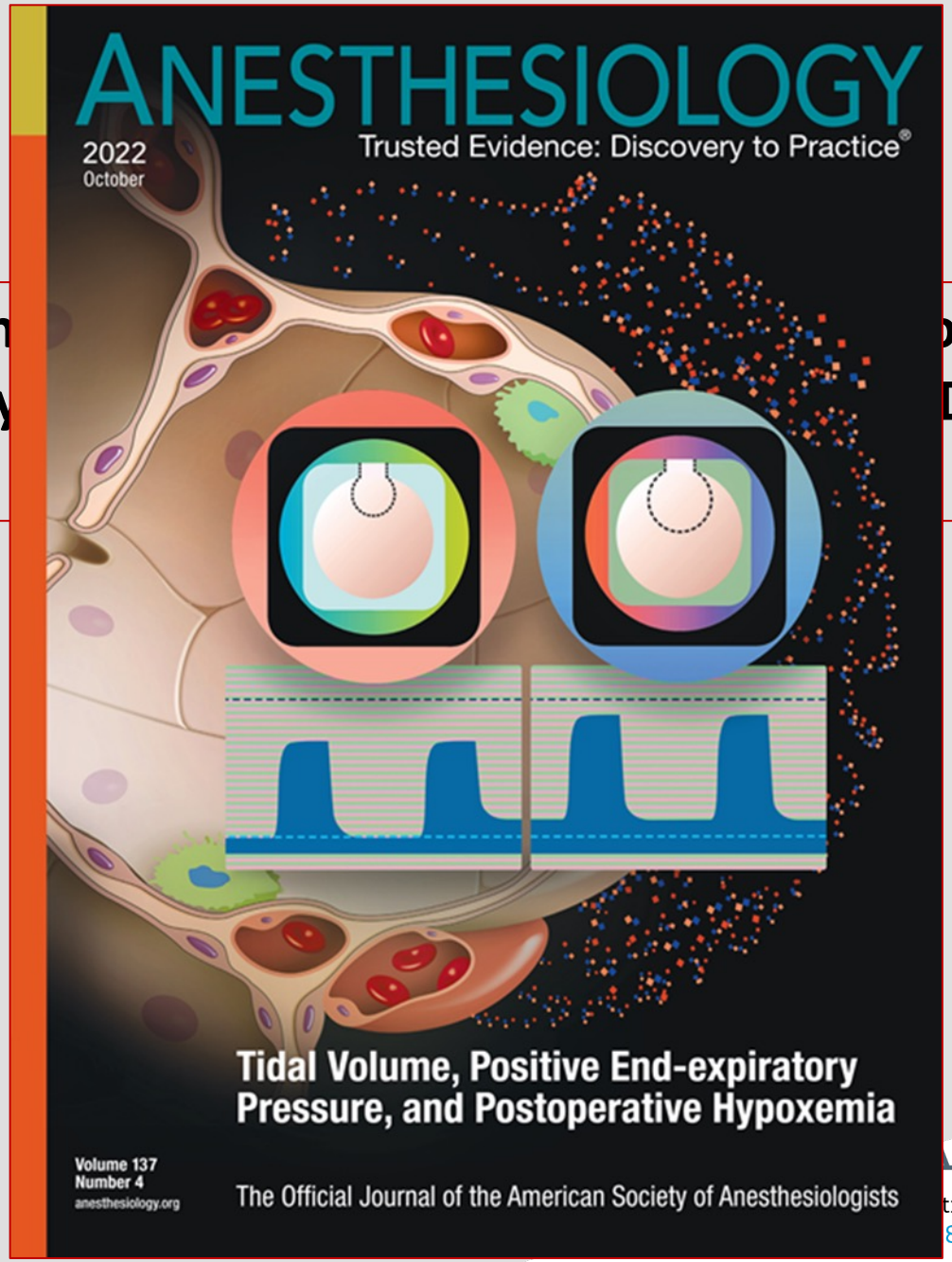
ASA DIFFICULT AIRWAY ALGORITHM: PEDIATRIC PATIENTS

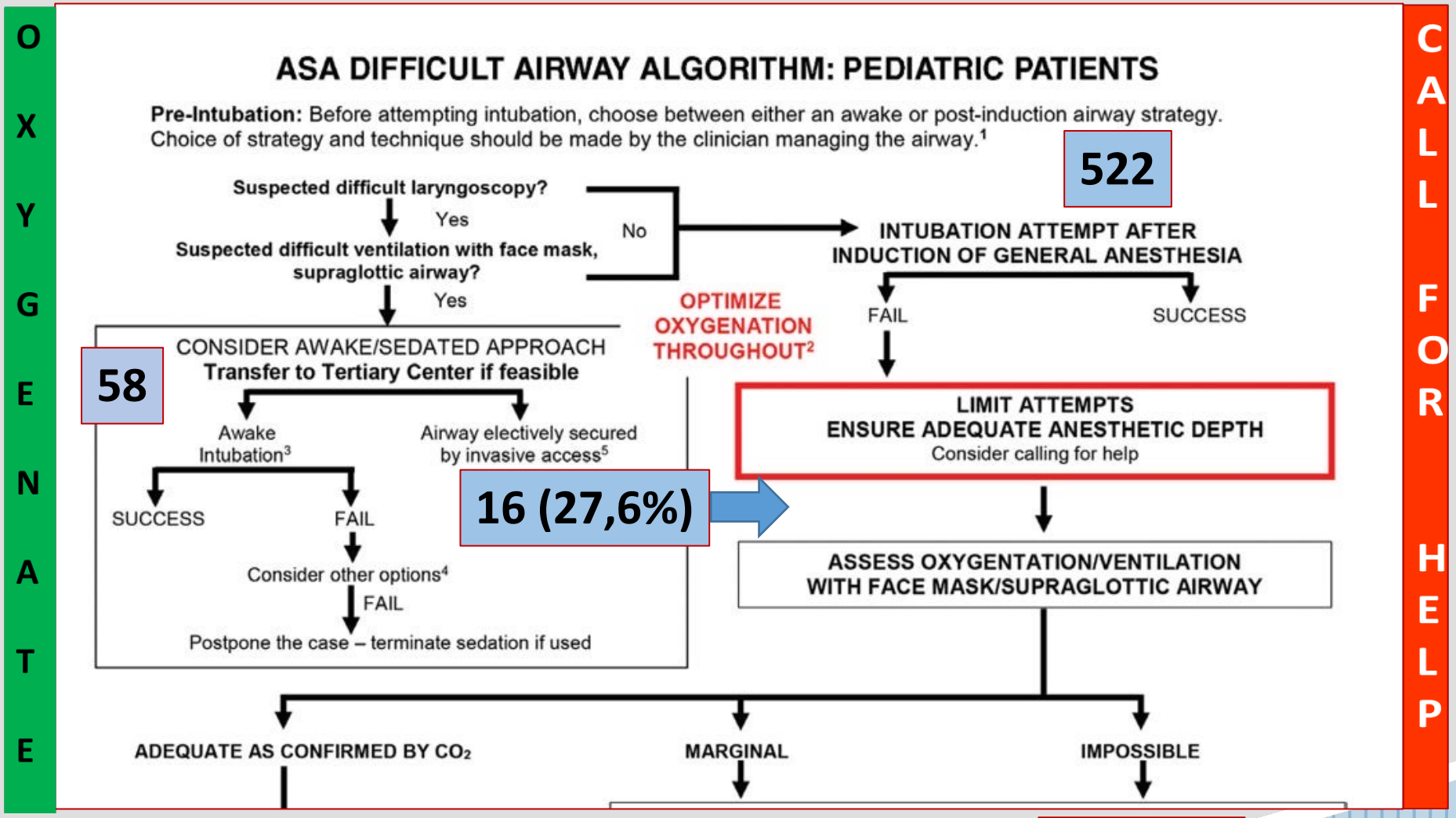
Pre-Intubation: Before attempting intubation, choose between either an awake or post-induction airway strategy. Choice of strategy and technique should be made by the clinician managing the airway.[1]



