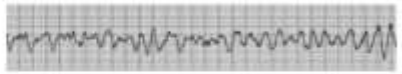
La gestione della via aerea pediatrica

Miriam Tumolo

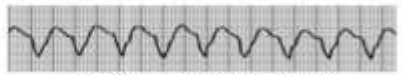
UOC Anestesia Neonatale e Pediatrica e
Terapia del Dolore Acuto e Procedurale
IRCCS Giannina Gaslini - Genova

ARRESTO CARDIACO PRIMITIVO

- **Più frequente nell'adulto**
- Esordio acuto, imprevedibile
- Dovuto a malattia primitivamente cardiaca
- Sostenuto da un ritmo cardiaco defibrillabile: FV o TV senza polso



Fibrillazione ventricolare (FV)



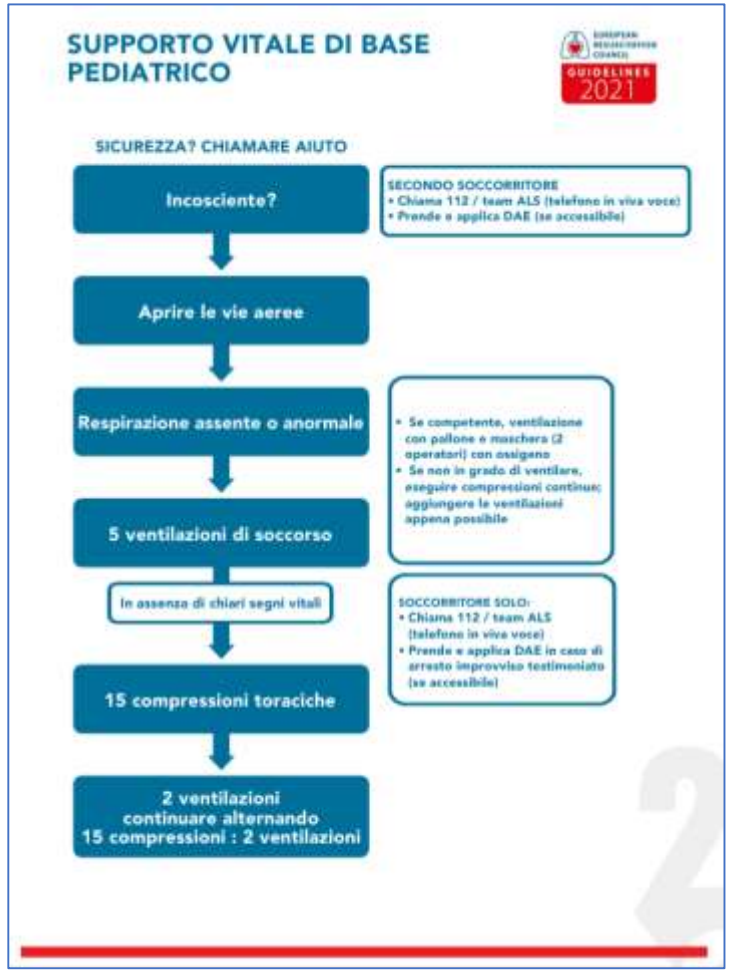
Tachicardia ventricolare senza polso (TV)

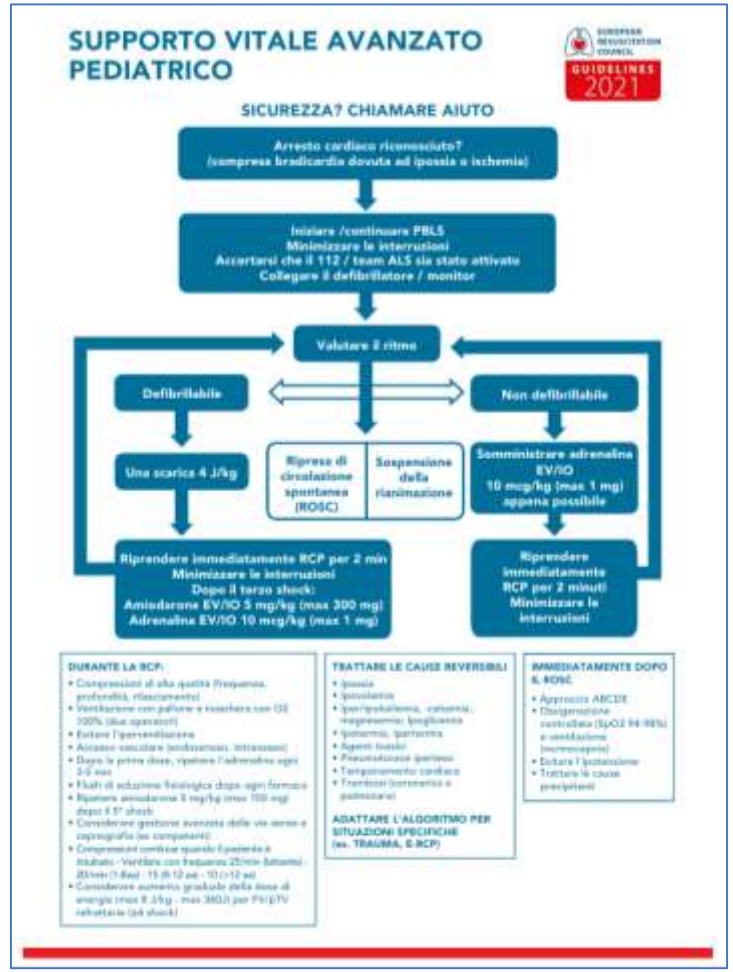
La prognosi dipende dalla DEFIBRILLAZIONE PRECOCE

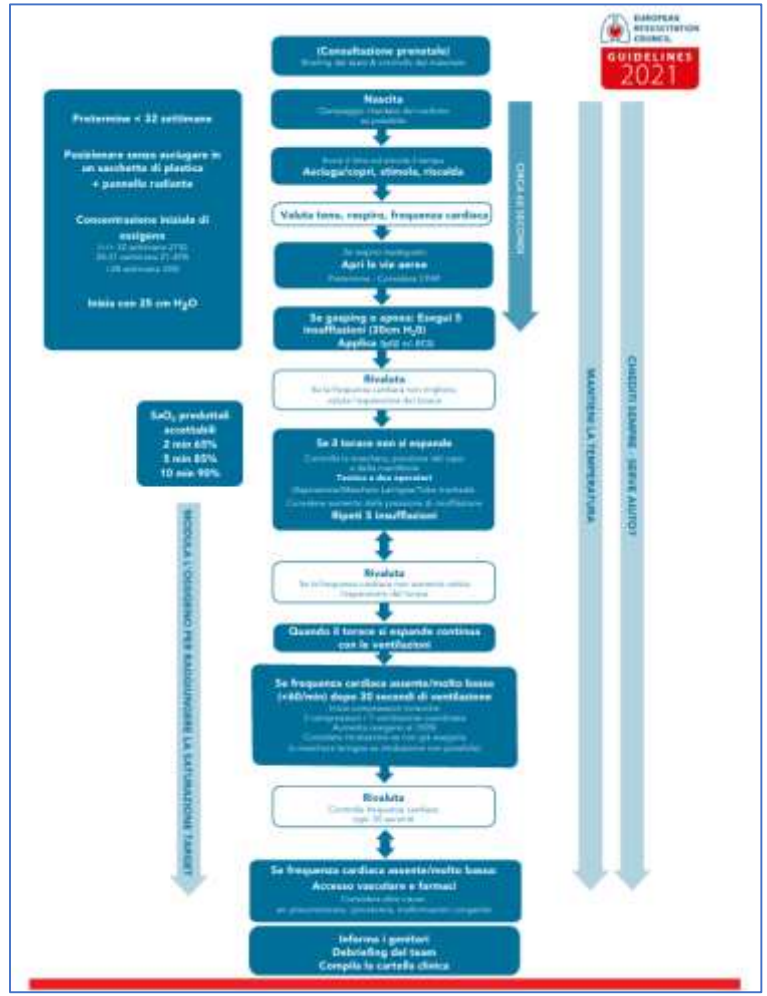
ARRESTO CARDIACO SECONDARIO

- **Più frequente nel bambino**
- Preceduto da insufficienza cardio-respiratoria progressiva
- Dovuto a grave ipossia che causa secondariamente disfunzione cardiaca
- Sostenuto da Bradicardia ipossico - ischemica che evolve in PEA o Asistolia

La prognosi dipende dalla prevenzione e dalla rianimazione immediata


SUPPORTO VITALE DI BASE PEDIATRICO
GUIDELINES 2021
SICUREZZA? CHIAMARE AIUTO
Incosciente?
SECONDO SOCCORRITORE
• Chiama 112 / team ALS (telefono in viva voce)
• Prende e applica DAE (se accessibile)
Aprire le vie aeree
Respirazione assente o anormale
• Se competente, ventilazione con pallone e maschera (2 operatori) con ossigeno
• Se non in grado di ventilare, eseguire compressioni continue; aggiungere le ventilazioni appena possibile
5 ventilazioni di soccorso
In assenza di chiari segni vitali
SOCCORRITORE SOLO:
• Chiama 112 / team ALS (telefono in viva voce)
• Prende e applica DAE in caso di arresto improvviso testimoniato (se accessibile)
15 compressioni toraciche
2 ventilazioni
continuare alternando
15 compressioni : 2 ventilazioni


