# Relevante Publikationen Kinderanästhesie 2019-2023

KATZ 23 hybrid

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# Conflict of interest

- Section editor: *Pediatric Anesthesia*
- Editor: *Acta Anaesthesiologica Scandinavica*
- Associate Editor: *British Journal Anaesthesia*

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# Top 5 topics

- SARS-CoV
- Airway
- Big Data
- Fasting
- Outcomes, Safety and Education

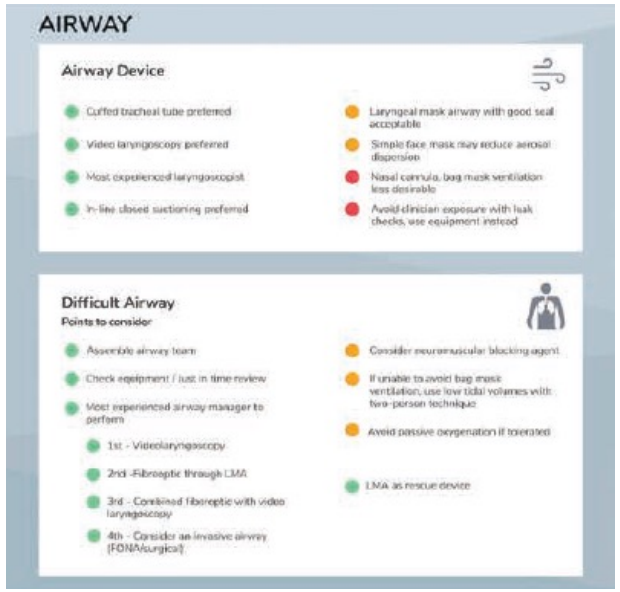
# SARS-CoV-2 (COVID-19)

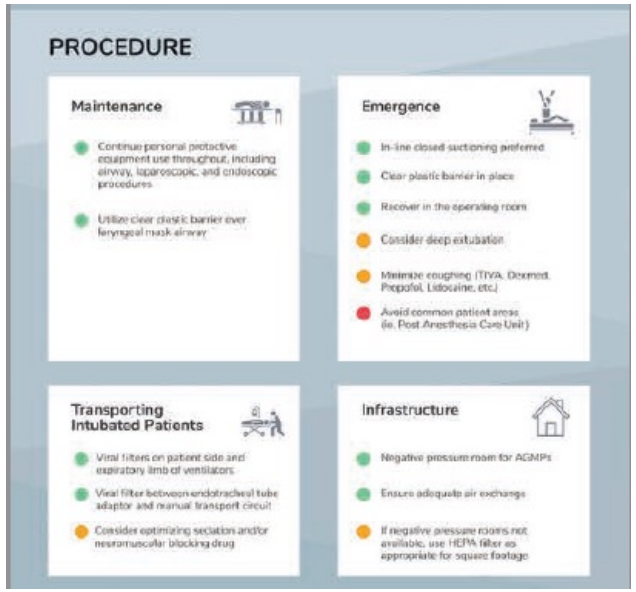
- Beginnings
- Understanding
- End-game

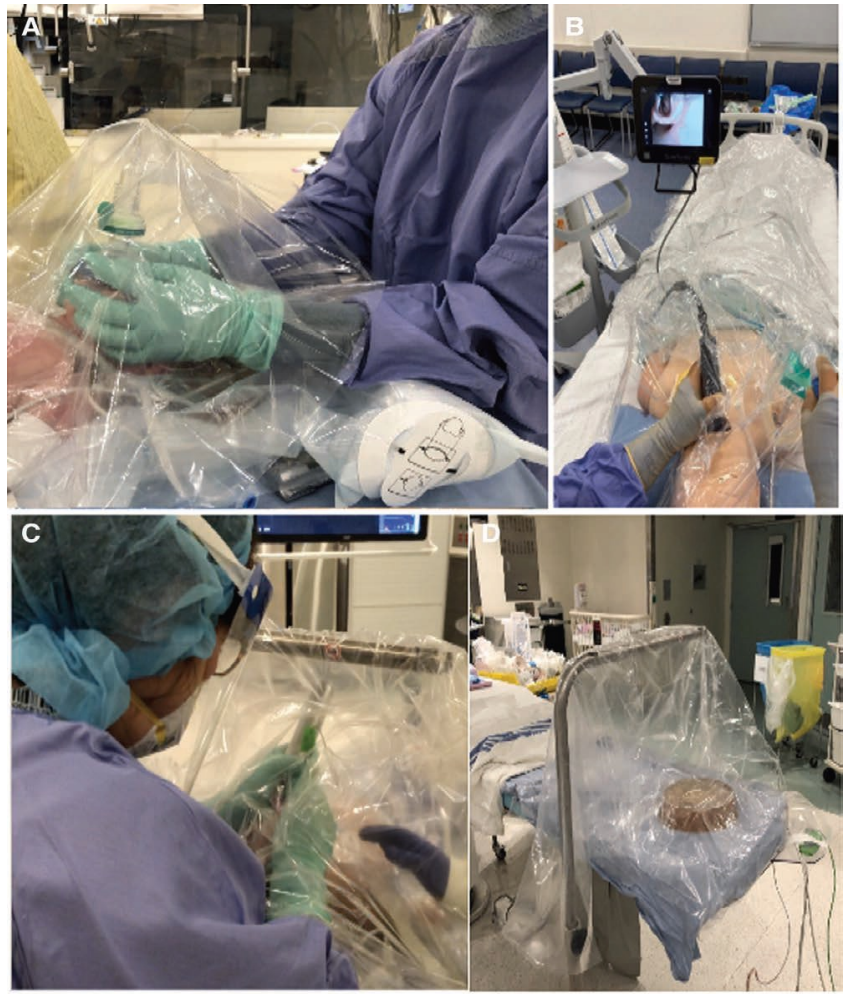
# Pediatric Airway Management in Coronavirus Disease 2019 Patients: Consensus Guidelines From the Society for Pediatric Anesthesia's Pediatric Difficult Intubation Collaborative and the Canadian Pediatric Anesthesia Society

Anesth Analg 2020;131:61–73

| Aerosol-Generating Medical Procedure | Odds Ratio |
|---|---|
| Tracheal intubation | 6.6 |
| Tracheostomy | 4.2 |
| Suction before intubation | 3.5 |
| Noninvasive ventilation | 3.1 |
| Manual ventilation before intubation | 2.8 |
| Chest compression/defibrillation | 2.5 |
| Bronchoscopy | 1.9 |



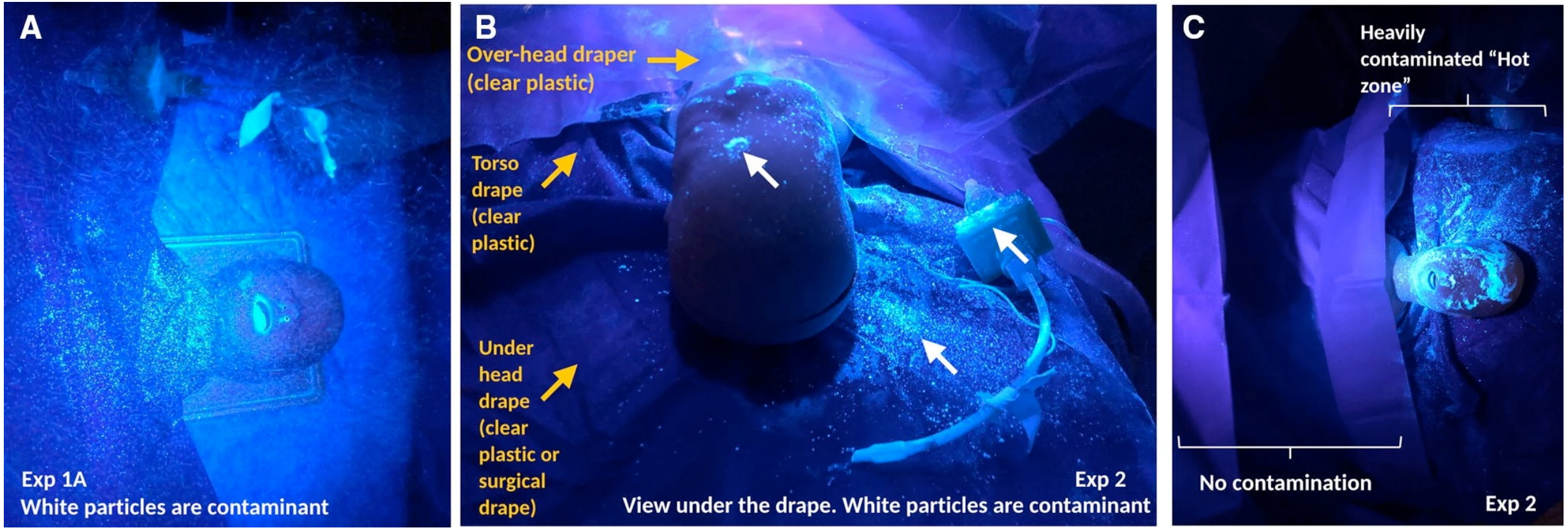



# Clear plastic drapes may be effective at limiting aerosolization and droplet spray during extubation: implications for COVID-19

Clyde T. Matava, MBCHB, MMed, MHSC ·
Julie Yu, MD, FRCA · Simon Denning, BMBS, BMedSci, FRCA

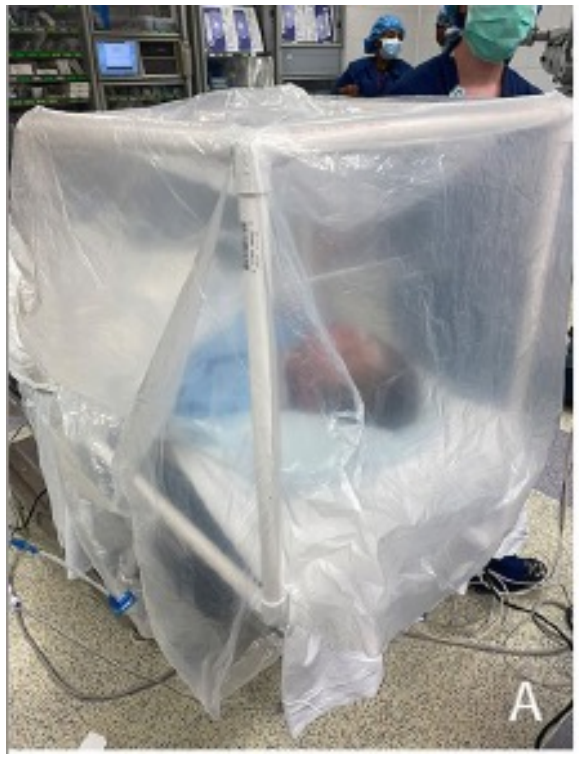
Can J Anesth/J Can Anesth (2020) 67:902–904



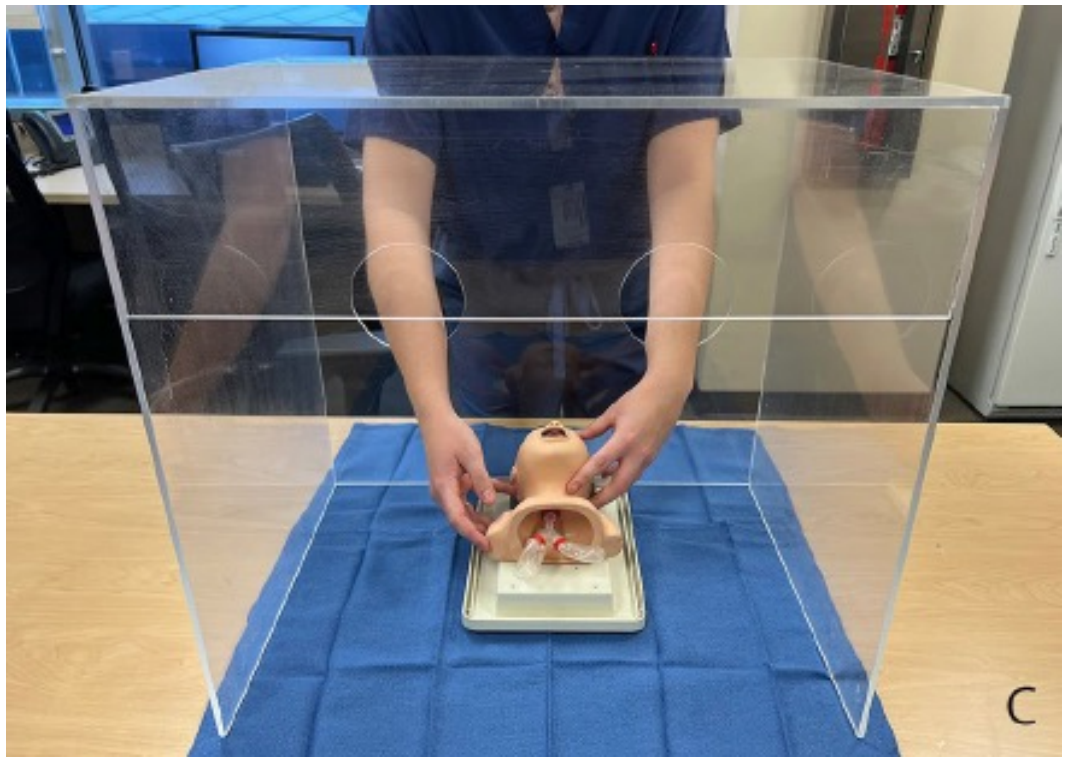
# Management of the Normal and Difficult Pediatric Airway: Unique Challenges in the Time of COVID-19