Sedation *versus* Gen
with Difficult Airway
Intubation Registry

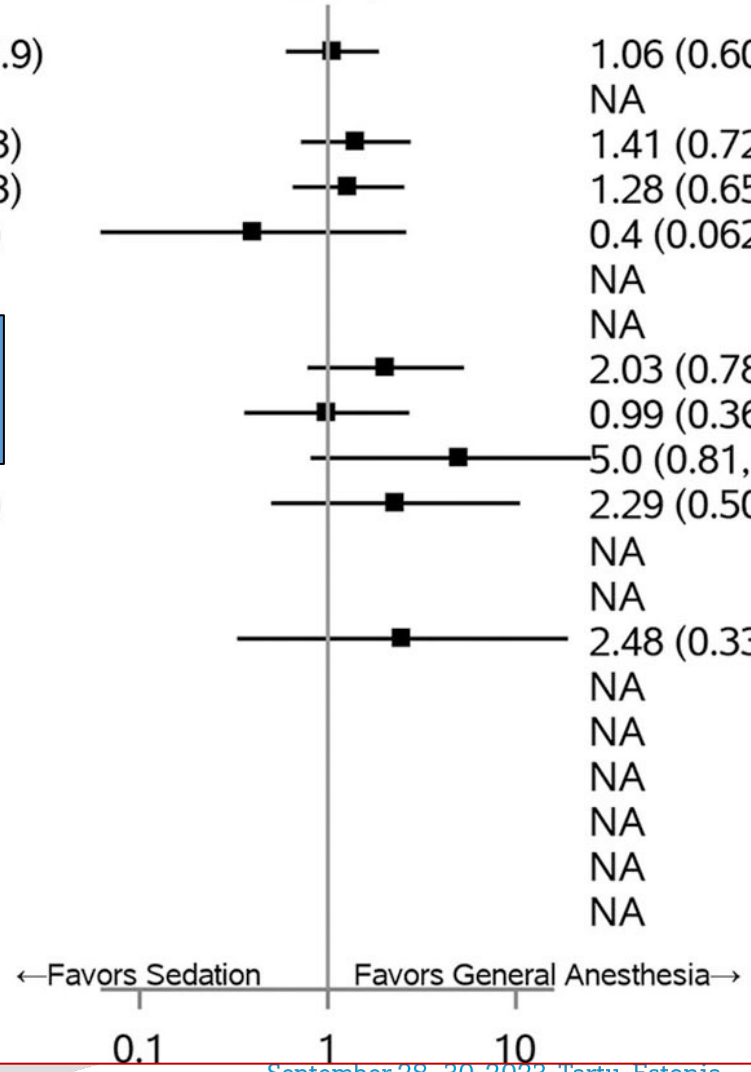
on in Children
Difficult




OXYGENATE
CALL FOR HELP
ASA DIFFICULT AIRWAY ALGORITHM: PEDIATRIC PATIENTS
Pre-Intubation: Before attempting intubation, choose between either an awake or post-induction airway strategy. Choice of strategy and technique should be made by the clinician managing the airway.[1]
522
Suspected difficult laryngoscopy?
Yes
No
Suspected difficult ventilation with face mask, supraglottic airway?
Yes
INTUBATION ATTEMPT AFTER INDUCTION OF GENERAL ANESTHESIA
FAIL
SUCCESS
OPTIMIZE OXYGENATION THROUGHOUT[2]
58
CONSIDER AWAKE/SEDATED APPROACH
Transfer to Tertiary Center if feasible
Awake Intubation[3]
Airway electively secured by invasive access[5]
SUCCESS
FAIL
Consider other options[4]
FAIL
Postpone the case – terminate sedation if used
16 (27,6%)
LIMIT ATTEMPTS
ENSURE ADEQUATE ANESTHETIC DEPTH
Consider calling for help
ASSESS OXYGENTATION/VENTILATION WITH FACE MASK/SUPRAGLOTTIC AIRWAY
ADEQUATE AS CONFIRMED BY CO_2
MARGINAL
IMPOSSIBLE
6 (2+4)