SUPPORTO VITALE AVANZATO PEDIATRICO
GUIDELINES 2021
SICUREZZA? CHIAMARE AIUTO
Arresto cardiaco riconosciuto?
(compresa bradicardia dovuta ad ipossia o ischemia)
Iniziare /continuare PBLS
Minimizzare le interruzioni
Accertarsi che il 112 / team ALS sia stato attivato
Collegare il defibrillatore / monitor
Valutare il ritmo
Defibrillabile
Non defibrillabile
Una scarica 4 J/kg
Ripresa di circolazione spontanea (ROSC)
Sospensione della rianimazione
Somministrare adrenalina EV/IO 10 mcg/kg (max 1 mg) appena possibile
Riprendere immediatamente RCP per 2 min
Minimizzare le interruzioni
Dopo il terzo shock:
Amiodarone EV/IO 5 mg/kg (max 300 mg)
Adrenaline EV/IO 10 mcg/kg (max 1 mg)
Riprendere immediatamente RCP per 2 minuti
Minimizzare le interruzioni
DURANTE LA RCP:
TRATTARE LE CAUSE REVERSIBILI
IMMEDIATAMENTE DOPO IL ROSC
ADATTARE L'ALGORITMO PER SITUAZIONI SPECIFICHE
(es. TRAUMA, E-RCP)


GUIDELINES 2021
(Consultazione prenatale)
Nascita
Pretermine < 32 settimane
Posizionare senza asciugare in un sacchetto di plastica + pannello radiante
Concentrazione iniziale di ossigeno
Inizia con 21 cm H2O
Asciuga/copri, stimola, riscalda
Valuta tono, respiro, frequenza cardiaca
Apri le vie aeree
Se gasping o apnea: Esegui 5 insufflazioni (30cm H2O)
Rivaluta
Se il torace non si espande
Tecnica a due operatori
Ripeti 5 insufflazioni
Rivaluta
Quando il torace si espande continua con le ventilazioni
Se frequenza cardiaca assente/molto bassa (<60/min) dopo 30 secondi di ventilazione
Rivaluta
Se frequenza cardiaca assente/molto bassa:
Accesso vascolare e farmaci
Informa i genitori
Debriefing del team
Compila la cartella clinica
CHIAMA AIUTO SE NECESSARIO
MANTIENI LA TEMPERATURA
CHIEDITI SEMPRE: SERVE AIUTO?
MODULA L'OSSIGENO PER RAGGIUNGERE LA SATURAZIONE TARGET


BLS-D
per operatori sanitari
AR


EMERGENZE IN ETÀ PEDIATRICA


European Paediatric Immediate Life Support
AR


European Paediatric Advanced Life Support
AR

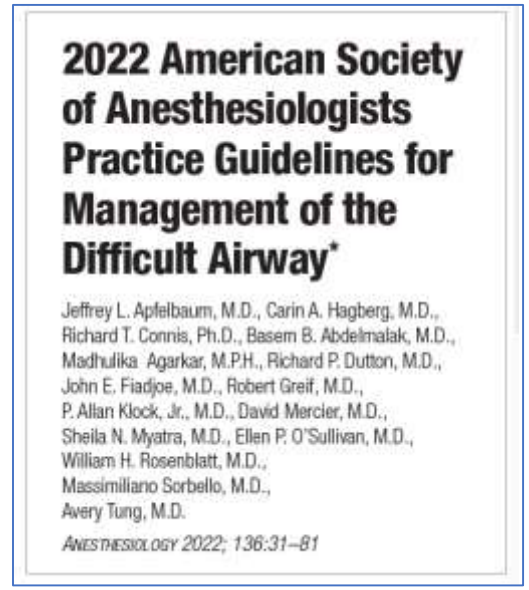

Newborn Life Support
AR

BASSA INCIDENZA DI VIE AEREE DIFFICILI IN ETA' PEDIATRICA (Bambini sani)

- Ventilazione in maschera difficoltosa: 0,2% (1,4 nell'adulto)
- Intubazione difficoltosa:
  - 0,6% < 1 anno
  - 0,1% età prescolare
  - 0,05% > 8 anni

VIE AEREE DIFFICILI: DEFINIZIONE

- Difficoltosa ventilazione in maschera
- Difficoltosa laringoscopia
- Difficoltoso posizionamento o ventilazione mediante SGA
- Difficoltosa intubazione (più di due tentativi)
- Difficoltoso approccio invasivo alle vie aeree



2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway*

Jeffrey L. Apfelbaum, M.D., Carin A. Hagberg, M.D., Richard T. Connis, Ph.D., Basem B. Abdelmalak, M.D., Madhulika Agarkar, M.P.H., Richard P. Dutton, M.D., John E. Fiadjoe, M.D., Robert Greif, M.D., P. Allan Klock, Jr., M.D., David Mercier, M.D., Sheila N. Myatra, M.D., Ellen P. O'Sullivan, M.D., William H. Rosenblatt, M.D., Massimiliano Sorbello, M.D., Avery Tung, M.D.

ANESTHESIOLOGY 2022; 136:31–81

Observational Study > Lancet Respir Med. 2017 May;5(5):412-425.
doi: 10.1016/S2213-2600(17)30116-9. Epub 2017 Mar 28.

Incidence of severe critical events in paediatric anaesthesia (APRICOT): a prospective multicentre observational study in 261 hospitals in Europe

Walid Habre [1], Nicola Disma [2], Katalin Virag [3], Karin Becke [4], Tom G Hansen [5], Martin Jöhr [6], Brigitte Leva [7], Neil S Morton [8], Petronella M Vermeulen [9], Marzena Zielinska [10], Krisztina Boda [11], Francis Veyckemans [12];
APRICOT Group of the European Society of Anaesthesiology Clinical Trial Network

Anaesthesia
PRactice
In
Children
Observational
Trial

- Studio prospettico osservazionale
- 261 centri partecipanti in 33 paesi europei
- 31.127 anestesie in neonati e bambini <15 anni (età media 6,35 anni)
- **Incidenza di eventi critici perioperatori: 5,2%**
- **Incidenza di eventi critici respiratori: 3,1%**
- Maggiore incidenza di eventi respiratori **nei neonati e nei lattanti**
- Altri fattori di rischio: storia di **prematurità** e **iperreattività delle vie aeree**

BJA

British Journal of Anaesthesia, 126 (6): 1173–1181 (2021)

doi: 10.1016/j.bja.2021.02.021
Advance Access Publication Date: 1 April 2021
Paediatric Anaesthesia

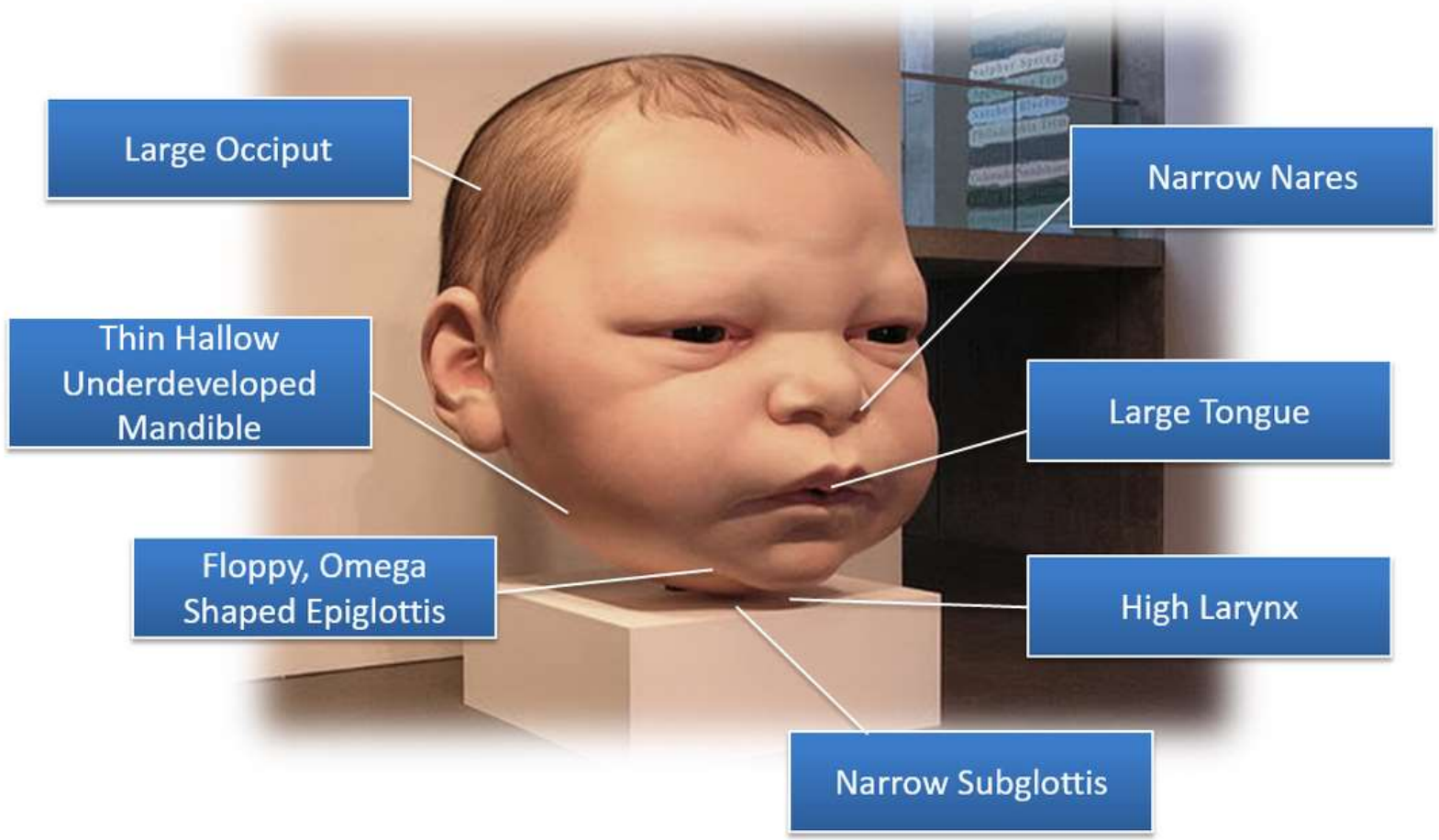
Difficult tracheal intubation in neonates and infants. NEonate and Children audiT of Anaesthesia pRactice IN Europe (NECTARINE): a prospective European multicentre observational study