Edgar Kiss[1,2] · Annery Garcia-Marcinkiewicz[3,4] · John Zhong[1,2] · Matthew Roberts[1] · Neethu Chandran[1,2] · Rhae Battles[1,2] · Rita Saynhalath[1,2,5] · Iamze Agdgomelashvili[6,7] · Patrick Olomu[1,2]

Current Surgery Reports
https://doi.org/10.1007/s40137-023-00359-8

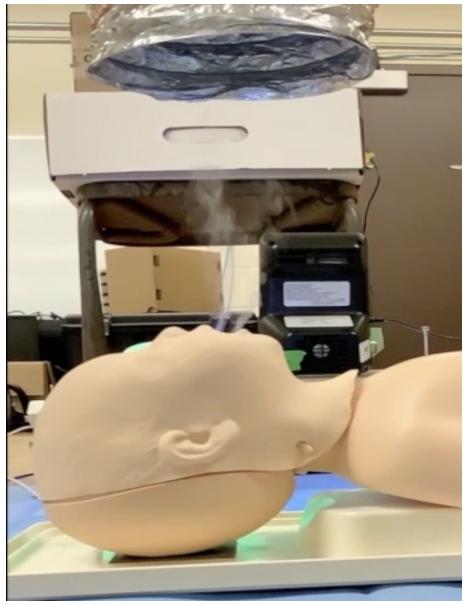


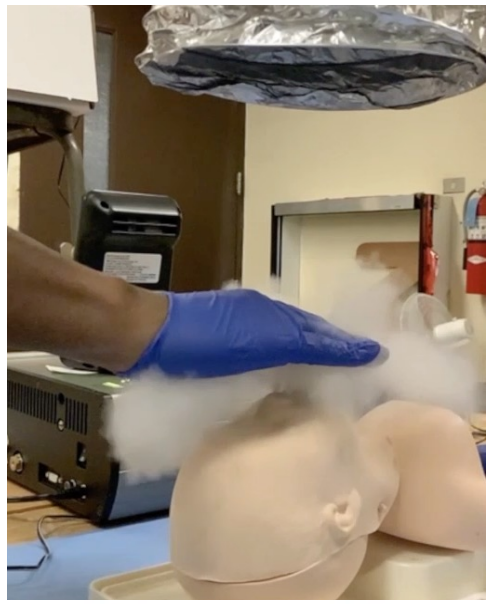


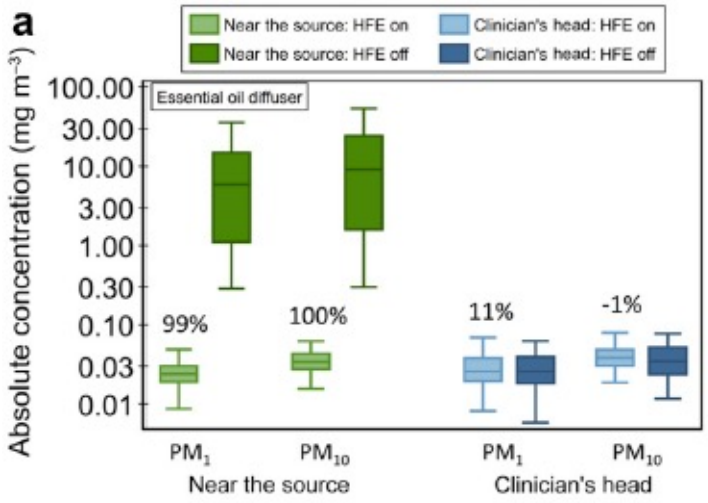


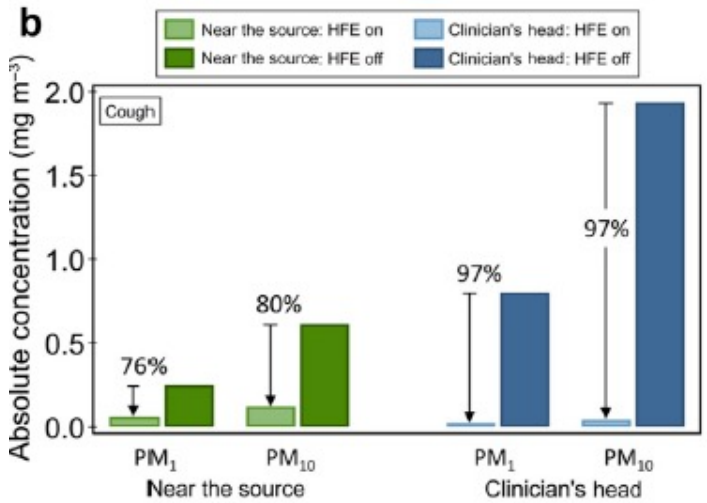
# Use of a high-flow extractor to reduce aerosol exposure in tracheal intubation

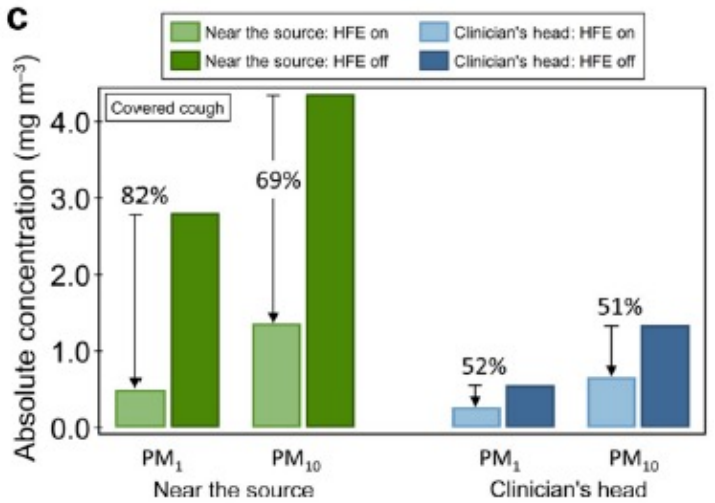
https://doi.org/10.1016/j.bja.2020.07.014.







# Desperate times breed desperate measures: About valiance or foolhardiness

*Pediatric Anesthesia*. 2020;30:634–635.

Do not let our actions be guided solely by panic and emotions, but rather by common sense and good judgment. This is our responsibility.

# COVID-19 implications for pediatric anesthesia: Lessons learnt and how to prepare for the next pandemic

*Pediatric Anesthesia*. 2022;32:385–390.

We are obliged to assess the true value of our strategies, approaches, and treatment modalities during this pandemic in a solid scientific manner, and we should not compromise our standards and scientific rigor.

# Lessons from COVID-19: A reflection on the strengths and weakness of early consensus recommendations for pediatric difficult airway management during a respiratory viral pandemic using a modified Delphi method

Mary Lyn Stein[1,2] | Raymond S. Park[1,2] | Arash Afshari[3] | Nicola Disma[4] | John E. Fiadjoe[1,2] | Clyde T. Matava[5] | Alistair F. McNarry[6] | Britta S. von Ungern-Sternberg[7,8,9] | Pete G. Kovatsis[1,2] | James M. Peyton[1,2]

*Pediatric Anesthesia*. 2021;31:1074–1088.

# Lessons from COVID-19: A reflection on the strengths and weakness of early consensus recommendations for pediatric difficult airway management during a respiratory viral pandemic using a modified Delphi method

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*Pediatric Anesthesia*. 2021;31:1074–1088.

*In a pediatric patient with suspected or confirmed COVID-19:*

Call for additional help as soon as difficulty is identified. All clinicians involved in airway management should don appropriate personal protective equipment (PPE) prior to engaging in patient care

First attempt at airway management by the most experienced clinician in chosen technique

Only senior trainees or fully trained clinicians should manage COVID-19–positive children with anticipated difficult airways

Aerosol barriers should not be used in children with anticipated difficult airways

Induction technique should be selected based on the clinical situation

Videolaryngoscopy is the preferred first attempt approach for intubation. Direct laryngoscopy is not recommended

# Complications associated with paediatric airway management during the COVID-19 pandemic: an international, multicentre, observational study

**M. B. Peterson,[1] H. G. Gurnaney,[2] N. Disma,[3] C. Matava,[4] N. Jagannathan,[5] M. L. Stein,[6] H. Liu,[7] P. G. Kovatsis,[6] B. S. von Ungern-Sternberg,[8] J. E. Fiadjoe,[2,6] and the PAWS-COVID-19 Group***

Anaesthesia 2022, 77, 649–658

| | All patients | | | Airway managed with tracheal tube | | | Airway managed with SAD | | |
|---|---|---|---|---|---|---|---|---|---|
| | No COVID-19 n = 7567 | COVID-19 n = 329 | Odds ratio (95%CI) | No COVID-19 n = 4241 | COVID-19 n = 232 | Odds ratio (95%CI) | No COVID-19 n = 2432 | COVID-19 n = 66 | Odds ratio (95%CI) |
| Any hypoxaemia | 214 (3%) | 24 (7%) | 2.70 (1.7–4.1) | 162 (4%) | 19 (8%) | 2.25 (1.33–3.59) | 40 (2%) | 1 (2%) | 0.92 (0.05–4.34) |
| Mild | 121 (2%) | 13 (4%) | 2.53 (1.35–4.37) | 87 (2%) | 12 (5%) | 2.60 (1.34–4.65) | 28 (1%) | 1 (2%) | 1.32 (0.07–6.34) |
| Moderate | 66 (1%) | 9 (3%) | 3.20 (1.47–6.14) | 54 (1%) | 5 (2%) | 1.71 (0.59–3.92) | 8 (<1%) | - | - |
| Severe | 27 (<1%) | 2 (1%) | 1.71 (0.27–5.73) | 21 (<1%) | 2 (1%) | 1.75 (0.28–6.00) | 4 (<1%) | - | - |