Outcomes n (%)	Sedation (n=58)	General Anesthesia (n=522)	Odds Ratio (95% Confidence Interval)	p value
First-attempt success	28 (48.3)	250 (47.9)	1.06 (0.60, 1.87)	0.846
Failed intubation	0 (0.0)	6 (1.1)	NA	NA
Complications overall (missing=1)	15 (25.9)	90 (17.3)	1.41 (0.72, 2.76)	0.323
Nonsevere complications	14 (24.1)	90 (17.3)	1.28 (0.65, 2.55)	0.478
Minor airway trauma	1 (1.7)	20 (3.8)	0.4 (0.062, 2.61)	0.34
Esophageal intubation with immediate recognition	0 (0.0)	7 (1.3)	NA	NA
Epistaxis	0 (0.0)		NA	NA
Pharyngeal bleeding	8 (13		2.03 (0.78, 5.3)	0.146
Hypoxemia	6 (10		0.99 (0.36, 2.71)	0.977
Bronchospasm	3 (5.2)		5.0 (0.81, 31.5)	0.083
Laryngospasm	2 (3.4)	12 (2.3)	2.29 (0.50, 10.5)	0.283
Vomiting	0 (0.0)	1 (0.2)	NA	NA
Arrhythmia	1 (1.7)	1 (0.2)	NA	NA
Severe complications	2 (3.4)	4 (0.8)	2.48 (0.33, 18.9)	0.381
Major airway trauma	1 (1.7)	2 (0.4)	NA	NA
Esophageal intubation with delayed recognition	0 (0.0)	0 (0.0)	NA	NA
Aspiration	0 (0.0)	0 (0.0)	NA	NA
Pneumothorax	0 (0.0)	0 (0.0)	NA	NA
Cardiac arrest	1 (1.7)	2 (0.4)	NA	NA
Death	0 (0.0)	0 (0.0)	NA	NA

37%



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ÄRKVEL/SEDATSIOONIS INTUBATSIOON LASTEL

OKSÜGENEERIMINE

- HFNO varakult
- <1a 2L/kg/min; kuni 30kg 30L/min; kuni 50 kg 40L/min
- Jätka kogu protseduuri jooksul

TUIMASTAMINE

- Lidokaiin 2% sprei neelu ja keelepärale
- Lidokaiin 1% atomisaatoriga ninna
  - Lidokaiini maksimum doos 4…5mg/kg (süsteemse toksilisuse oht)
  - Lidokaiin 1% valmis läbi bronhoskoobi häälepaeltele pritsimiseks
  - Lidokaiini geel intubatsioonitorule

PROTSEDUURI TEOSTAMINE

- Sobiva intubatsioonitoru valik ja bronhoskoobi läbitavuse kontroll (+2 väiksemat suurust, mansetiga ja ilma)
- Atropiini manustamine 0,02mg/kg
- Suuremal lapsel istuv asend
- FB: protseduuri teostaja seisab näoga patsiendi poole
- VL: protseduuri teostaja seisab tavapäraselt patsiendi taga
- Veendu, et tuimastus ja sedatsioon on piisavad
- Libestatud bronhoskoobiga, mille peal on intubatsioonitoru, liigud häälepaelteni, pihustad sinna lidokaiini 1% ja edasi trahhea bifurkatsioonini jõudes liigud intubatsioonitoruga järgi
- Topelt kontroll enne anesteesia süvendamist: trahhea bifurkatsioon nähtav ja kapnograaf kinnitab