Nicola Disma[1,*], Katalin Virag[2], Thomas Riva[3], Jost Kaufmann[4,5], Thomas Engelhardt[6], Walid Habre[7], and NECTARINE Group of the European Society of Anaesthesiology Clinical Trial Network[†]

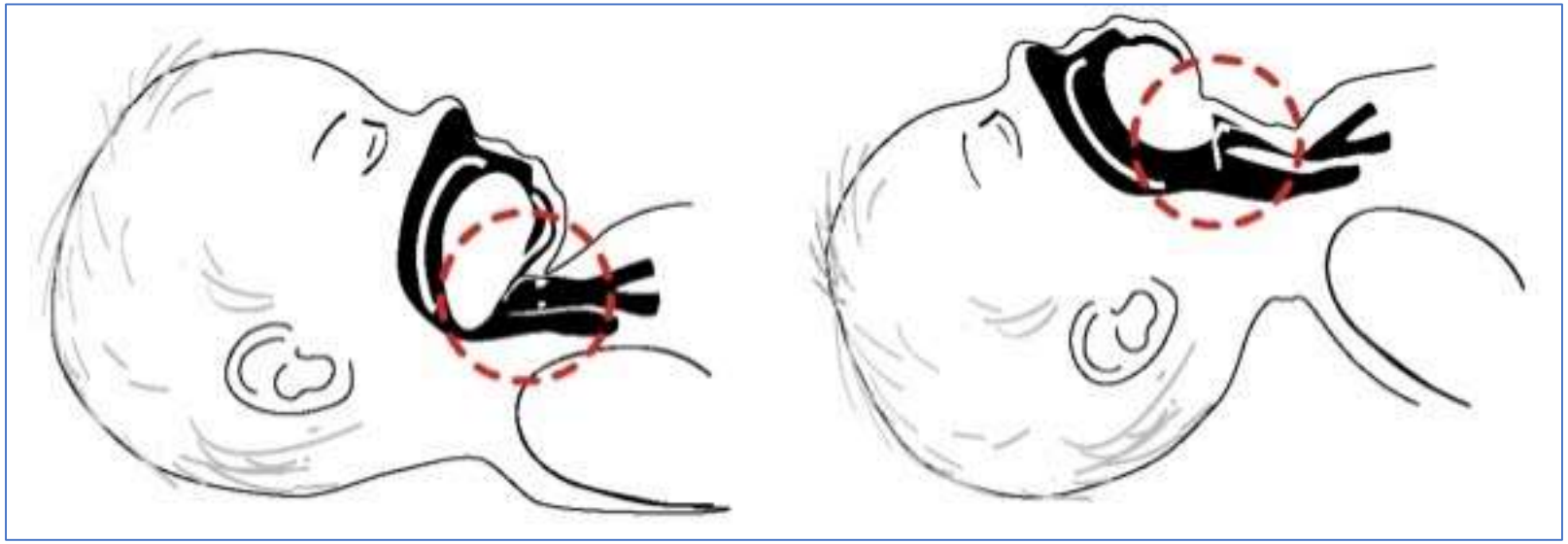
NEonate and
Children
audi**T** of
Anesthesia
p**R**actice
IN
Europe

- 4683 procedure in neonati e lattanti età post concezionale < 60 sett
- **Intubazione difficoltosa** in 271 procedure (**incidenza 5.8%),** non prevista in 2/3 dei casi
- Circa la metà aveva malformazioni congenite, circa il 40% ASA ≥ 3
- **Desaturazione** (SpO2<90% per 60 sec) nel 40% delle intubazioni difficoltose, **bradicardia** nell'8%

Infants are Different !



L’OSTRUZIONE DELLE PRIME VIE AEREE E’ FREQUENTE

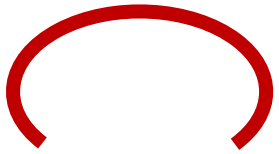


Neonate

Infant

Toddler

Adult



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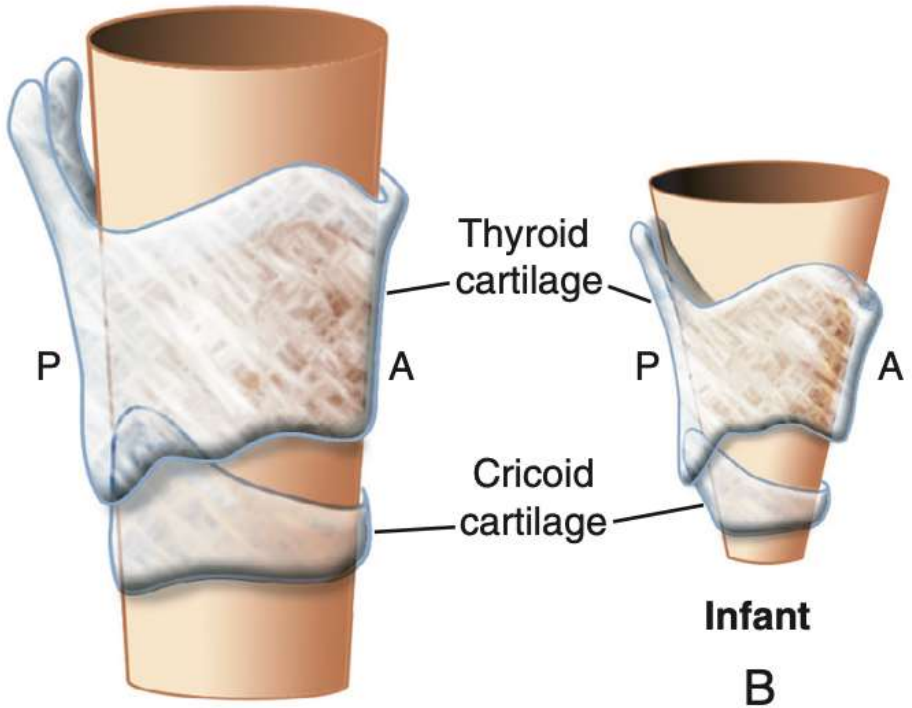


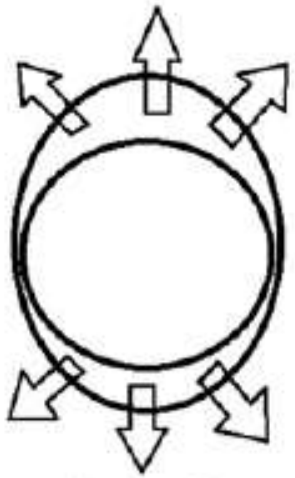


Figure 1(a)
Air leak with uncuffed ETT

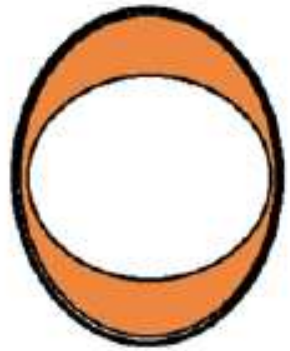


Figure 1(b)
Minimal leak with optimally inflated cuffed ETT

Figure 1(c)
Mucosal injury with over-inflated cuffed ETT represented by dotted line

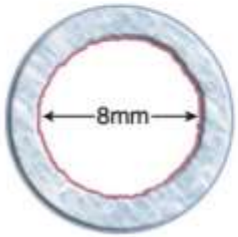
Accepted: 11 October 2017
DOI: 10.1111/pan.13281

SYSTEMATIC REVIEW

WILEY Pediatric Anesthesia

The anatomy of the pediatric airway: Has our knowledge changed in 120 years? A review of historic and recent investigations of the anatomy of the pediatric larynx

Josef Holzki[1] | Karen A. Brown[2] | Robert G. Carroll[3†] | Charles J. Coté[4]

	Normal	Edema 1 mm	Decreased X-sectional area	Resistance Laminar flow $\left(R \propto \frac{1}{\text{radius}^4}\right)$	Resistance Turbulent flow $\left(R \propto \frac{1}{\text{radius}^5}\right)$
Infant			~ ↓75%	~ ↑16x	~ ↑32x
Adult			~ ↓44%	~ ↑3x	~ ↑5x