14,000 patients from 78 sites in 16 countries

# SARS-CoV-2 airway reactivity in children: more of the same?

Anaesthesia 2022, 77, 956–958

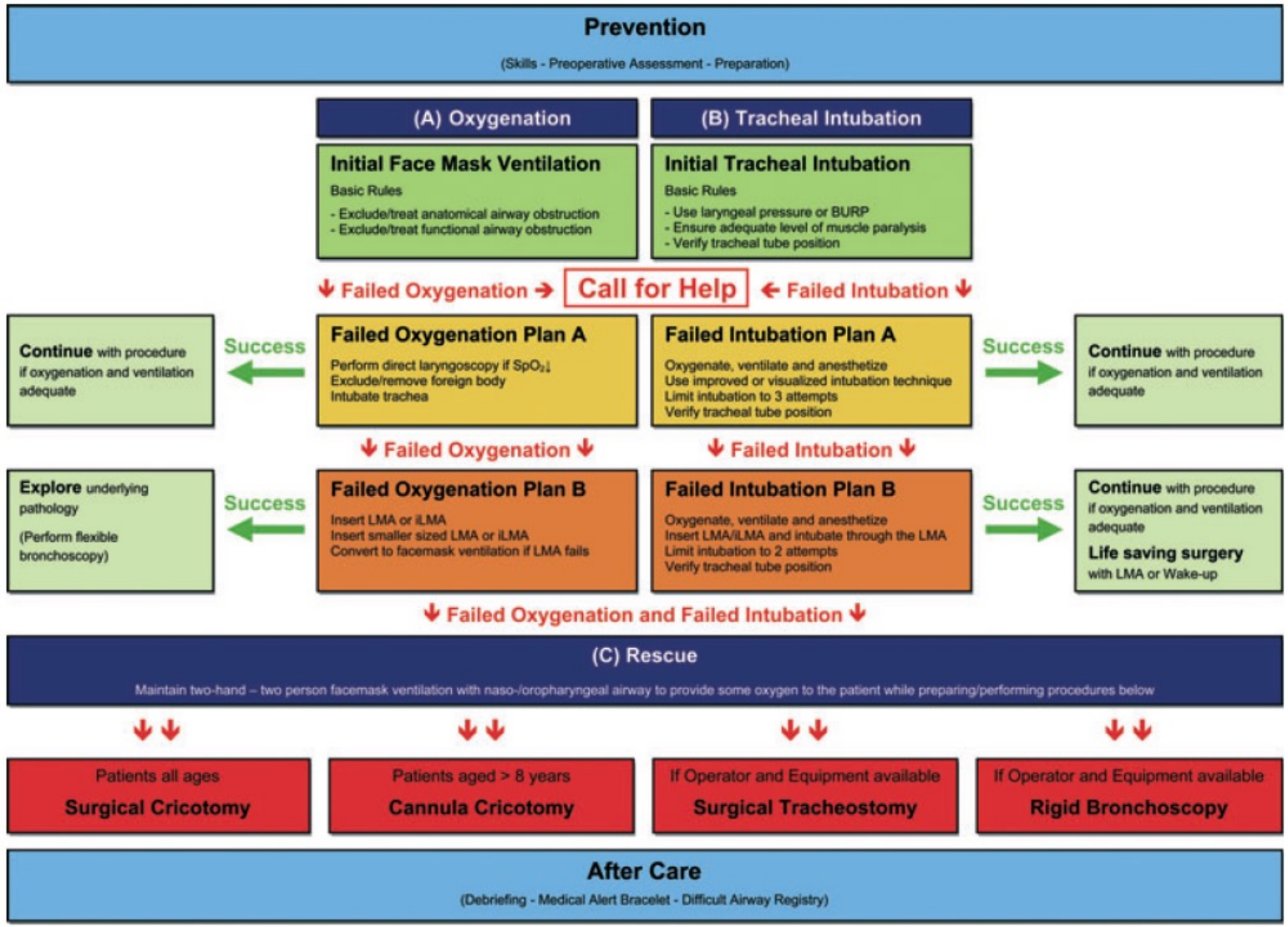
Meanwhile, the time has come to move beyond data collection for COVID-19 in children undergoing anaesthesia and airway management and provide the same previous care and judicious clinical principles as with other viral URTIs in children. We can also paraphrase the Big Lebowski: "*I can't be worried about that anymore. Life goes on, man!*"

# Airway

- Guidelines
- Trials
- New directions

# *Proposal for the management of the unexpected difficult pediatric airway*

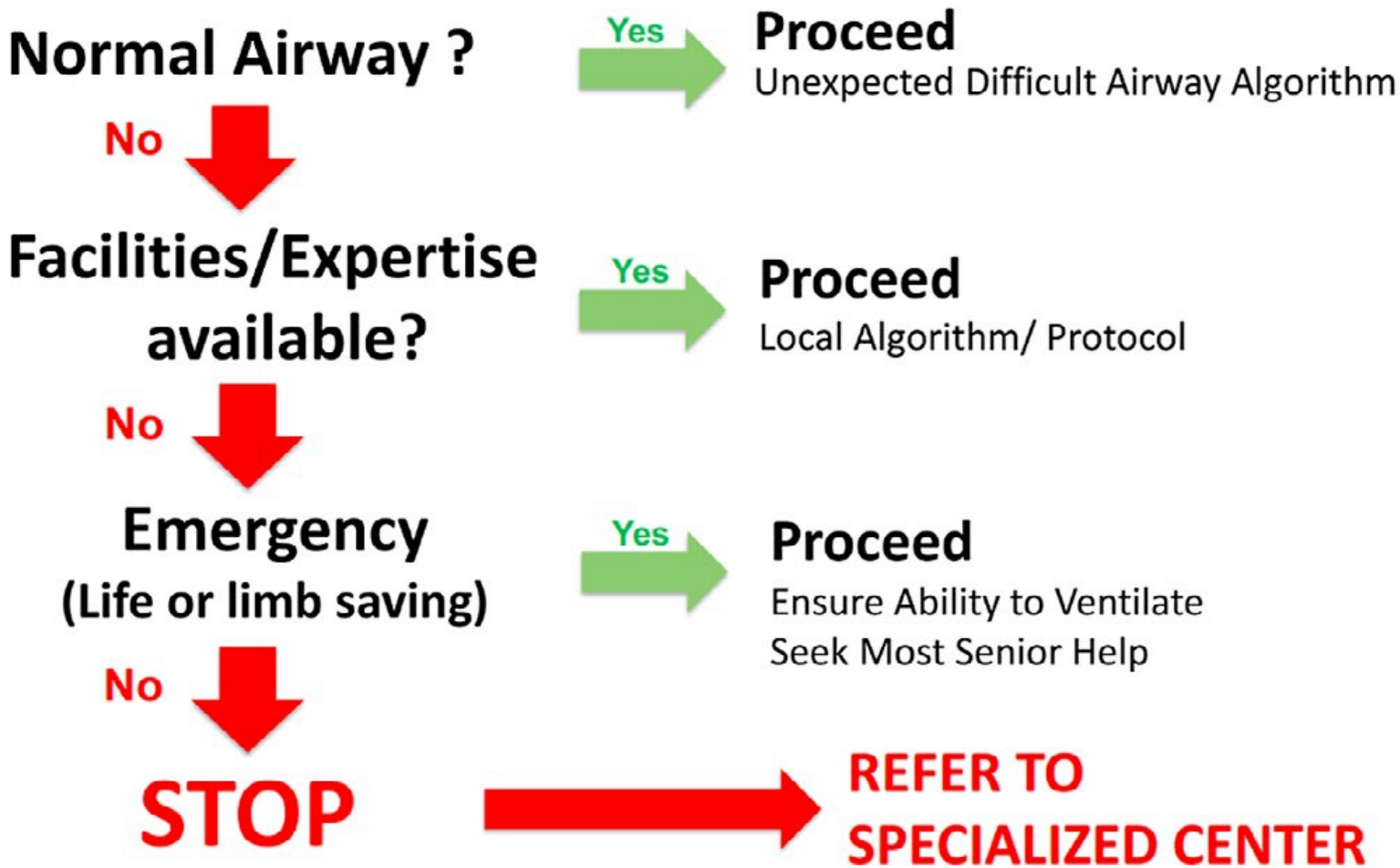
*Pediatric Anesthesia 2010* **20**: 454–464



# A framework for the management of the pediatric airway

Thomas Engelhardt[1,2] | John E. Fiadjoe[3] | Markus Weiss[4] | Paul Baker[5,6] | Stephanie Bew[7] | Piedad Echeverry Marín[8] | Britta S von Ungern-Sternberg[9,10,11]

*Pediatric Anesthesia*. 2019;29:985–992.



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*Pediatric Anesthesia*. 2019;29:985–992.

| | |
|---|---|
| Anatomical/mechanical airway obstructions | |
| Inadequate head position | Repositioning, reopening |
| Large adenoids/ tonsils/ obesity | Oropharyngeal/ nasopharyngeal airway |
| Difficult facemask technique | Two hand/ two person technique |
| Blood, foreign body, secretions[a] | Suction, removal |
| Alveolar collapse (closing capacity) | Alveolar recruitment maneuvers |
| Gastric hyperinflation/ distension | Decompression by an orogastric tube |
| Functional airway obstructions | |
| Inadequate depth of anesthesia | Deepen anesthesia |
| Laryngospasm[b] | Propofol, muscle relaxation |
| Opioid-induced muscle rigidity and/or vocal cord closure | Muscle relaxation |
| Bronchospasm[c] | Epinephrine, bronchodilators (sevoflurane) |

# A framework for the management of the pediatric airway

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*Pediatric Anesthesia*. 2019;29:985–992.

## Pediatric Oxygenation and Ventilation

(Please adapt according to local expertise and facilities)

**Prevention, Teaching, Training, Facilities**

Careful assessment and planning

↓

Recognize and treat

ANATOMICAL/ MECHANICAL Airway Obstructions

TREATMENT (specify)

Positioning, mouth-opening, oral or nasal airway, two-hand two person facemask ventilation

↓

**CALL FOR HELP**

(insert contact details)

↓

**Recognize and treat**

FUNCTIONAL Airway Obstructions

TREATMENT (specify)

Hypnotic, musde relaxant, epinephrine

↓

**Plan A**

Direct/ Video Laryngoscopy

(specify local choice)

↓

**Plan B**

Supraglottic Airway Device (SAD)

## Pediatric Tracheal Intubation Approach

(Please adapt according to local expertise and facilities)

**Ensure Oxygenation and ventilation at all times**

Consider using a SAD if Tracheal Intubation fails at any stage

**Prevention, Teaching, Training, Facilities**

Initial Local Tracheal Intubation Protocol

Direct/Video Laryngoscopy (VL)

(specify local choice)

**Limit to 2 attempts**

↓

**CALL FOR HELP**

(insert contact details)

↓

**Plan A**

Alternative Approach

VL/fiberoptic

(specify local choice)

**Limit to 2 attempts**

↓

**Plan B**

Insert Supraglottic Airway Device (SAD)

(oxygenate/anesthetize)

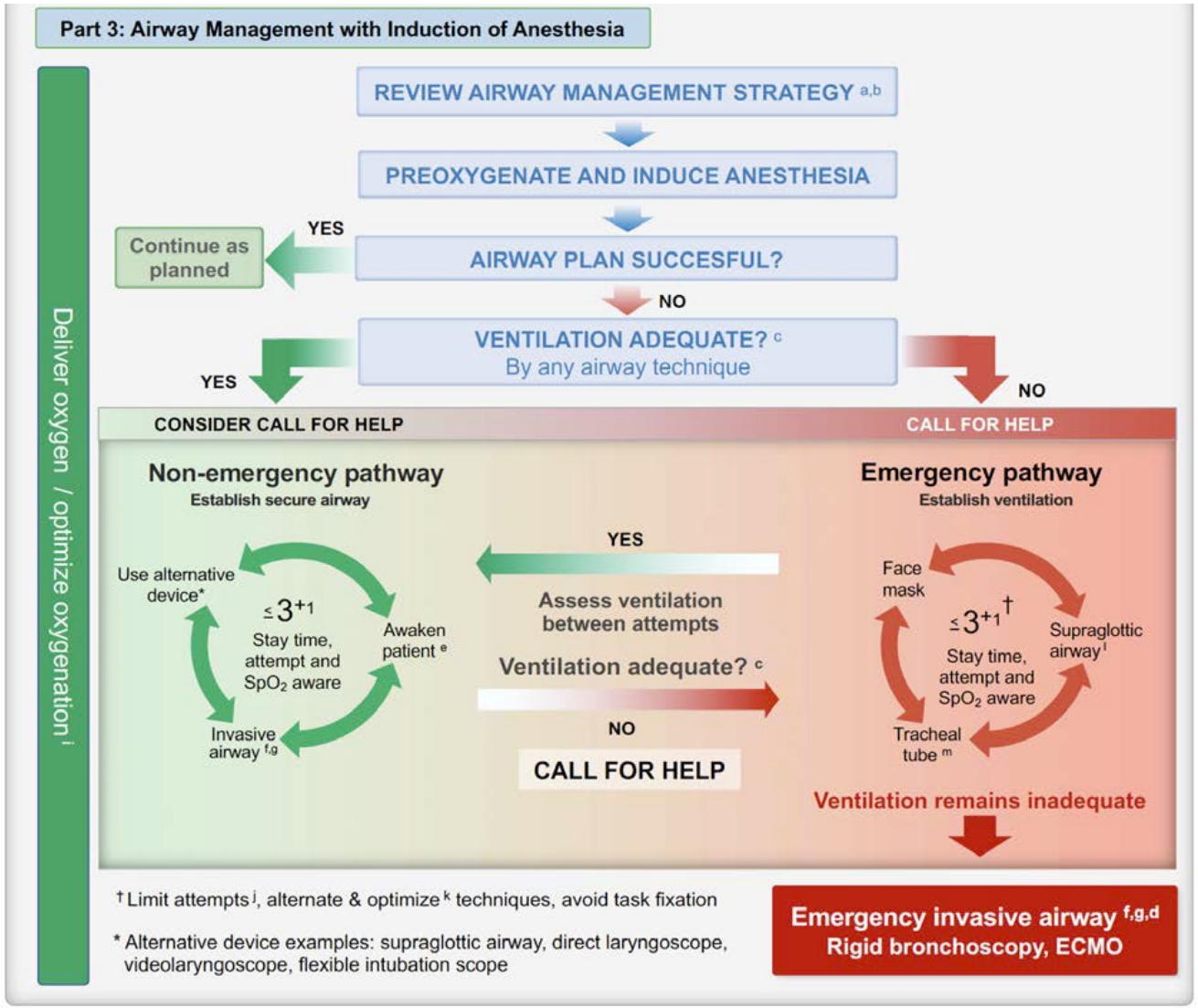
Fibreoptic intubation via SAD

(specify)