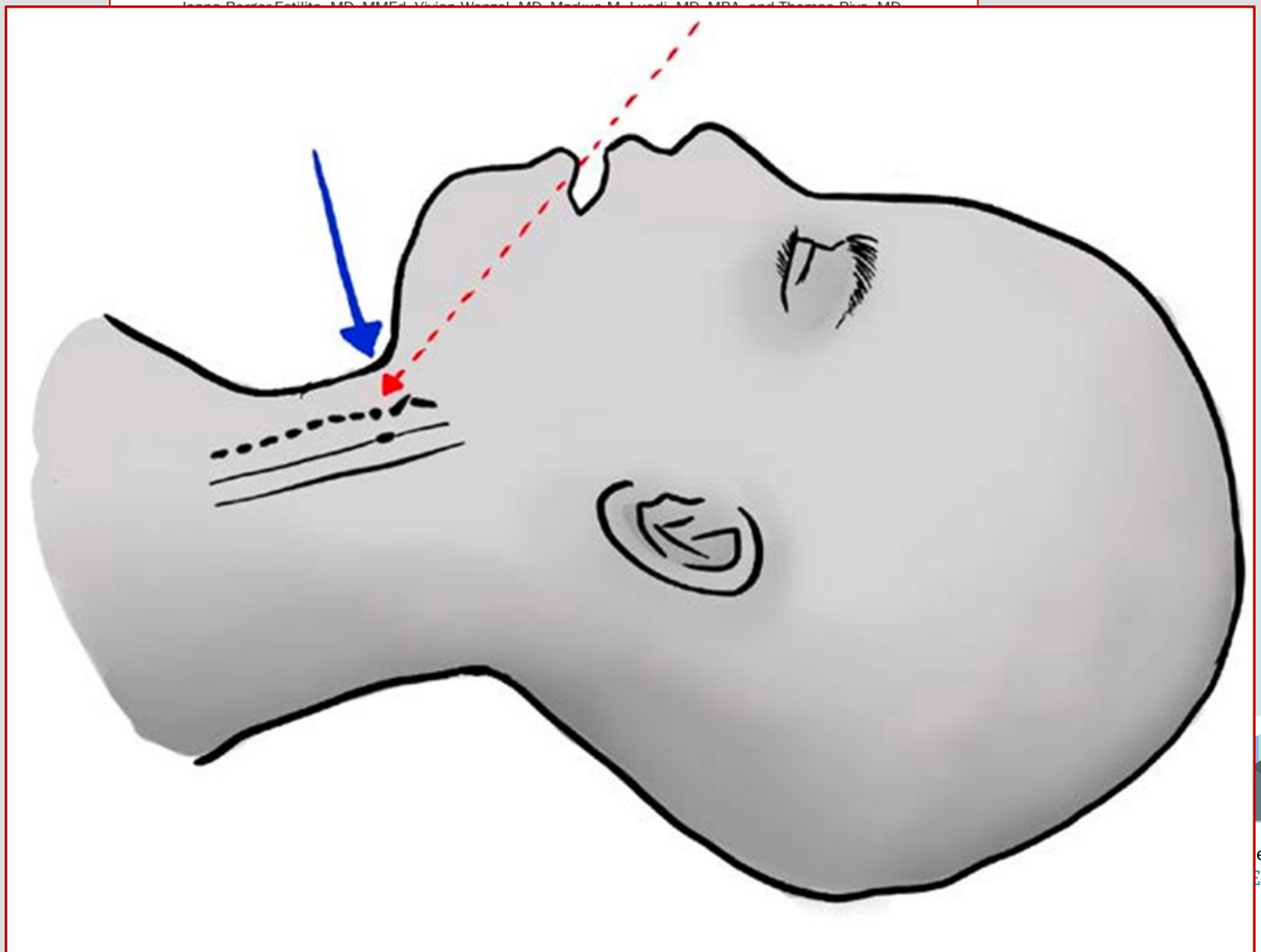
SEDEERIMINE

- Hinda vajadust ja vali ravim
- Veenitee rajamine enne sedatsiooni, kui see ei ole võimalik, valmista ette suktsinüülkoliin (4mg/kg) ja atropiin im manustamiseks

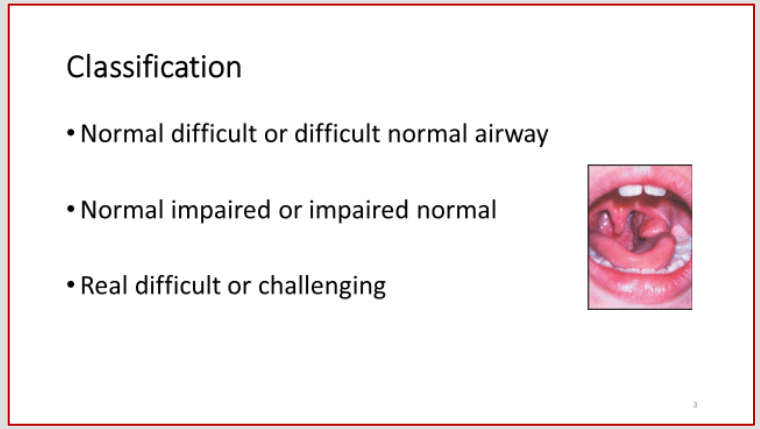
EDUCATIONAL TOOL

OPEN

A Primer for Pediatric Emergency Front-of-the-Neck Access



Let`s learn from it



- Unexpected difficult tracheal intubation occurs frequently in small children
- Success rate is quite low with direct laryngoscopy
  - When difficult intubatsion is predicted, or intubation has failed twice, there is no reason to attempt to intubate the trachea using direct laryngoscopy
- Maintain clear airway (no repeated attempts), call for help, call for alternative equipment and provide apnoeic oxygenation
- Structured checklist and time out
- Brief and debrief