The Pediatric Airway

14

JOHN E. FIADJOE, RONALD S. LITMAN, JULIA F. SERBER, PAUL A. STRICKER, AND CHARLES J. COTÉ

A Practice of Anesthesia for Infants and Children

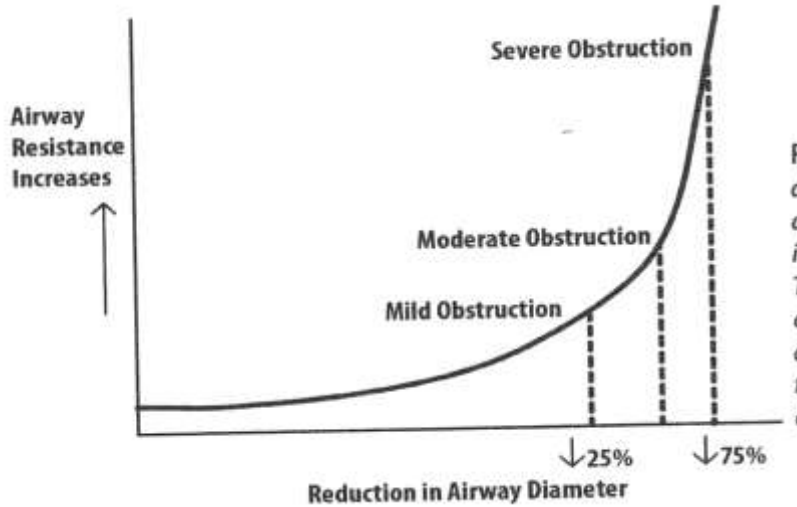
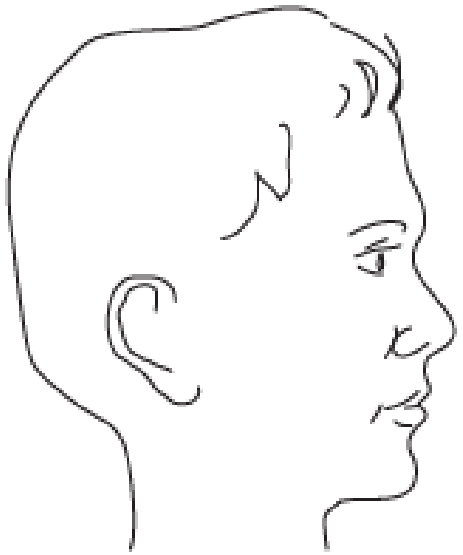
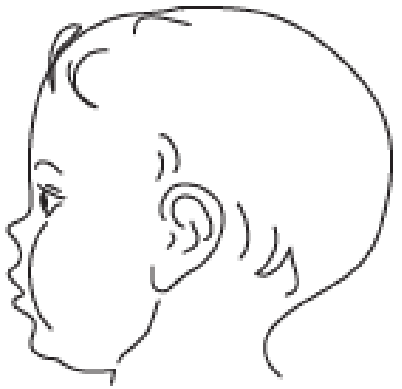


Fig. 1-24: *As airway diameter decreases, airway resistance increases exponentially. The infant and young child are particularly at risk for obstruction from even minor edema.*





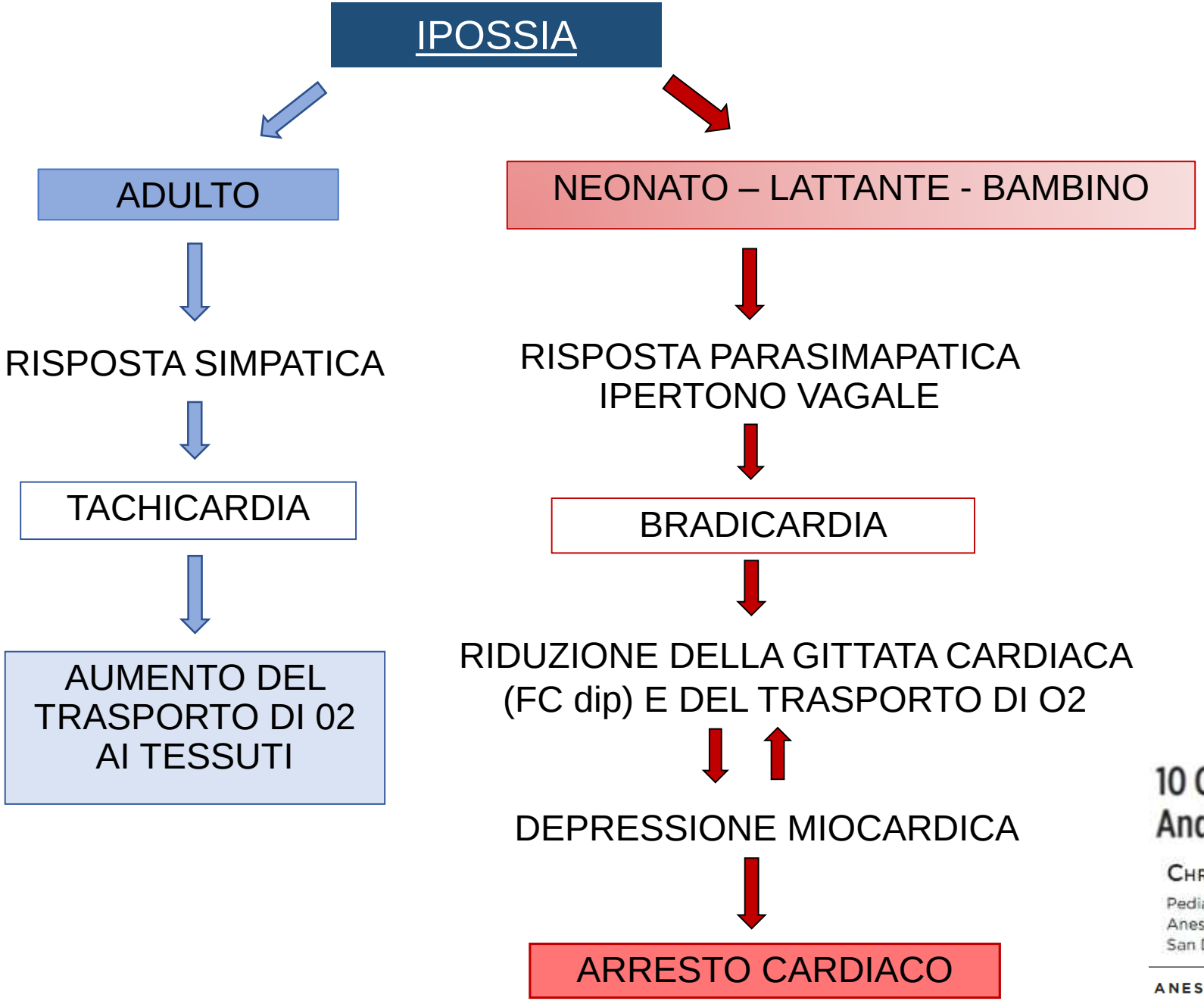
ADOLESCENTE SANO

- 60 kg
- Tidal Volume 480 ml (8 ml/kg x 60)
- Spazio morto anatomico 120 ml (2 ml/kg x60)
- Ventilazione alveolare **360 ml (una lattina)**
- CFR 70 ml/kg

NEONATO SANO

- 3 kg
- Tidal Volume 24 ml (8 ml/kg x 3)
- Spazio morto anatomico 9 ml (3 ml/kg x 3)
- Ventilazione alveolare **15 ml (un cucchiaio)**
- CFR 18 ml/kg

I BAMBINI DIVENTANO PIU' FACILMENTE IPOSSICI



10 Common Pediatric Airway Problems—And Their Solutions

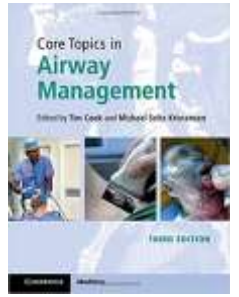
CHRISTINE E. WHITTEN, MD
Pediatric Anesthesiologist
Anesthesia Services Medical Group
San Diego

ANESTHESIOLOGY NEWS AIRWAY MANAGEMENT 2019

PATOLOGIE CHE POSSONO DETERMINARE DIFFICOLTOSA GESTIONE DELLE VIE AEREE

congenite
infettive
infiammatorie

metaboliche
traumatiche
iatrogene



Classification	Condition
Supraglottic pathology	**Maxillary hypoplasia**
	Apert syndrome
	Crouzon syndrome
	Pfeiffer syndrome
	Choanal atresia
	CHARGE association
	Mandibular hypoplasia (micrognathia)
	Pierre Robin sequence
	Treacher Collins syndrome
	Goldenhar syndrome
	Stickler syndrome
	Moebius syndrome
	Macroglossia
	Beckwith–Wiedemann syndrome
	Trisomi 21 (Down syndrome)
	Vascular malformation
	Metabolic disease
	Laryngomalacia
	Infection
	Peritonsillar/parapharyngeal/ retropharyngeal
	Epiglottitis
	Masses of neck/parapharynx
Glottic pathology	**Glottic stenosis**
	Iatrogenic (intubation sequelae)
	Congenital
	Infection (e.g. papilloma)
	Neuromuscular (e.g. recurrent laryngeal nerve paresis)
Subglottic pathology	**Subglottic stenosis**
	Iatrogenic (intubation sequelae)
	Tracheal inflammation (e.g. tracheitis)
	Tracheal stenosis
	Tracheomalacia
Whole airway pathology	**Mucopolysaccharidoses**
	Hurler syndrome
	Hunter syndrome
	Sanfilippo syndrome
	Morquio syndrome
	Maroteaux–Lamy syndrome
	Vascular lesions
	Lymphatic malformation
	Haemangioma
	Inflammation
	Trauma
	Foreign bodies
	Burns
Reduced mobility	Freeman–Sheldon syndrome
Mouth	Noonan syndrome
Jaw	Spinal fusion
Neck	Cervical stenosis
	Cervical instability
	Perioperative instrumentation – reduced post-op mobility