# 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.; ... Show more

ANESTHESIOLOGY 2022; 136:31–81



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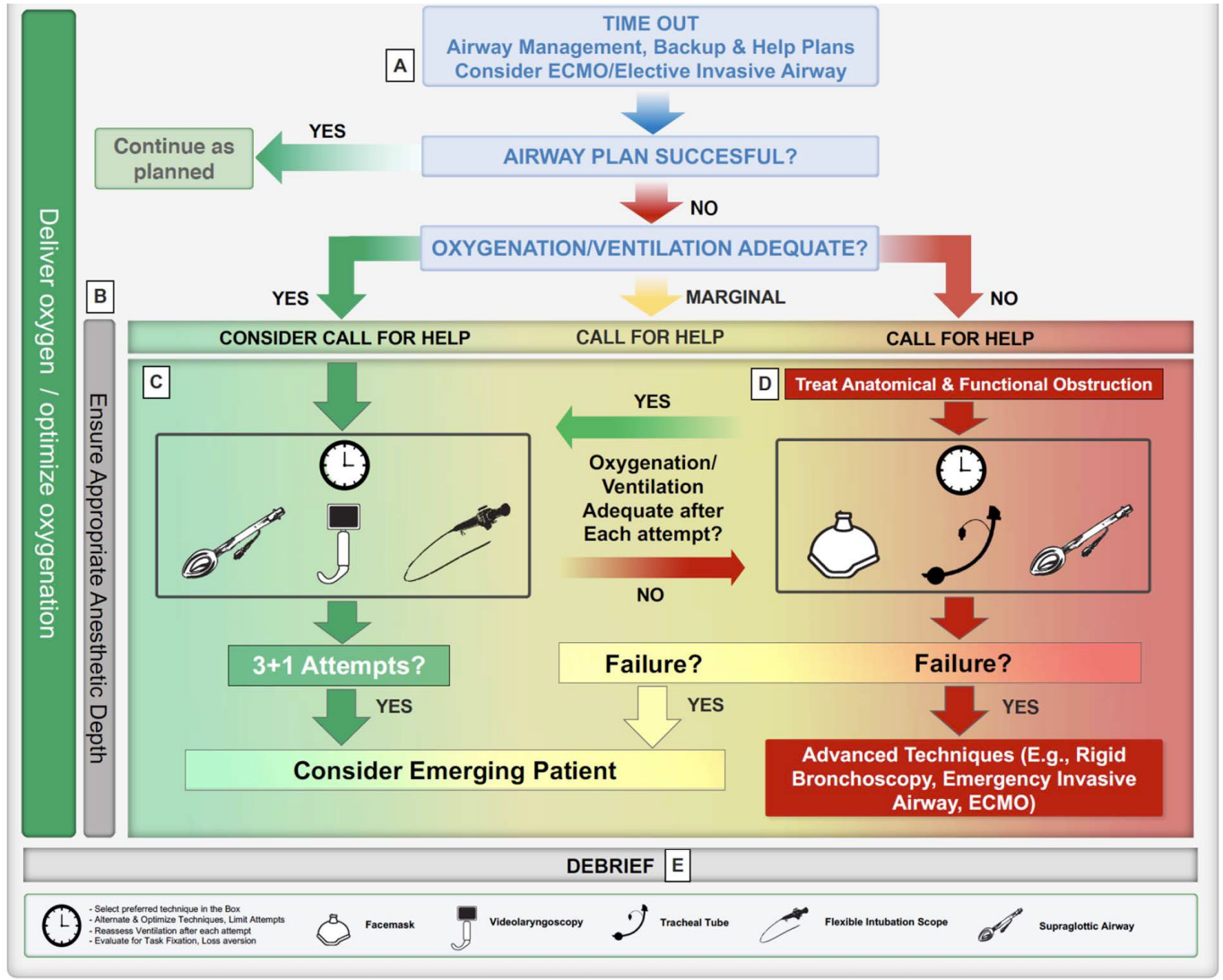
ANESTHESIOLOGY 2022; 136:31–81



Pediatric Difficult Intubation (PeDI) Registry group is a multicenter organization dedicated to assessing, understanding and improving the outcomes of children with Difficult Direct Laryngoscopy (DDL) to facilitate benchmarking, quality improvement and research. The objectives of the group are (1) to provide site specific and aggregate data back to sites on DDL events and (2) to augment local quality improvement efforts and (3) to facilitate research studies related to DDL.

“We make airway management safer”

6694 cases

2012 to 2022 Q1

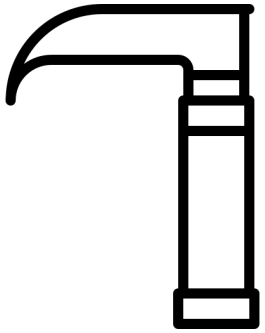
30+ Countries

# Airway management complications in children with difficult tracheal intubation from the Pediatric Difficult Intubation (PeDI) registry: a prospective cohort analysis

*Lancet Respir Med* 2016; 4: 37–48

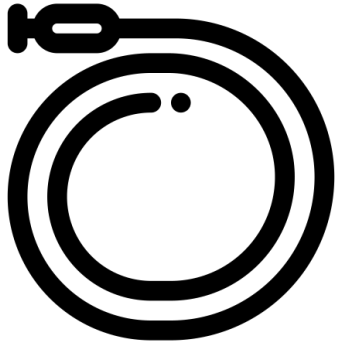
1018 cases

16 (3%)



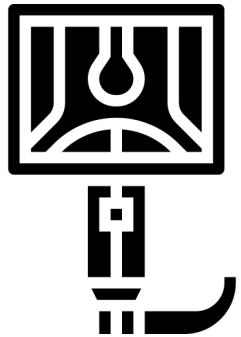
(n=461, 46%)

153 (54%)



(n=284, 28%)

101 (55%)



(n=183, 18%)

# Airway management complications in children with difficult tracheal intubation from the Pediatric Difficult Intubation (PeDI) registry: a prospective cohort analysis

*Lancet Respir Med* 2016; 4: 37–48

**Occurrence of complications was associated with:**

**2**

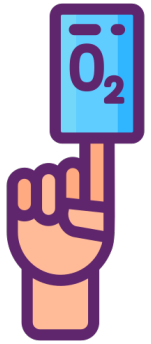
**More than two attempts**

**10**

**< 10kg**

# Airway management complications in children with difficult tracheal intubation from the Pediatric Difficult Intubation (PeDI) registry: a prospective cohort analysis

*Lancet Respir Med* 2016; 4: 37–48




Temporal Hypoxemia

15 (2%) of patients (1018 cases)

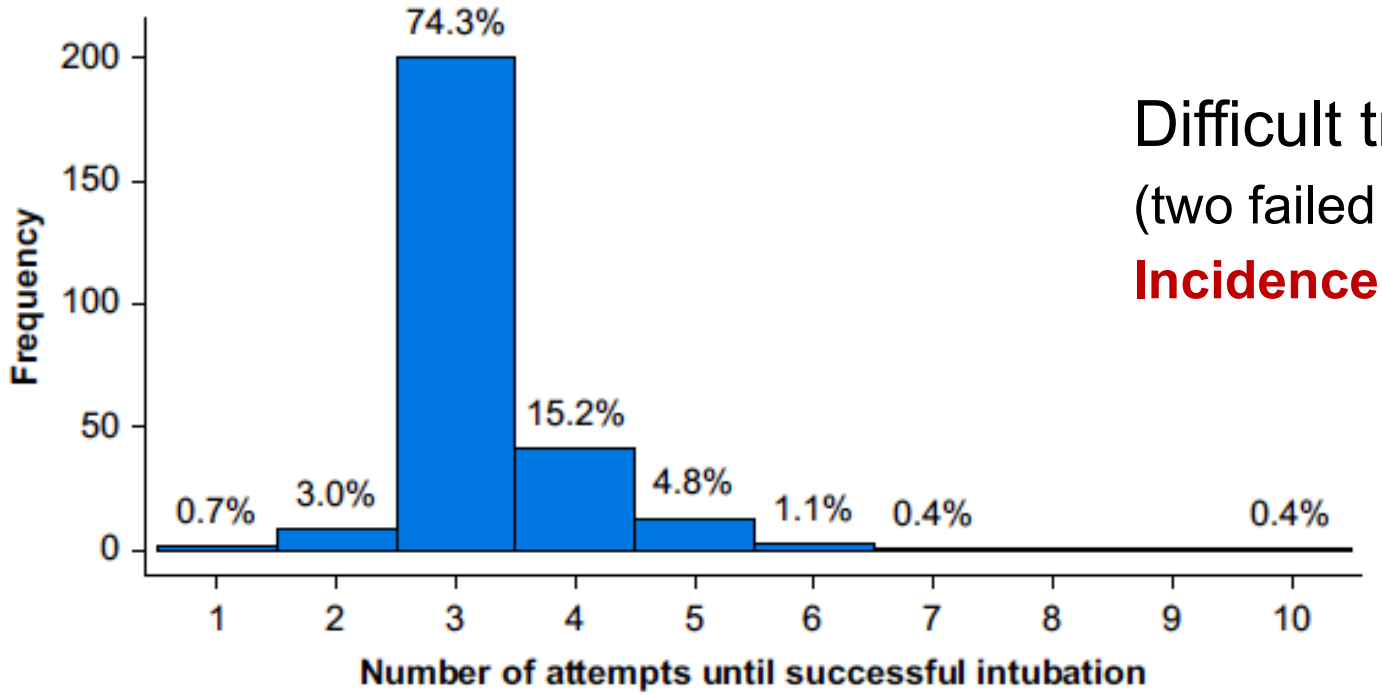
1.6% of patients (5000 cases)

# 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[‡]

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

5609 cases, <60 weeks, 271 difficult intubations




Difficult tracheal intubation

(two failed attempts of laryngoscopy)

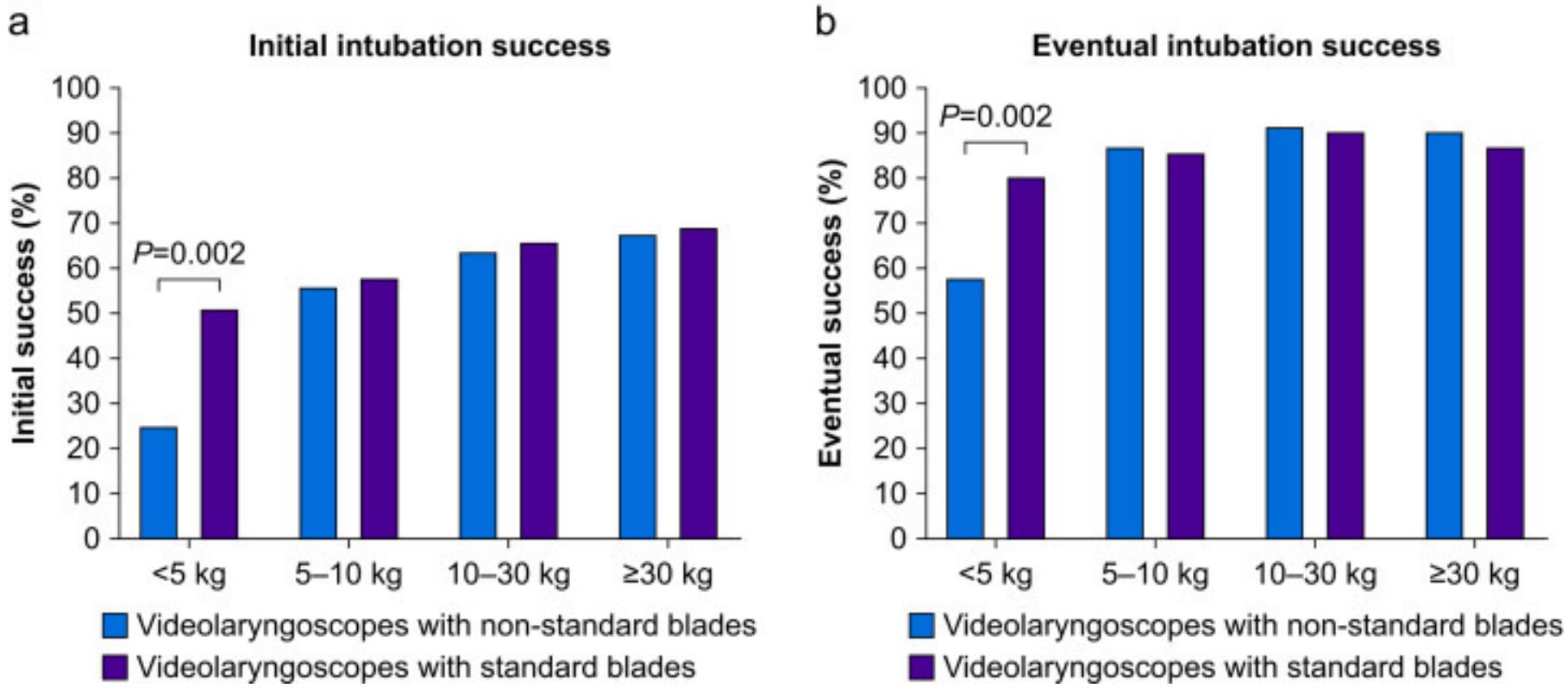
**Incidence: 5.8% (95% CI, 5.1–6.5)**

Hyperangulated blade

Standard blade

# A comparison of videolaryngoscopy using standard blades or non-standard blades in children in the Paediatric Difficult Intubation Registry

British Journal of Anaesthesia, 126 (1): 331–339 (202



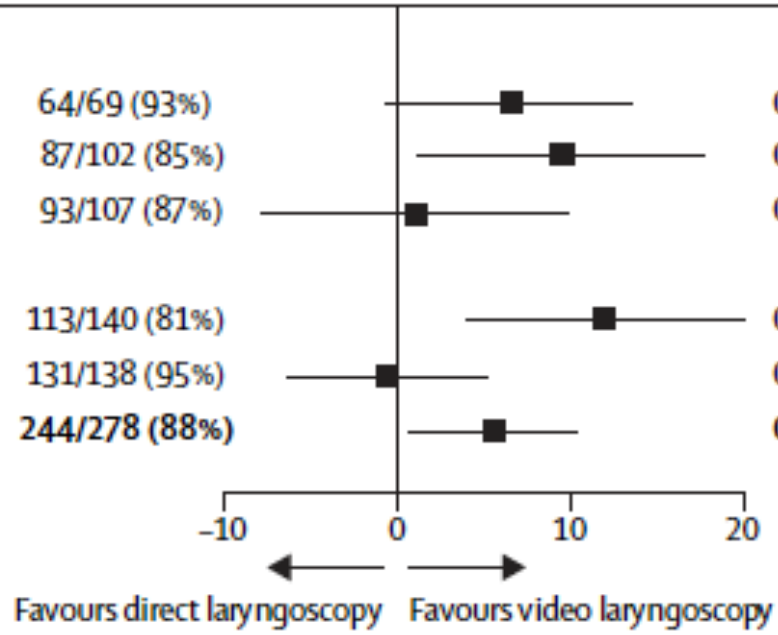

Standard blades had 3-fold greater odds of success at initial tracheal intubations compared with non-standard blades in children < 5kg (adjusted odds ratio 3.0, 95% confidence interval): 1.32–6.86, P=0.0009).

# First-attempt success rate of video laryngoscopy in small infants (VISI): a multicentre, randomised controlled trial

*Annery G Garcia-Marcinkiewicz*, Pete G Kovatsis*, Agnes I Hunyady, Patrick N Olomu, Bingqing Zhang, Madhankumar Sathyamoorthy, Adolfo Gonzalez, Siri Kanmanthreddy, Jorge A Gálvez, Amber M Franz, James Peyton, Raymond Park, Edgar E Kiss, David Sommerfield, Heather Griffis, Akira Nishisaki, Britta S von Ungern-Sternberg, Vinay M Nadkarni, Francis X McGowan Jr, John E Fiadjoe, on behalf of the PeDI Collaborative investigators†*

*Lancet* 2020; 396: 1905–13

| | Video laryngoscopy | Direct laryngoscopy | p value | $p_{Interaction}$ |
|---|---|---|---|---|
| **Clinician role** | | | | **0·41** |
| Attending anaesthetist | 67/69 (97%) | 64/69 (93%) | 0·07 | |
| Fellow anaesthetist | 93/99 (94%) | 87/102 (85%) | 0·026 | |
| Resident anaesthetist | 94/106 (89%) | 93/107 (87%) | 0·81 | |
| **Bodyweight** | | | | **0·016** |
| ≤6·5 kg | 119/129 (92%) | 113/140 (81%) | 0·003 | |
| >6·5 kg | 135/145 (93%) | 131/138 (95%) | 0·83 | |
| **Overall** | **254/274 (93%)** | **244/278 (88%)** | **0·024** | |




564 cases, <12 months

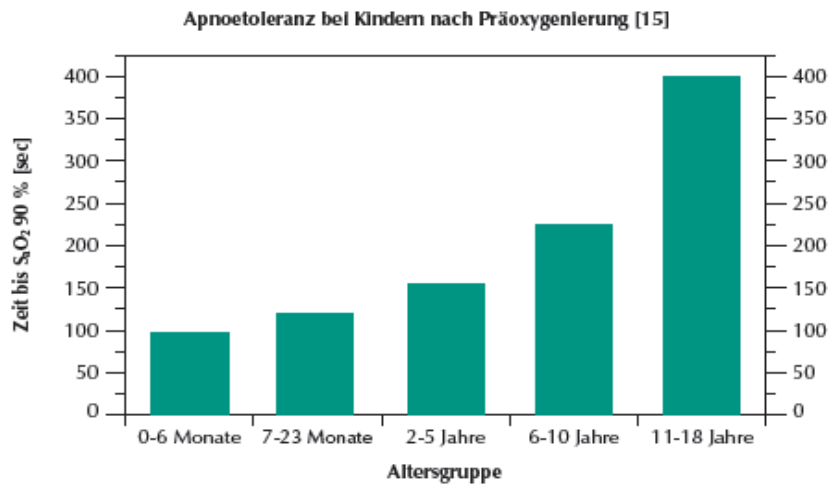
**Interpretation** Among anaesthetised infants, using video laryngoscopy with a standard blade improves the first-attempt success rate and reduces complications.

# First-attempt success rate of video laryngoscopy in small infants (VISI): a multicentre, randomised controlled trial

*Annery G Garcia-Marcinkiewicz*, Pete G Kovatsis*, Agnes I Hunyady, Patrick N Olomu, Bingqing Zhang, Madhankumar Sathyamoorthy, Adolfo Gonzalez, Siri Kanmanthreddy, Jorge A Gálvez, Amber M Franz, James Peyton, Raymond Park, Edgar E Kiss, David Sommerfield, Heather Griffis, Akira Nishisaki, Britta S von Ungern-Sternberg, Vinay M Nadkarni, Francis X McGowan Jr, John E Fiadjoe, on behalf of the PeDI Collaborative investigators†*

*Lancet* 2020; 396: 1905–13

| | All patients (n=552) | Video laryngoscopy (n=274) | Direct laryngoscopy (n=278) | Adjusted absolute risk difference (95% CI)* | p value |
|---|---|---|---|---|---|
| **Successful first-attempt intubation** | | | | | |
| Modified Intention-to-treat analysis | 498 (90%) | 254 (93%) | 244 (88%) | 5·5 (0·7 to 10·3) | 0·024 |
| Per-protocol analysis | 496/550 (90%) | 252/272 (93%) | 244/278 (88%) | 5·4 (0·6 to 10·2) | 0·028 |
| **Secondary outcomes†** | | | | | |
| Intubation duration >1 min | 67 (12%) | 40 (15%) | 27 (10%) | 5·6 (−0·1 to 11·3) | 0·053 |




# Direct versus video laryngoscopy with standard blades for neonatal and infant tracheal intubation with supplemental oxygen: a multicentre, non-inferiority, randomised controlled trial

Lancet Child Adolesc Health 2022

*Thomas Riva, Thomas Engelhardt, Reto Basciani, Rachele Bonfiglio, Evelien Cools, Alexander Fuchs, Annery G Garcia-Marcinkiewicz, Robert Greif, Walid Habre, Markus Huber, Maria-Alexandra Petre, Britta S von Ungern-Sternberg, David Sommerfield, Lorenz Theiler, Nicola Disma, for the OPTIMISE Collaboration**

## Direct *vs* videolaryngoscopy for neonatal and infant intubation with supplemental oxygen

Randomized Controlled Trial | Non-inferiority Single-blinded | Multicentre
Seven tertiary level pediatric hospitals in Europe, North America and Australia

POPULATION

**250** neonates and infants requiring tracheal intubation for non-emergency procedures in the operating room

**38 weeks** GESTATIONAL AGE | **29%** FEMALE | **79%** ORAL INTUBATION

PRIMARY OUTCOME

### FIRST-ATTEMPT TRACHEAL INTUBATION SUCCESS RATE

**Direct laryngoscopy** WITH SUPPLEMENTAL OXYGEN **79%**

**Video laryngoscopy** WITH SUPPLEMENTAL OXYGEN **89%**

ADJUSTED ABSOLUTE RISK DIFFERENCE [95% CI] 10% [0.8-18.1%] P = 0.033

SECONDARY OUTCOME

INCIDENCE OF OXYGEN DESATURATION

ADJUSTED RISK DIFFERENCE [95% CI] 0.6% [-1.6%-2.8%] P = 0.617

Incidence of hypoxemia increased with the number of attempts but was comparable between video- or direct laryngoscopy

CONCLUSIONS

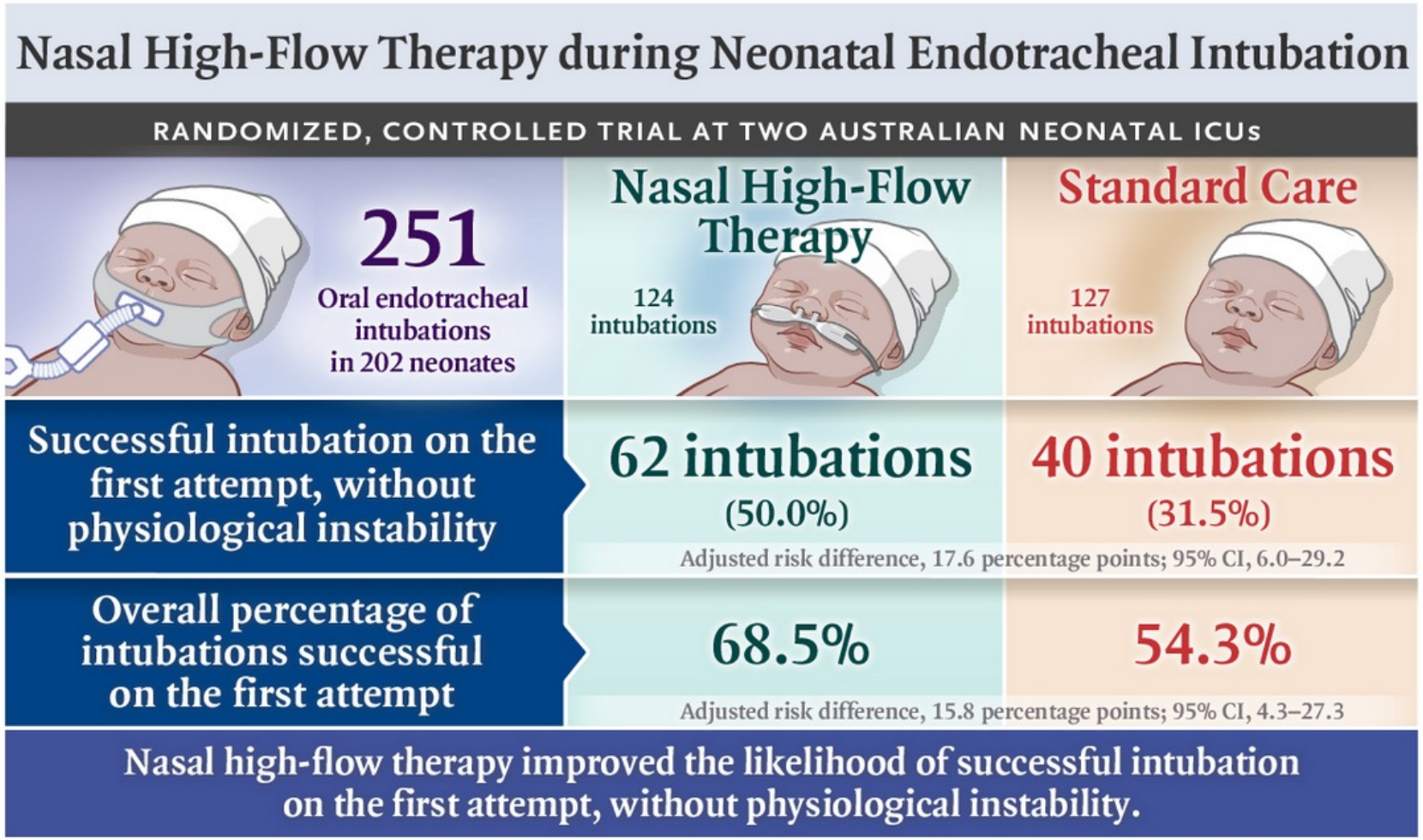
**Videolaryngoscopy in neonates and infants increases the success rate of first-attempt tracheal intubation. Applying systematically supplemental oxygen during airway management minimize the incidence of hypoxemia.**


1L/kg/min

# Nasal High-Flow Therapy during Neonatal Endotracheal Intubation

Kate A. Hodgson, M.B., B.S., Louise S. Owen, M.D., C. Omar F. Kamlin, D.Med.Sci., Calum T. Roberts, Ph.D., Sophie E. Newman, M.B., B.S., Kate L. Francis, M.Biostat., Susan M. Donath, M.A., Peter G. Davis, M.D., and Brett J. Manley, Ph.D.