Sindr. di Pierre Robin

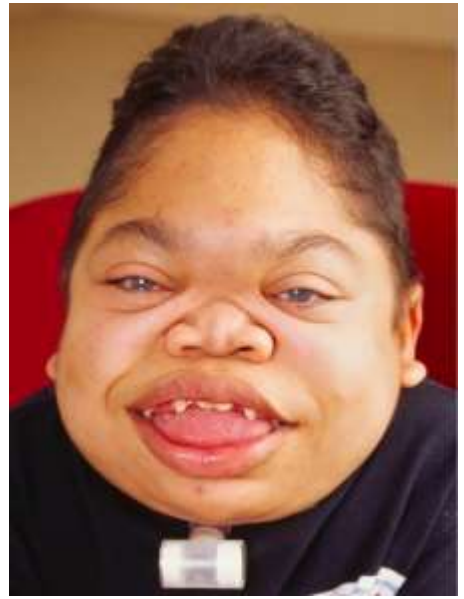
Sindr. di Crouzon

Sindr. di Beckwith Wiedemann

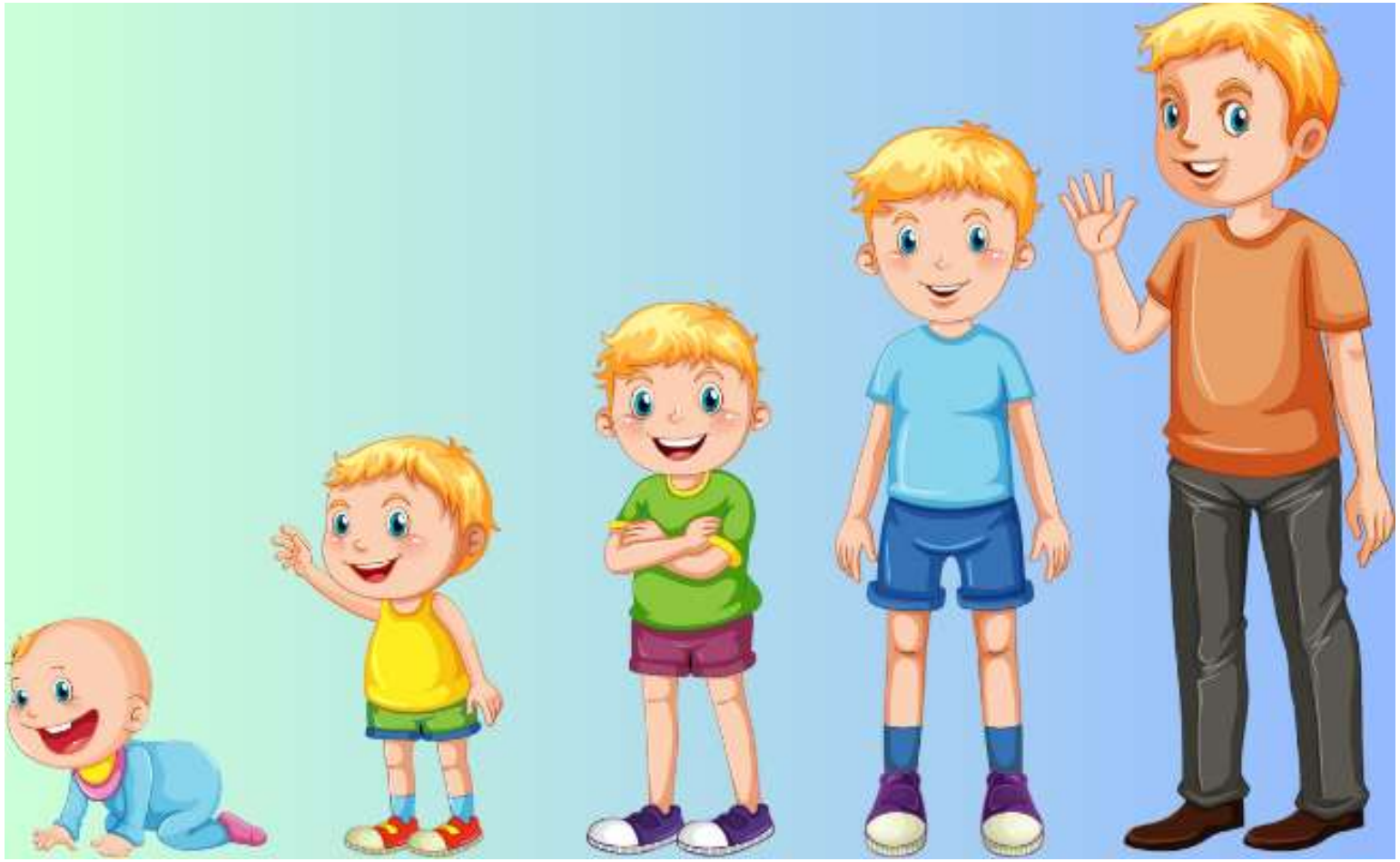
Igroma cistico del collo

Deformità del
rachide cervicale

Sindr. di Treacher Collins



Mucopolisaccaridosi



ETA’ PEDIATRICA

10 Common Pediatric Airway Problems—And Their Solutions

CHRISTINE E. WHITTEN, MD
Pediatric Anesthesiologist
Anesthesia Services Medical Group
San Diego

YouTube IT

era un'operazione di routine

Just A Routine Operation

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Jeffrey L. Apfelbaum, M.D., Carin A. Hagberg, M.D., Richard T. Connis, Ph.D., Basem B. Abdelmalak, M.D., Madhulika Agarkar, M.P.H., Richard P. Dutton, M.D., John E. Fiadjoe, M.D., Robert Greif, M.D., P. Allan Klock, Jr., M.D., David Mercier, M.D., Sheila N. Myatra, M.D., Ellen P. O'Sullivan, M.D., William H. Rosenblatt, M.D., Massimiliano Sorbello, M.D., Avery Tung, M.D.

ANESTHESIOLOGY 2022; 136:31–81

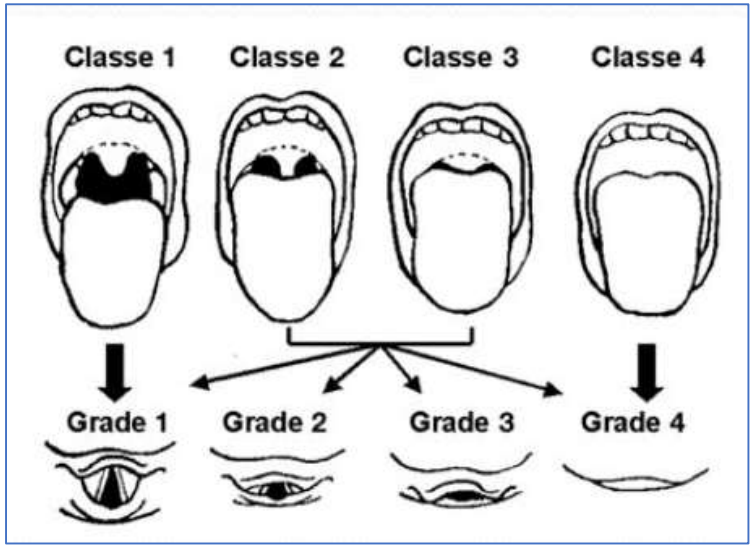
Be aware of the passage of time, the number of attempts, and oxygen saturation