N Engl J Med 2022;386:1627-37.





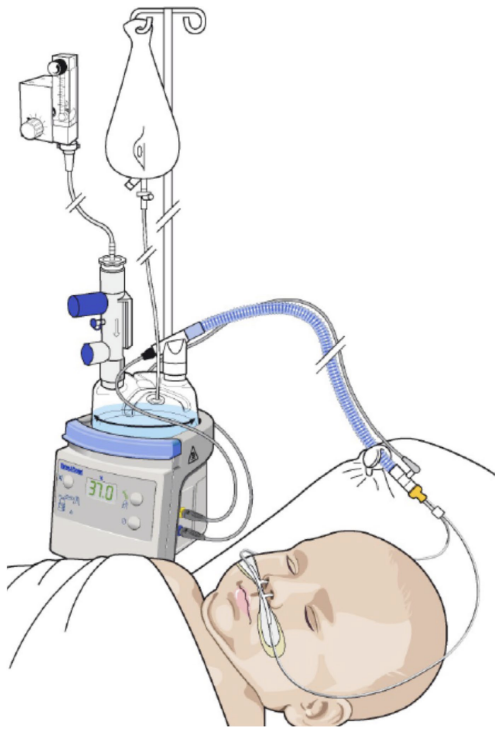
8L/kg/min

# Nasal high-flow oxygen in pediatric anesthesia and airway management

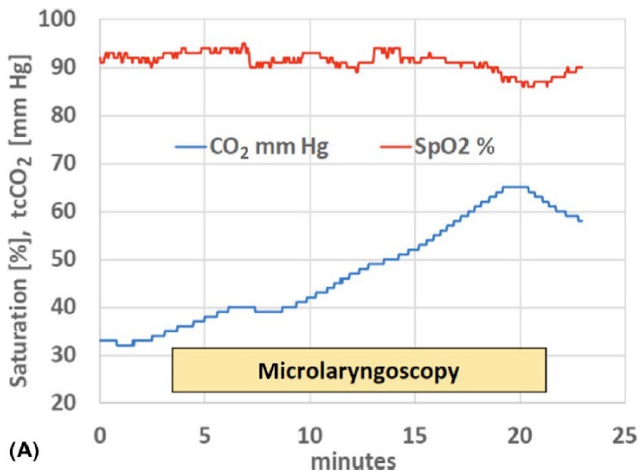
*Pediatric Anesthesia*. 2020;30:339–346.

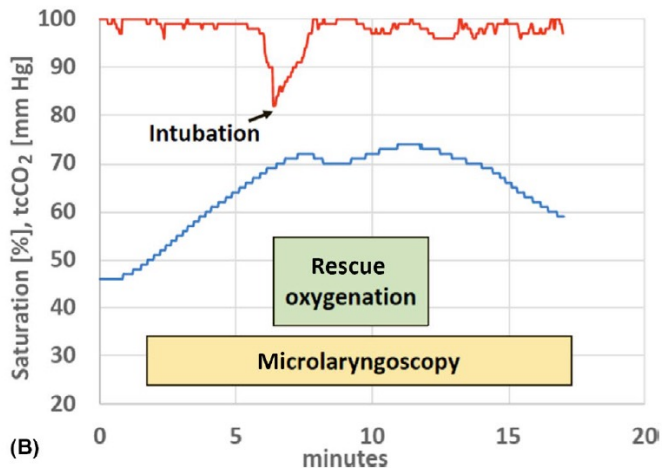
# *H*igh-flow oxygen for children's *a*irway surgery: rando*m*ised controll*e*d *t*rial protocol (HAMSTER)

Humphreys S, *et al*. *BMJ Open* 2019;**9**:e031873. doi:10.1136/bmjopen-2019-031873



| Weight | HIGH-FLOW rates |
|---|---|
| 0-12 kg | 2 L/kg/min |
| 13-15 kg | 30 L/min |
| 16-30 kg | 35 L/min |
| 31-50 kg | 40 L/min |
| >50 kg | 50 L/min |



# Big Data

- Registries
- Fruits and all
- To target or not?

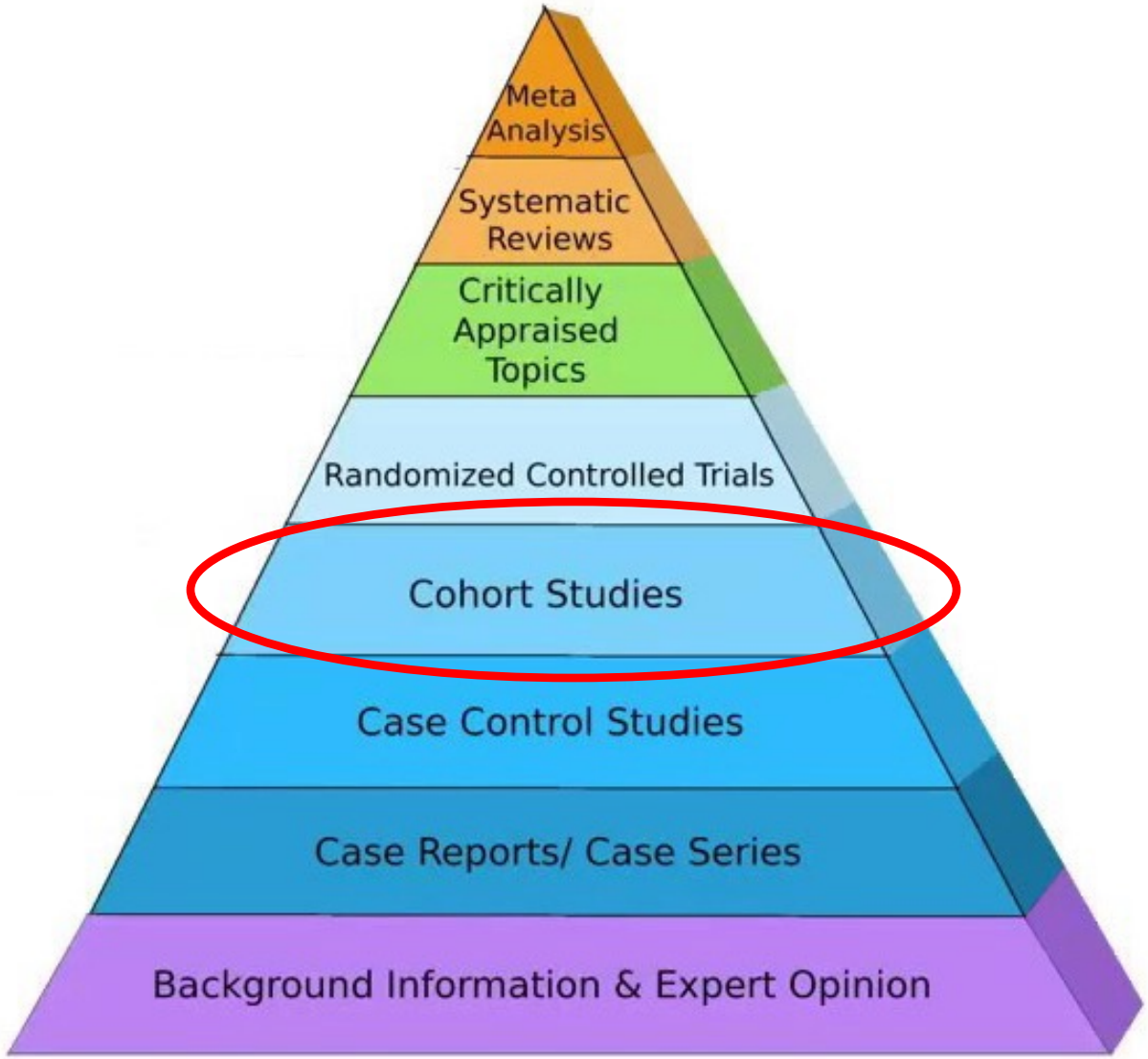
# Big Data - Registries

Rare Events

Niche Populations

Hetorogeneous, uncommon or unpredictable

# Levels of Evidence



# Big Data - Registries

- Wake Up Safe
- Pediatric Regional Anesthesia Network
- Pediatric Difficult Intubation Registry
- Pediatric Craniofacial Surgery Perioperative Registry
- The Society For Pediatric Anesthesia Improvement Network
- National Emergency Airway Registry For Children
- Pediatric Anesthesia COVID Collaboration
- Congenital Cardiac Anesthesia Society Database
- Pediatric Sedation Research Consortium
- The Pediatric Perioperative Cardiac Arrest Registry
- Paediatric Airway Registry
- National Anesthesia Clinical Outcomes Registry
- Soap Registry – General Anesthesia For Cesarean Delivery
- Anesthesia Awareness Registry
- Obstructive Sleep Apnea Death And Near Miss Registry
- International Registry Of Regional Anesthesia
- Multicenter Perioperative Outcomes Group
- Society For Ambulatory Anesthesia Clinical Outcomes Registry
- North American Malignant Hyperthermia Registry
- Hyperthermia Association Of The United States
- American College Of  Surgeons NSQIPs
- Day Care Anaesthesia Registry
- Registry In India On Suprane Emergence
- Danish Anaesthesia Database
- Improvement In Postoperative Pain Outcome
- Anaesthetic Benchmarking System
- Perioperative Quality Improvement Programme
- Anesthesia Incidents Reporting system  ANZCA
- German Network of Regional Anesthesia
- Swedish Perioperative Registry
- National Audit Project (UK)
- National Emergency Airway Registry

# Big Data - Registries

- Wake Up Safe
- Pediatric Regional Anesthesia Network
- Pediatric Difficult Intubation Registry
- Pediatric Craniofacial Surgery Perioperative Registry
- The Society For Pediatric Anesthesia Improvement Network
- National Emergency Airway Registry For Children
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- Registry In India On Suprane Emergence
- Danish Anaesthesia Database
- Improvement In Postoperative Pain Outcome
- Anaesthetic Benchmarking System
- Perioperative Quality Improvement Programme
- Anesthesia Incidents Reporting system  ANZCA
- German Network of Regional Anesthesia
- Swedish Perioperative Registry
- National Audit Project (UK)
- National Emergency Airway Registry

RESEARCH REPORT

Pediatric Anesthesia

*Pediatric Anesthesia*. 2021;31:594–603.

# Perianesthetic neurological adverse events in children: A review of the Wake-Up Safe Database

Kavitha C. Raghavan[1] | Manon Hache[2] | Purva Bulsara[3] | Zhaohua Lu[3] | Michael G. Rossi[1]

Pediatric Anesthesiology www.anesthesia-analgesia.org July 2020 • Volume 131 • Number 1

# Complications Associated With the Anesthesia Transport of Pediatric Patients: An Analysis of the Wake Up Safe Database

Bishr Haydar, MD,* Anne Baetzel, MD,* Margaret Stewart, MD,* Terri Voepel-Lewis, RN, PhD,*† Shobha Malviya, MD,* and Robert Christensen, MD*

Pediatric Anesthesiology www.anesthesia-analgesia.org August 2020 • Volume 131 • Number 2

# A Retrospective Analysis of Neuromuscular Blocking Drug Use and Ventilation Technique on Complications in the Pediatric Difficult Intubation Registry Using Propensity Score Matching

Annery G. Garcia-Marcinkiewicz, MD,* H. Daniel Adams, MD,† Harshad Gurnaney, MBBS, MPH,*
Vikram Patel, MD,‡ Narasimhan Jagannathan, MD, MBA,§ Nicholas Burjek, MD,§
Janell L. Mensinger, PhD,‖ Bingqing Zhang, MPH,* Kenneth N. Peeples, MPH,*¶
Pete G. Kovatsis, MD,¶ and John E. Fiadjoe, MD,* on behalf of The PeDI Collaborative

Spontaneous ventilation is associated with:

- More non-severe complications, such as hypoxemia and laryngospasm, than controlled ventilation techniques during intubation of children with difficult airways.
- Inadequate anesthetic depth may contribute to increased complications.

NMB may be beneficial if mask ventilation is possible
Ensure adequate depth of anesthesia with or without NMB

BJA British Journal of Anaesthesia, 122 (2): 215–223 (2019)

PAEDIATRIC ANAESTHESIA

# Predictors of perioperative complications in paediatric cranial vault reconstruction surgery: a multicentre observational study from the Pediatric Craniofacial Collaborative Group

S. M. Goobie[1,2,*], D. Zurakowski[1,2], K. V. Isaac[3], B. M. Taicher[4,5], P. G. Fernandez[6,7], C. K. Derderian[8,9], M. Hetmaniuk[10,11], P. A. Stricker[12,13], and the Pediatric Craniofacial Collaborative Group[13]

Pediatric Anesthesia

Pediatric Anesthesia ISSN 1155-5645
doi:10.1111/pan.13076

# Safety of antifibrinolytics in cranial vault reconstructive surgery: a report from the pediatric craniofacial collaborative group

Susan M. Goobie[1], Franklyn P. Cladis[2], Chris D. Glover[3], Henry Huang[3], Srijaya K. Reddy[4], Allison M. Fernandez[5], David Zurakowski[1] & Paul A. Stricker[6] the Pediatric Craniofacial Collaborative Group[a]

www.anesthesia-analgesia.org

# Perioperative Outcomes and Surgical Case Volume in Pediatric Complex Cranial Vault Reconstruction: A Multicenter Observational Study From the Pediatric Craniofacial Collaborative Group

Allison M. Fernandez, MD, MBA,* Srijaya K. Reddy, MD, MBA,† Heather Gordish-Dressman, PhD,‡ Bridget L. Muldowney, MD,§ José Luis Martinez, MD,‖ Franklin Chiao, MD,¶ and Paul A. Stricker, MD,# on behalf of The Pediatric Craniofacial Collaborative Group

October 2019 • Volume 129 • Number 4

# Big Data – Fruits and all..


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

Lancet Respir Med 2017

*Walid Habre, Nicola Disma, Katalin Virag, Karin Becke, Tom G Hansen, Martin Jöhr, Brigitte Leva, Neil S Morton, Petronella M Vermeulen, Marzena Zielinska, Krisztina Boda, Francis Veyckemans, for the APRICOT Group of the European Society of Anaesthesiology Clinical Trial Network**

"*What is both surprising and concerning is that more than 5% of children undergoing anaesthesia in our study experienced at least one severe critical event. In 17% of them additional anaesthesia treatments, prolonged treatment in hospital, or both were needed*" said Professor Walid Habre, APRICOT Lead Investigator. "*Our findings reinforce the urgent need to elaborate and implement standardised training programmes and good clinical practice guidelines for paediatric anaesthesia management throughout Europe.*"

The APRICOT study showed startling differences in severe critical events among European countries with a 20- to 30-times variation in incidence. Many factors are involved, but there was statistical evidence that experienced paediatric anaesthesiologists and teams with a higher volume of paediatric cases had significantly fewer severe critical events. The results suggest that children less than 3 years of age should be managed by more experienced teams with specific paediatric training and support.

Natural continuation of APRICOT:

30,874 cases 10.6% < 1 year-old [361 neonates]

# Morbidity and mortality after anaesthesia in early life: results of the European prospective multicentre observational study, neonate and children audit of anaesthesia practice in Europe (NECTARINE)

Nicola Disma[1,*], Francis Veyckemans[2], Katalin Virag[3], Tom G. Hansen[4,5], Karin Becke[6], Pierre Harlet[7], Laszlo Vutskits[8,9], Suellen M. Walker[10], Jurgen C. de Graaff[11], Marzena Zielinska[12], Dusica Simic[13], Thomas Engelhardt[14] and Walid Habre[8,9], for the NECTARINE Group of the European Society of Anaesthesiology Clinical Trial Network[†]

*British Journal of Anaesthesia*, 126 (6): 1157–1172 (2021)

# Impact of composite adverse events

## Hypotension, Hypoxaemia and Anaemia

↓

↑ **M**orbidity (**RR 3.56** [95%CI: 1.64-7.71])
↑ **M**ortality (**RR 19.80** [95% CI 5.87-66.73])

5609 cases, <60 weeks

# Incidence of paediatric unplanned day-case admissions in the UK and Ireland: a prospective multicentre observational study

Zoe Green[1,*,†], Natasha Woodman[2,*,†], David J. McLernon[3], PATRN[‡], Thomas Engelhardt[4]

*British Journal of Anaesthesia*, 124 (4): 463–472 (2020)

| Characteristic | Odds ratio (95% CI) | P-value |
|---|---|---|
| ASA physical status | | <0.001* |
| ASA-PS 2 vs ASA-PS 1 | 1.59 (1.31, 1.94) | <0.001 |
| ASA-PS ¾ vs ASA-PS 1 | 2.80 (2.07, 3.77) | <0.001 |
| Specialty vs ENT | | <0.001* |
| Cardiology | 1.89 (1.15, 3.06) | 0.01 |
| Orthopaedics and trauma | 0.91 (0.69, 1.18) | 0.46 |
| Urology | 0.64 (0.43, 0.96) | 0.03 |
| General surgery | 0.59 (0.46, 0.77) | <0.001 |
| Gastroenterology | 0.54 (0.36, 0.81) | 0.003 |
| Plastic | 0.49 (0.34, 0.69) | <0.001 |
| Ophthalmology | 0.34 (0.22, 0.54) | <0.001 |
| Oral and maxillofacial surgery | 0.21 (0.12, 0.36) | <0.001 |
| Radiology | 0.14 (0.09, 0.23) | <0.001 |
| Oncology | 0.10 (0.05, 0.22) | <0.001 |
| Dental | 0.08 (0.04, 0.14) | <0.001 |
| Oral surgery | 0.08 (0.02, 0.31) | <0.001 |
| Other | 0.39 (0.23, 0.65) | <0.001 |
| Duration of surgery (per 15 min) | 1.04 (1.03, 1.05) | <0.001 |

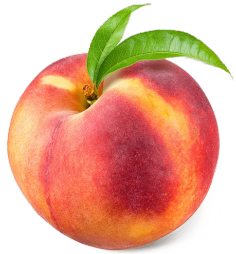
25,986 cases, 93 hospitals, 6 weeks

## Unplanned admissions

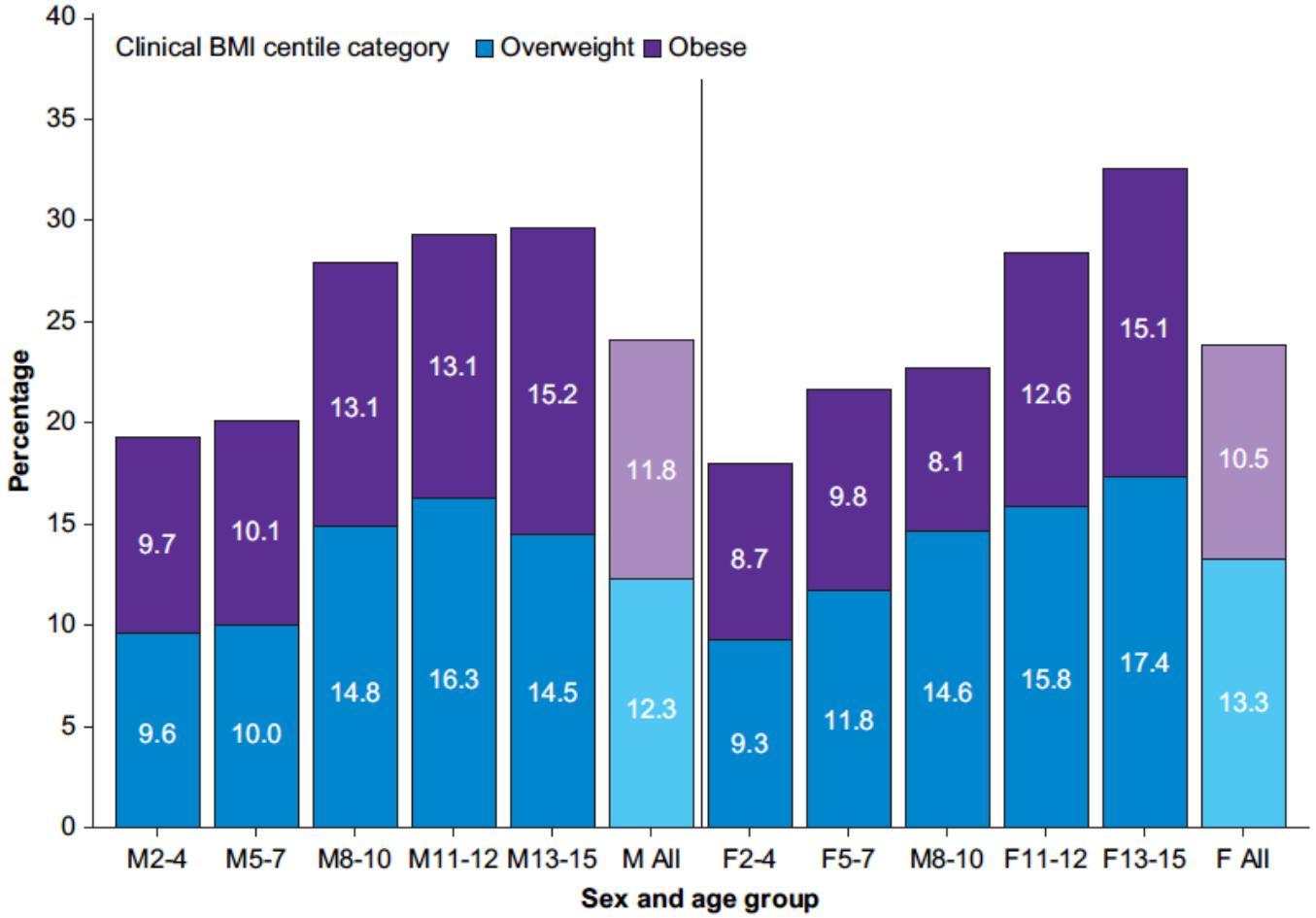
- AS-PS >2
- Cardiology, ENT, Orthopedics
- Complexity/ duration
- Pain, PONV

# Prevalence of PErioperAtive CHildhood obesitY in children undergoing general anaesthesia in the UK: a prospective, multicentre, observational cohort study

Zoë A. Burton[1,*,†], Rosie Lewis[2,†], Tom Bennett[3,†], David J. McLernon[4], Paediatric Anaesthesia Trainee Research Network[‡], Thomas Engelhardt[5], Peter B. Brooks[6] and Mark R. Edwards[3]



*British Journal of Anaesthesia*, 127 (6): 953–961 (2021)



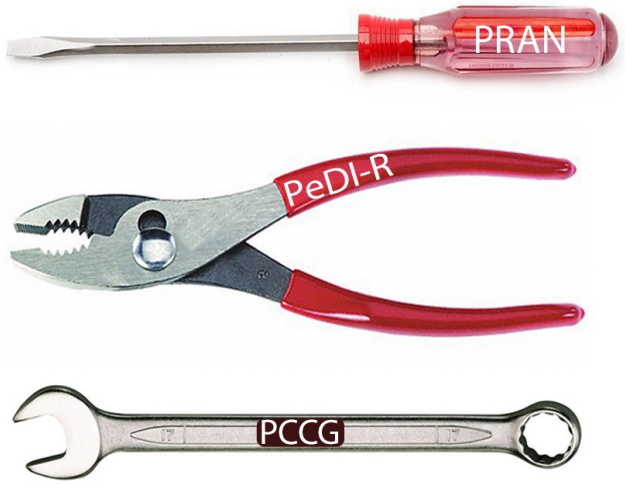

4232 cases, 102 hospitals, 1 week

- 1 in 4 overweight or obese
- ENT surgery
- Difficult mask ventilation

# Big Data - Registries

- Wake Up Safe
- Pediatric Regional Anesthesia Network
- Pediatric Difficult Intubation Registry
- Pediatric Craniofacial Surgery Perioperative Registry
- The Society For Pediatric Anesthesia Improvement Network
- National Emergency Airway Registry For Children
- Pediatric Anesthesia COVID Collaboration
- Congenital Cardiac Anesthesia Society Database
- Pediatric Sedation Research Consortium
- The Pediatric Perioperative Cardiac Arrest Registry
- Paediatric Airway Registry
- National Anesthesia Clinical Outcomes Registry
- Soap Registry – General Anesthesia For Cesarean Delivery
- Anesthesia Awareness Registry
- Obstructive Sleep Apnea Death And Near Miss Registry
- International Registry Of Regional Anesthesia
- Multicenter Perioperative Outcomes Group
- Society For Ambulatory Anesthesia Clinical Outcomes Registry
- North American Malignant Hyperthermia Registry
- Hyperthermia Association Of The United States
- American College Of  Surgeons NSQIPs
- Day Care Anaesthesia Registry
- Registry In India On Suprane Emergence
- Danish Anaesthesia Database
- Improvement In Postoperative Pain Outcome
- Anaesthetic Benchmarking System
- Perioperative Quality Improvement Programme
- Anesthesia Incidents Reporting system  ANZCA
- German Network of Regional Anesthesia
- Swedish Perioperative Registry
- National Audit Project (UK)
- National Emergency Airway Registry