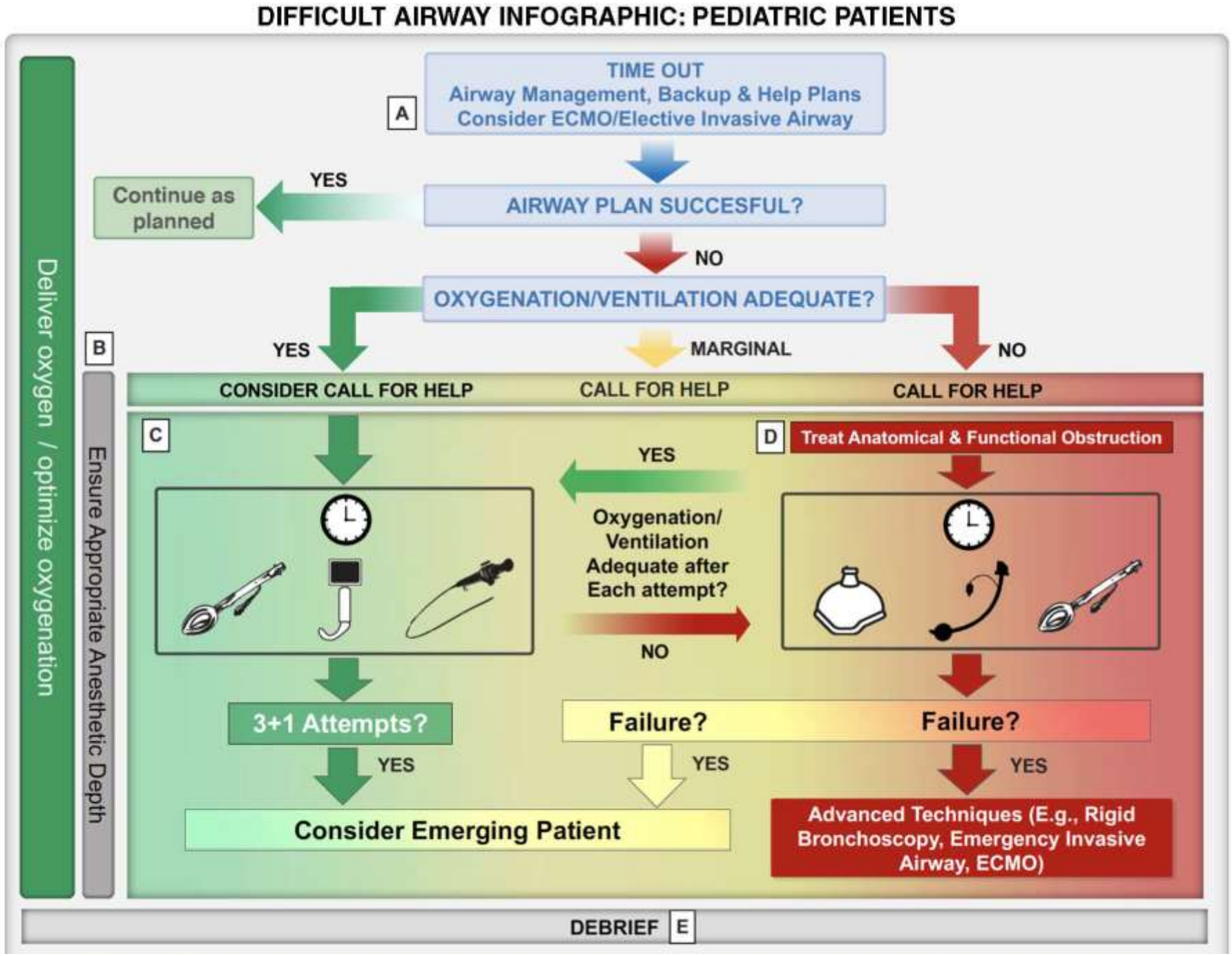
- Riconoscere una potenziale via aerea difficile
- Qual è la persona più adatta a gestire il problema?
- Avere un piano A e un piano B condiviso con il team
- Avere a disposizione il materiale necessario
- Sedazione, miorisoluzione
- Pre-ossigenazione, per-ossigenazione
- **L’obiettivo è ossigenare e ventilare, non intubare!**

E’ possibile prevedere una via aerea difficile?

- Storia clinica
- Esame fisico
  - Micrognazia o prognatismo
  - Asimmetria facciale
  - Macroglossia
  - Limitata apertura della bocca
  - Ipomobilità del rachide cervicale
  - Labiopalatoschisi
  - Masse del faringe o del collo
- Misurazioni anatomiche
  - Distanza tiromentale / sternomentale

  (non disponibili valori normali per le varie fasce di età)
  - Mallampati (non eseguibile sotto i 3 anni)
  - Upper lip bite test





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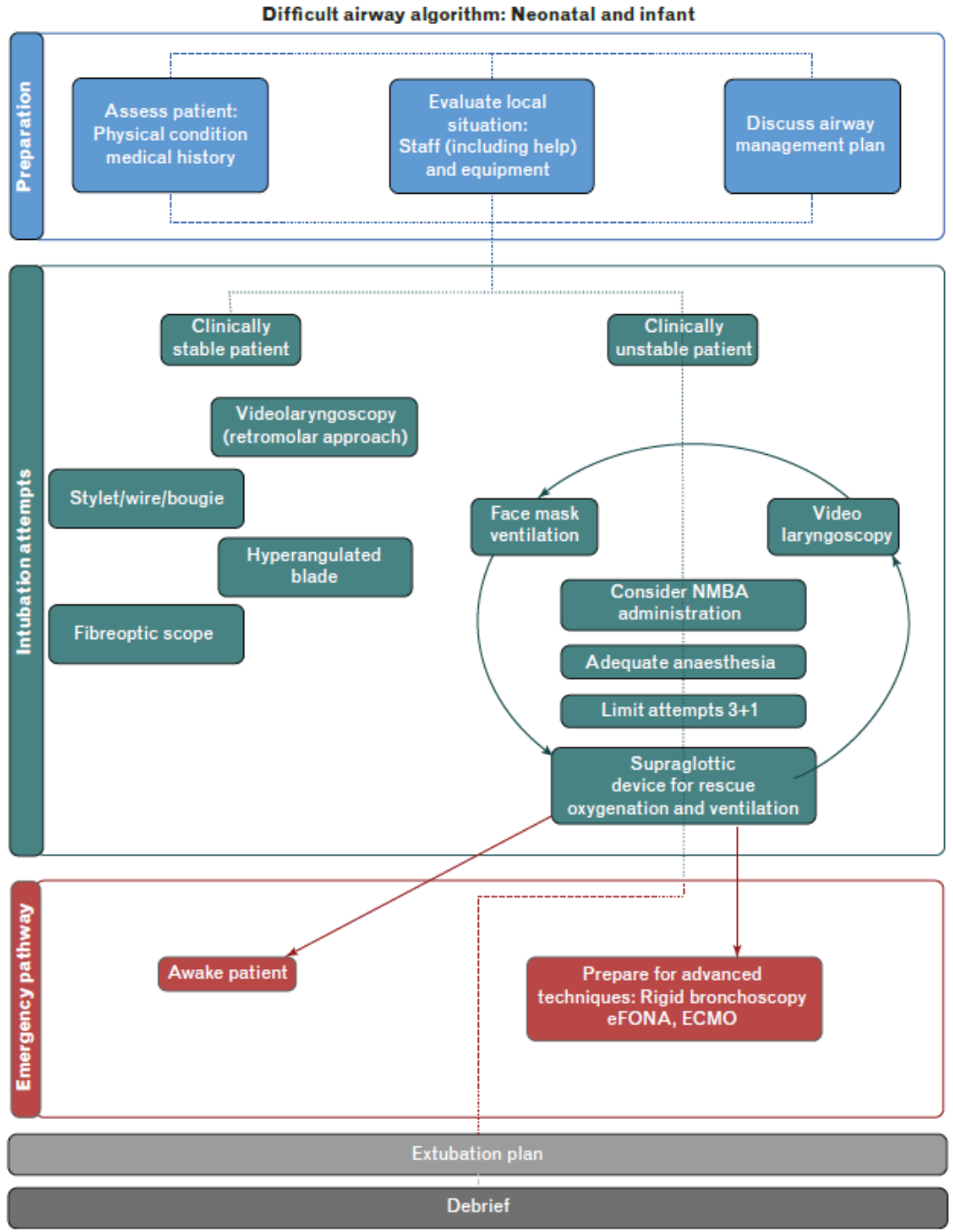
Anesthesiology 2022; 136:31–81



EJA
Eur J Anaesthesiol 2024; 41:3–23
OPEN
GUIDELINES

Airway management in neonates and infants

European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines

Nicola Disma, Takashi Asai, Evelien Cools, Alexandria Cronin, Thomas Engelhardt, John Fiadjoe, Alexander Fuchs, Annery Garcia-Marcinkiewicz, Walid Habre, Chloe Heath, Mathias Johansen, Jost Kaufmann, Maren Kleine-Brueggeney, Peter G. Kovatsis, Peter Kranke, Andrea C. Lusardi, Clyde Matava, James Peyton, Thomas Riva, Carolina S. Romero, Britta von Ungern-Sternberg, Francis Veyckemans and Arash Afshari, and airway guidelines groups of the European Society of Anaesthesiology and Intensive Care (ESAIC) and the *British Journal of Anaesthesia* (BJA)

Table 2. Suggested Sizes of Pediatric ETTs

Age	Size (mm ID) (age in years/4) +4	Oral Depth (cm) (age in years/2) +12	Miller	Macintosh
Premature	2.5-3	6-8	0	0
Newborn	3-3.5	9-10	0	0
3-12 months	4	10.5-12	0	0
1 year	4	12.5-13.5	1	1
2 years	4.5	13.5	2	2
4 years	5	14	2	2
6 years	5.5	15	2	2
8 years	6 cuffed	16	2	2
10 years	6.5 cuffed	17	2-3	2-3
12 years	6.5-7 cuffed	18	2-3	3
Adolescent	6.5-7+ cuffed	21	2, 3, 4	3
Adult	6.5-8 cuffed	21	2, 3, 4	3-4

American Heart Association formulas: uncuffed ETT: (age in years) + 4; cuffed ETT: (age in years) + 3; depth at lip: ETT size X 3
Note: all patients are different and formulas are guidelines only—always check position clinically

ETT, endotracheal tube; **ID,** internal diameter

Great Ormond Street Hospital for Children
NHS Foundation Trust

Great Ormond Street Hospital Chart for Paediatric Airways

All dimensions in mm		Preterm – 1 month	1 – 6 months	6 – 18 months	18 mths – 3 years	3 – 6 years	6 – 9 years	9 – 12 years	12+ years
Cricoid (AP diameter)			3.6 – 4.8	4.8 – 5.8	5.8 – 6.5	6.5 – 7.4	7.4 – 8.2	8.2 – 9.0	10.7	10.7
Trachea (transverse diameter)		5		5 – 6	6 – 7	7 – 8	8 – 9	9 – 10	10 – 13	13
Endotracheal tube (Portex®)	Size = ID	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0
	OD	3.4	4.2	4.8	5.4	6.2	6.8	8.2	9.6	10.8
Bronchoscope (Storz)	Size = ID		2.5	3.0	3.5	4.0	4.5	5.0	6.0	
	ID		3.5	4.3	5.0	6.0	6.6	7.1	7.5	
	OD		4.2	5.0	5.7	6.7	7.3	7.6	8.2	
Bivona® Uncuffed/ Fome-Cuf®/ Aire-Cuf®/TTS™ cuff ranges	Size = ID	2.5	3.0	3.5	4.0	4.5	5.0	5.5		
	OD	4.0	4.7	5.3	6.0	6.7	7.3	8.0		
	Shaft length Neo	30	32	34	36					
	Shaft length Ped	38	39	40	41	42	44	46		
Bivona® Flextend™ OD as above	Size = ID	2.5	3.0	3.5	4.0	4.5	5.0	5.5		
	Shaft length – Neo	30	32	34	36					
	Proximal length – Neo	20	20	20	15					
	Shaft length – Ped	38	39	40	41	42	44	46		
	Proximal length – Ped	20	20	20	30	30	30	30		
Bivona® Hyperflex™	Size = ID	2.5	3.0	3.5	4.0	4.5	5.0	5.5		
	Max usable length	55	60	65	70	75	80	85		
Shiley™ *Ped cuffed tube available (PDC)	Size = ID		3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
	OD		4.5	5.2	5.9	6.5	7.1	7.7	8.3	9.0
	Length Neo		30	32	34	36				
	Length Ped		39	40	41*	42*	44*	46*		
	Length Ped – Long (PDL)						50*	52*	54*	56*
Great Ormond Street	Size = ID		3.0	3.5	4.0	4.5	5.0	5.5	6.0	7.0
	OD		4.5	5.0	6.0	6.7	7.5	8.0	8.7	10.7
Sheffield (Metal)	French gauge		12-14	16	18	20	22	24	26	
	ID (mm)		2.9-3.6	4.2	4.9	6.0	6.3	7.0	7.6	
Adult Portex® Blue Line Ultra® Cuffed and/or fenestrated	Size = ID								6.0	7.0
	OD								9.2	10.5
	Length								64.5	70
Adult Bivona® Cuffed and/or fenestrated	Size = ID						5.0		6.0	7.0
	OD (TTS)						7.4		8.8	10.0
	Length (TTS)						60		70	80
	Max usable length (Hyperflex)								110	120

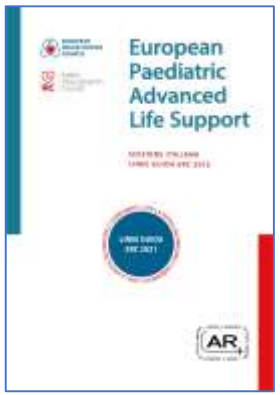
NB – Length measurements cannot be totalled to give suction length. This should be measured using a suction catheter for each tracheostomy tube.

Tabella 2.1
Regole per stimare le dimensioni corrette del tubo

	Senza cuffia	Con cuffia
Neonato prematuro	Età gestazionale in settimane/10	Non utilizzato
Neonato a termine	3.5	Non utilizzato di solito
Lattante	3.5 – 4.0	3.0 – 3.5
Bambino 1 – 2 anni	4.0 – 4.5	3.5 – 4.0
Bambino > 2 anni	Età/4 + 4	Età/4 + 3.5

Tabella 2.2
Strumento di calcolo per stimare la lunghezza del tubo

Tubo endotracheale per via orale - Lunghezza dalle labbra:
12 + (età/2) cm
Tubo endotracheale per via nasale - Lunghezza dalle narici:
15 + (età/2) cm

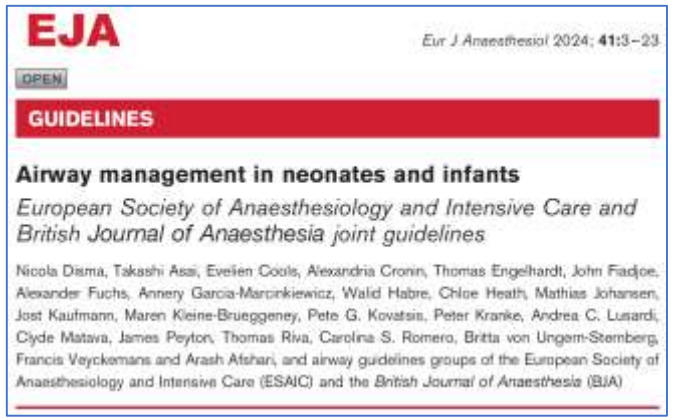


PICO 2. Preparation for airway management and pharmacological treatment (outside resuscitation)

What preparation and planning should be mandatory before airway management in neonates and infants? Is neuromuscular block mandatory if spontaneous breathing is not necessary (pharmacology)?

Recommendation: We recommend use of an adequate level of sedation or general anaesthesia in neonates and infants during airway management to ensure patient comfort and safety (1B).

Recommendation: We recommend use of neuromuscular block before tracheal intubation when maintaining spontaneous breathing is not necessary (1C). The risks and benefits of neuromuscular blocking agent administration should be balanced for the individual patient and team skills.


EJA

Eur J Anaesthesiol 2024; 41:3–23

OPEN

GUIDELINES

Airway management in neonates and infants

European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines

Nicola Disma, Takashi Asai, Evelien Cools, Alexandria Cronin, Thomas Engelhardt, John Fiadjoe, Alexander Fuchs, Annery Garcia-Marcinkiewicz, Walid Habre, Chloe Heath, Mathias Johansen, Jost Kaufmann, Maren Kleine-Brueggeney, Pete G. Kovatsis, Peter Kranke, Andrea C. Lusardi, Clyde Matava, James Peyton, Thomas Riva, Carolina S. Romero, Britta von Ungern-Sternberg, Francis Veyckemans and Arash Afshari, and airway guidelines groups of the European Society of Anaesthesiology and Intensive Care (ESAIC) and the *British Journal of Anaesthesia* (BJA)

- Sevoflurane
- Midazolam
- Propofol
- Ketamina
- Fentanyl / Remifentanil
- Rocuronio (Sugammadex)
- Lidocaina (max 4 mg/kg)
- Atropina

Should apnoeic oxygenation become standard of care during tracheal intubation?

Recommendation: We recommend the use of apnoeic oxygenation during tracheal intubation in neonates (1B).

Clinical practice statement: In infants, the of apnoeic oxygenation (low or high flow) during tracheal intubation should be based on the risk of hypoxaemia in the patient and the experience of the provider.

PRE-OSSIGENAZIONE

PER-OSSIGENAZIONE

O2 0,2-2 l/kg/min: aumenta la durata del periodo di «**Safe Apnea**» (SpO2 non < 90%)

Per-ossigenazione: come?

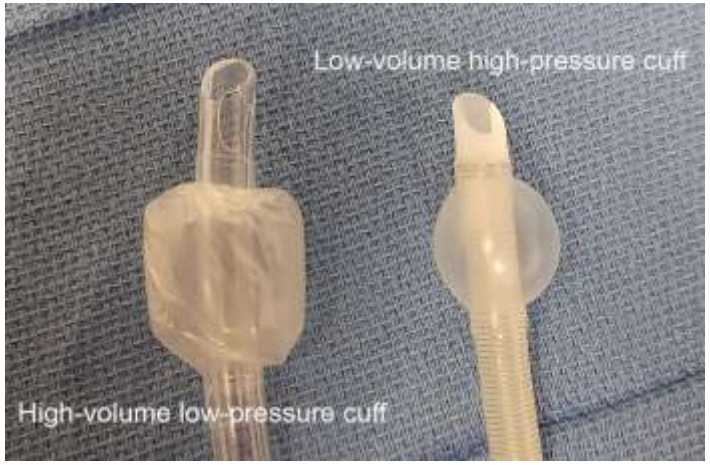
Interface	Technique	Oxygen	Tips
Nasal trumpet or naso-pharyngeal tube	Connect to the anesthesia circuit	6 L/min with APL valve fully open	Equipment easily available in the operating room
Low-flow nasal cannulae	Connect to extra source of oxygen	0.2–1 L/kg/min	Need for dedicated cannulae and equipment
High-flow nasal cannulae	Connect to high-flow system	2 L/kg/min max 20 L/min	Need for dedicated cannulae and equipment for humidified oxygen
Oral RAE tube	Connect to extra source of oxygen	6 L/min or more	In the corner of the mouth

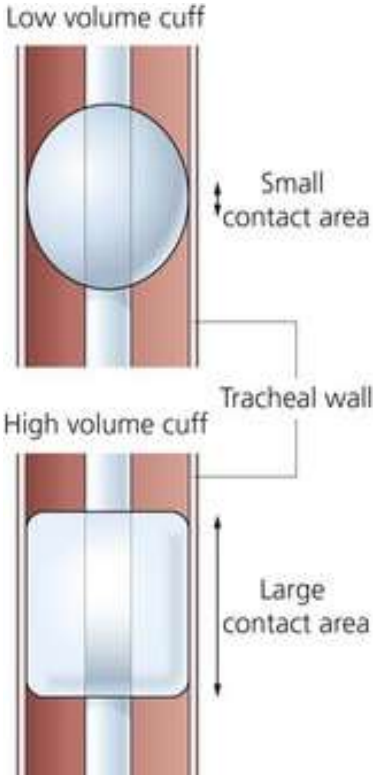
TUBI CUFFIATI / NON CUFFIATI

Cuffed or uncuffed tracheal tube as standard of care?

Recommendation: Cuffed and uncuffed tubes can both be safely used (cuffed tubes in children >3 kg) (1C).

Clinical practice statement: For the safe use of cuffed tubes, we recommend adherence to the manufacturer's instructions, including size and cuff inflation pressure (minimal cuff pressure to avoid air leak, not exceeding 20–30 cm H_2O), to reduce the risk of postextubation stridor. Anatomical variation, clinical conditions, and degree of prematurity might warrant the use of an uncuffed tube.





Usare tubi tracheali cuffiati per il PLS (tranne forse nei neonati e nei piccoli lattanti). Monitorare la pressione di insufflazione della cuffia e limitarla secondo le raccomandazioni del produttore (di solito da < 20 a 25 cm H2O).

LINEE GUIDA EUROPEAN RESUSCITATION COUNCIL 2021 CAPITOLO 10: SUPPORTO DELLE FUNZIONI VITALI IN ETÀ PEDIATRICA

PICO 3. Tracheal intubation

Is direct laryngoscopy or videolaryngoscopy the first-choice technique for tracheal intubation in neonates and infants?

Recommendation: We recommend the use of a video-laryngoscope with an age-adapted standard blade (Mac-intosh or Miller) as first choice for tracheal intubation of neonates and infants (1B), including for tracheal intuba-tion in the lateral position (1C).

LARINGOSCOPIA DIRETTA vs VIDEOLARINGOSCOPIA

- Neonati e lattanti (<6,5 kg)
- Ossigenazione apneica
- First attempt success rate:
  - VL (standard blade) 89%
  - DL 79%


EJA

GUIDELINES

Airway management in neonates and infants

European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines

PICO 3. Tracheal intubation

Is direct laryngoscopy or videolaryngoscopy the first-choice technique for tracheal intubation in neonates and infants?

Clinical practice statement: There is insufficient evidence to recommend which patients should be intubated with hyperangulated blades. However, in cases where standard blades fail and the airway is difficult (anterior larynx, suspected cervical spine injury, or limited movement), the next step should be an alternative advanced technique including use of hyperangulated blades with a stylet, flexible or rigid bronchoscopy alone or in combination with video-laryngoscopy, or flexible bronchoscopy via a supraglottic airway device.

Recommendation: We recommend use of a stylet to reinforce and preshape tracheal tubes when a hyperangulated laryngoscope blade is used or when the larynx is anatomically anterior (1C).

Clinical practice statement: Routine use of a stylet to improve the success rate of tracheal intubation by novice practitioners and trainees cannot be recommended when performing laryngoscopy with standard blades. Bougies

VIDEOLARINGOSCOPIA
Lame standard
Lame iperangolate

Maggiore disallineamento tra asse del faringe e asse della trachea (tubo mandrinato)

Anche in associazione a fibrobroncoscopio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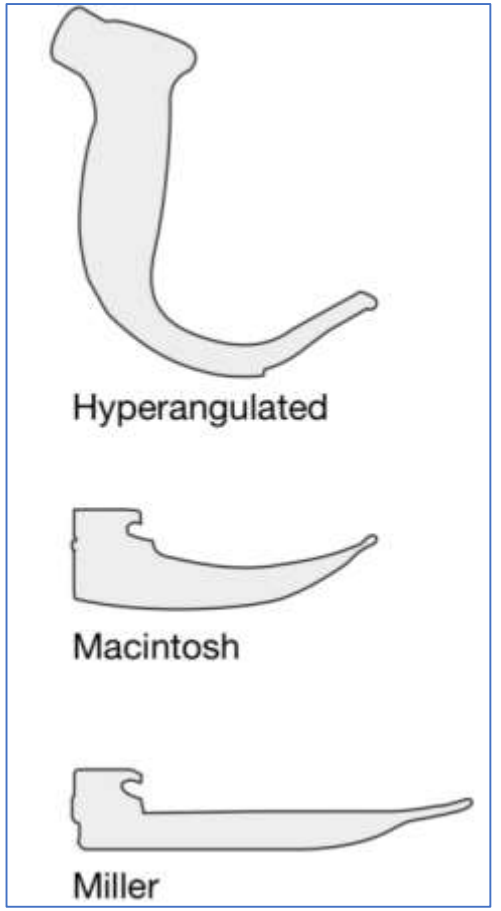
GUIDELINES

Airway management in neonates and infants

European Society of Anaesthesiology and Intensive Care and British Journal of Anaesthesia joint guidelines



PICO 4. Difficult airway management

What should be the gold standard for anticipated difficult airway management and who should be involved?

Recommendation: We recommend flexible bronchoscopy by the nasal route in case of restricted mouth opening (1C).

Clinical practice statement: Flexible fibreoptic tracheal intubation can be performed through a supraglottic airway device, a specially designed face mask or via one nostril while a nasopharyngeal tube is in place in the other nostril for oxygenation. Intubation through a special face mask can be easier, especially for trainees or novices, and when performed via the nasal route. Another provider can assist with mask ventilation during the intubation. If not using a supraglottic airway device, trainees and novices might

Suggestion: We suggest use of a rigid bronchoscope as an advanced technique when the laryngeal inlet is obstructed by swelling and in cases of upper airway stenosis or compression or in congenital or postsurgical tracheal constriction or tortuosity (2C). If necessary, a multidisciplinary team (including an otolaryngologist) should be involved.

- **Fibrobroncoscopio flessibile**
- Paziente sedato in respiro spontaneo
- Anest. topica della mucosa nasale e delle corde
  - Attraverso maschera facciale specifica (endoscopy mask)
  - Attraverso SGA
  - Attraverso una narice con tubo nasofaringeo nell'altra narice
  - In combinazione con VLS
- **Broncoscopio rigido** in caso di stenosi severa laringea o tracheale

Cannot intubate, cannot oxygenate (CICO)

Ossigenazione non ottenibile con alcun metodo di ventilazione (pallone e maschera, SGA, intubazione)

- 1.005.623 anestesie pediatriche
- 531 arresti cardiaci, di cui
- 186 di origine respiratoria, di cui
- 20 CICO

Pediatric Perioperative Cardiac Arrest, Death in the Off Hours: A Report From Wake Up Safe, The Pediatric Quality Improvement Initiative

Robert E. Christensen, MD,* Angela C. Lee, MD,† Marie S. Gowen, MPH,‡ Mallikarjuna R. Rettiganti, PhD,‡ Jayant K. Deshpande, MD, MPH,§ and Jeffrey P. Morray, MD¶

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eFONA

Percutanea

Chirurgica

ECMO

Pediatric emergency front of neck access (eFONA)

CANNOT INTUBATE, CANNOT OXYGENATE (CICO)

↓

CALL FOR EXPERT HELP

↓

UNSUCCESSFUL
FOUR-HANDED FACEMASK VENTILATION
SUPRAGLOTTIC AIRWAY DEVICE
▶ **TRY TO MAINTAIN OXYGENATION**

↓

eFONA

AGE <8 YEARS

TRACHEOSTOMY
Puncture site: 1st-2nd tracheal ring

SCALPEL BOUGIE

Equipment needed:

- ☐ size 11 pointed tip blade scalpel (x 1)
- ☐ needle holders (x 2)
- ☐ size 8 Fr Frova intubating introducer (x 1)
- ☐ lubricated cuffed tracheal tube (x 1)
- ☐ a device applying the Venturi effect

Steps:

1. identify anatomical structures and stabilize the trachea with laryngeal handshake
2. vertical skin incision with 11-blade scalpel
3. grasp the skin with the clamps, dilate the incision and cut the different layers until the trachea is seen
4. open the trachea (max 2 tracheal rings) with a longitudinal incision with the tip of the scalpel
5. insert a 8 Fr Frova catheter in the trachea and advance it caudally
6. insert a cuffed tracheal tube according to the size of the child over the catheter to secure the airway and ventilate the lungs
7. in case of difficulties during tube placement, oxygenate through the Frova intubating introducer using a device applying the Venturi effect
8. confirm correct tube placement with $EtCO_2$

AGE ≥8 YEARS

CRICOTHYROIDOTOMY
Puncture site: cricothyroid membrane

SCALPEL BOUGIE

Equipment needed:

- ☐ size 10 curved blade scalpel (x 1)
- ☐ needle holders (x 2)
- ☐ size 8 Fr Frova intubating introducer (x 1)
- ☐ lubricated cuffed tracheal tube (x 1)
- ☐ a device applying the Venturi effect

Steps:

1. identify anatomical structures and stabilize the trachea with laryngeal handshake
2. transverse incision through cricothyroid membrane
3. turn blade through 90° (sharp edge caudally)
4. insert a 8 Fr Frova catheter in the trachea and advance it caudally
5. insert a cuffed tracheal tube according to the size of the child over the catheter to secure the airway and ventilate the lungs
6. in case of difficulties during tube placement, oxygenate through the Frova intubating introducer using a device applying the Venturi effect
7. confirm correct tube placement with $EtCO_2$

or

PERCUTANEOUS
with ready to use sets

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EDUCATIONAL REVIEW

Pediatric Anesthesia WILEY

Emergency front-of-neck access in pediatric anesthesia: A narrative review

Anna-Katharina Haag[1] | Alberto Tredese[2] | Martina Bordini[3] | Alexander Fuchs[1,2] | Robert Greif[4,5] | Clyde Matava[3] | Thomas Riva[1] | Tommaso Scquizzato[6] | Nicola Disma[2]

FIGURE 1 3D printed model for eFONA. Photo credit Dr. Perry Ann Daley-Ogilvie (Department of Anesthesia and Pain Medicine, Hospital for Sick Children, Toronto).

Grazie per l'attenzione!

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