# Perioperative Investigative Collaboration for Neonates, Infants and Children (PICNIC)





Examples

- Neonatal emergency abdominal surgery
- EA/TEF repair
- Children with autism having surgery
- CDH repair
- Sacrococcygeal teratoma resection
- Seizure surgery
- Bowel resection in IBD

# Fasting

EJA

*Eur J Anaesthesiol* 2022; **39**:4–25

GUIDELINES

## Pre-operative fasting in children

*A guideline from the European Society of Anaesthesiology and Intensive Care*

Peter Frykholm, Nicola Disma, Hanna Andersson, Christiane Beck, Lionel Bouvet, Eloise Cercueil, Elizabeth Elliott, Jan Hofmann, Rebecca Isserman, Anna Klaucane, Fabian Kuhn, Mathilde de Queiroz Siqueira, David Rosen, Diana Rudolph, Alexander R. Schmidt, Achim Schmitz, Daniel Stocki, Robert Sümpelmann, Paul A. Stricker, Mark Thomas, Francis Veyckemans and Arash Afshari

Current paediatric anaesthetic fasting guidelines have recommended conservative fasting regimes for many years and have not altered much in the last decades. Recent publications have employed more liberal fasting regimes with no evidence of increased aspiration or regurgitation rates. In this first solely paediatric European Society of Anaesthesiology and Intensive Care (ESAIC) pre-operative fasting guideline, we aim to present aggregated and evidence-based summary recommendations to assist clinicians, healthcare providers, patients and parents.

We identified six main topics for the literature search: studies gastric content and gastric emptying studies; and early postoperative feeding. The literature search was performed by a professional librarian in collaboration with the ESAIC task force.

Recommendations for reducing clear fluid fasting to 1 h, reducing breast milk fasting to 3 h, and allowing early postoperative feeding were the main results, with GRADE 1C or 1B evidence. The available evidence suggests that gastric ultrasound may be useful for clinical decision-making, and that allowing a 'light breakfast' may be well tolerated if the intake is well controlled. More research is needed in these

- Rationale
- Evidence base
- Future studies

# GUIDELINES TO THE PRACTICE OF ANESTHESIA

Revised Edition 2022

*As recommended by the Canadian Anesthesiologists' Society*

## *Elective Surgery*

- Eight hours after a large meal of solids particularly containing protein (e.g., meat) or fatty foods
- Six hours after a light meal (e.g., non-fatty meal such as toast)
- Six hours after ingestion of infant formula, non-human milk, or expressed breast milk fortified with additions
- Four hours after ingestion of breast milk
- Two hours after ingestion of clear fluids for adults
- One hour after ingestion of clear fluids for infants and children.

- Huit heures après un repas copieux comportant des aliments solides, particulièrement s'il contenait des protéines (par ex. de la viande) ou des aliments gras;
- Six heures après un repas léger (par ex. repas faible en gras tel une tartine);
- Six heures après l'ingestion de lait maternisé, de lait non humain ou de lait maternel tiré et fortifié avec des adjuvants;
- Quatre heures après l'ingestion de lait maternel;
- Deux heures après l'ingestion de liquides clairs pour un adulte;
- Une heure après l'ingestion de liquides clairs pour les nourrissons ou les enfants.

# Morbidity and Mortality

## General population - Adults

**Table 1** Incidence (cases/anaesthetic), morbidity (cases/anaesthetic) and mortality (cases /anaesthetic) of pulmonary aspiration in the general surgical population (NR=not reported)

| Country | Study size | Aspiration | Incidence | Morbidity | Mortality | Reference |
|---|---|---|---|---|---|---|
| Sweden | 185 385 | 87 | 1/2131 | 1/3944 | 1/45 454 | Ollson[82] |
| USA | 215 488 | 67 | 1/3216 | 1/16 576 | 1/71 829 | Warner[112] |
| France | 198 103 | 14 | 1/14 150 | 1/99 052 | Nil | Tiret[104] |
| UK | 84 835 | 6 | 1/14 139 | 1/42 418 | 1/84 839 | Leigh[59] |
| South Africa | 240 483 | 1 | NR | NR | 1/240 483 | Harrison[35] |
| Finland | 338 934 | 5 | NR | NR | 1/67 786 | Hovi-Viander[39] |
| Canada | 112 721 | 101 | 1/1116 | NR | NR | Cohen[16] |

*Br J Anaesth 1999; 83:453*

- Overall risk small
- Morbidity minimal
- Mortality almost negligible (ASA >3)

} Adults

# Morbidity and Mortality

## Paediatric population

- Incidence: 6.0 - 10.2 per 10,000 anaesthetics
- Mortality: (None)
- Morbidity: Limited
  - Unanticipated admission
  - Cancellation of surgery
  - Intubation
  - Discharge after 2 hours if asymptomatic

- Risk factors: Emergency surgery, ileus, insufficient depth of anaesthesia

RESEARCH REPORT

Pediatric Anesthesia WILEY

# Real fasting times and incidence of pulmonary aspiration in children: Results of a German prospective multicenter observational study

Christiane E. Beck[1] | Diana Rudolp[2] | Karin Becke-Jakob[3] | Ehrenfried Schindler[4] | Alexander Etspüler[5] | Almut Trapp[6] | Gordon Fink[7] | Lutz Müller-Lobeck[8] | Katharina Röher[9] | Arka Genähr[10] | Christoph Eich[2] | Robert Sümpelmann[1]

*Pediatric Anesthesia*. 2019;29:1040–1045.

| Event | Age (m) | Status | Specifics | Fasting (h) | Induction | Airway | Time of event | Symptoms, diagnostics | Postoperative course | Type of surgery |
|---|---|---|---|---|---|---|---|---|---|---|
| R | 44 | Elective | Agitation | LaM 14.0<br>CF 0.5 | Inhalational | LMA | Induction | None | Recovery room | ENT |
| R | 24 | Elective | None | LiM 8.0<br>CF 0.6 | Inhalational | LMA | Induction | None | Recovery room | Trauma |
| R | 75 | Elective | None | LaM 13.8<br>CF 1.0 | iv | LMA | Emergence | Laryngospasm, $sO_2$ < 80% | Recovery room | Urology |
| R | 18 | Elective | None | LaM 13.3<br>CF 13.3 | iv | LMA | Maintenance | None | Recovery room | Others |
| R | 66 | Elective | Bucking during positioning | LaM 15.2<br>CF 1.0 | Inhalational | LMA | Maintenance | Laryngospasm, $sO_2$ < 80% | Recovery room | Others |
| R | 27 | Elective | None | LaM 11.5<br>CF 10.5 | Inhalational | ETT | Maintenance | None | Recovery room | ENT |
| R | 64 | Elective | None | LaM 14.8<br>CF 3.2 | Inhalational | ETT | Induction | $sO_2$ < 90% | Recovery room | ENT |
| R | 157 | Elective | None | LiM 9.1<br>CF 9.1 | iv | LMA | Emergence | None | Recovery room | Trauma |
| sPA | 23 | Elective | Unexpected pain stimulus | LaM 16.0<br>CF 1.0 | Inhalational | LMA | Maintenance | Obstruction, $sO_2$ < 90% | Recovery room, coughing | ENT |
| sPA | 41 | Elective | None | LaM 13.5<br>CF 13.1 | Inhalational | LMA | Induction | Obstruction | Recovery room, coughing | ENT |
| sPA | 67 | Elective | None | LaM 15.7<br>CF 2.2 | iv | ETT | Emergence | Laryngospasm, $sO_2$ < 80%, X-ray | Recovery room, coughing | Trauma |
| cPA | 158 | Elective | Achalasia | LaM 12.0<br>CF 5.0 | cRSI | ETT | Induction | None, bronchoscopy | Recovery room | Abdominal |
| R | 31 | Emergent | Agitation | LiM 4.6<br>CF 4.6 | Inhalational | ETT | Induction | None | Recovery room | Others |
| R | 131 | Emergent | Bucking during Gastroscopy | LaM 11.5<br>CF 11.5 | iv | Mask | Maintenance | None | Recovery room | Others |
| R | 150 | Emergent | None | LaM 18.0<br>CF 3.3 | iv | ETT | Induction | None | Recovery room | Abdominal |
| sPA | 22 | Emergent | Agitation | LiM 7.7<br>CF 1.2 | Inhalational | LMA | Induction | Obstruction | Recovery room, coughing | Others |
| cPA | 84 | Emergent | Opioids prior to anesthesia, severe trauma | LaM 4.2<br>CF 4.2 | cRSI | ETT | Induction | None | Recovery room | Trauma |

Confirmed cases: 2 per 3,324 (6 per 10,000)

*Pediatric Anesthesia*. 2019;29:1040–1045.

# Perioperative aspiration events in children: A report from the Wake Up Safe Collaborative

Kayla E. Pfaff[1,2] | Dmitry Tumin[3] | Rebecca Miller[2] | Ralph J. Beltran[2,4] | Joseph D. Tobias[2,4] | Joshua C. Uffman[2,4]

*Pediatric Anesthesia.* 2020;30:660–666.

| Characteristic | Aspiration (N = 136) | No aspiration (N = 2 434 533) |
|---|---|---|
| Female | 63 (46%) | 1 062 952 (44%) |
| Age | 6 (2, 11) | 6 (2, 11) |
| ASA | | |
| 1 | 12 (9%) | 599 273 (25%) |
| 2 | 44 (32%) | 1 071 632 (44%) |
| 3 | 63 (46%) | 663 019 (27%) |
| ≥4 | 17 (13%) | 100 679 (4%) |
| Emergency status | 15 (11%) | 136 037 (6%) |

Confirmed cases: 135 per 2,440,810 (6 per 10,000)

# Perioperative aspiration events in children: A report from the Wake Up Safe Collaborative

Kayla E. Pfaff[1,2] | Dmitry Tumin[3] | Rebecca Miller[2] | Ralph J. Beltran[2,4] | Joseph D. Tobias[2,4] | Joshua C. Uffman[2,4]

*Pediatric Anesthesia.* 2020;30:660–666.

12 y/o with history of cerebral palsy, developmental delay, and seizure disorder with prior anesthetics complicated by hypotension admitted preoperatively for IV hydration. AE occurred after induction with sevoflurane, requiring CPR and epi infusion. Return of spontaneous circulation with concern for allergic reaction to Rocuronium. Died 2 wk postoperatively with concern for undiagnosed cardiomyopathy

17 y/o with rhabdomyosarcoma presented for cystoscopy. After induction and placement of supraglottic airway, the patient aspirated bilious colored fluid. Patient was intubated and became increasingly difficult to ventilate and taken to intensive care postoperatively with dx of ARDS. The patient was able to be extubated POD#4, but recovery was complicated by pulmonary embolus, heart failure, and death

# Impact of clear fluid fasting on pulmonary aspiration in children undergoing general anesthesia: Results of the German prospective multicenter observational (NiKs) study

*Pediatric Anesthesia*. 2020;30:892–899.

Christiane E. Beck[1] | Diana Rudolph[2] | Christoph Mahn[3] | Alexander Etspüler[4] | Michael Korf[5] | Matthias Lüthke[5] | Ehrenfried Schindler[6,7] | Susanne Päukert[7] | Almut Trapp[8] | Johanna H. A. M. Megens[9] | Francesca Oppitz[9] | Gregor Badelt[10] | Katharina Röher[11] | Arka Genähr[12] | Gordon Fink[13] | Lutz Müller-Lobeck[14] | Karin Becke-Jakob[15] | Julius Z. Wermelt[16] | Dietmar Boethig[17] | Christoph Eich[2] | Robert Sümpelmann[1]

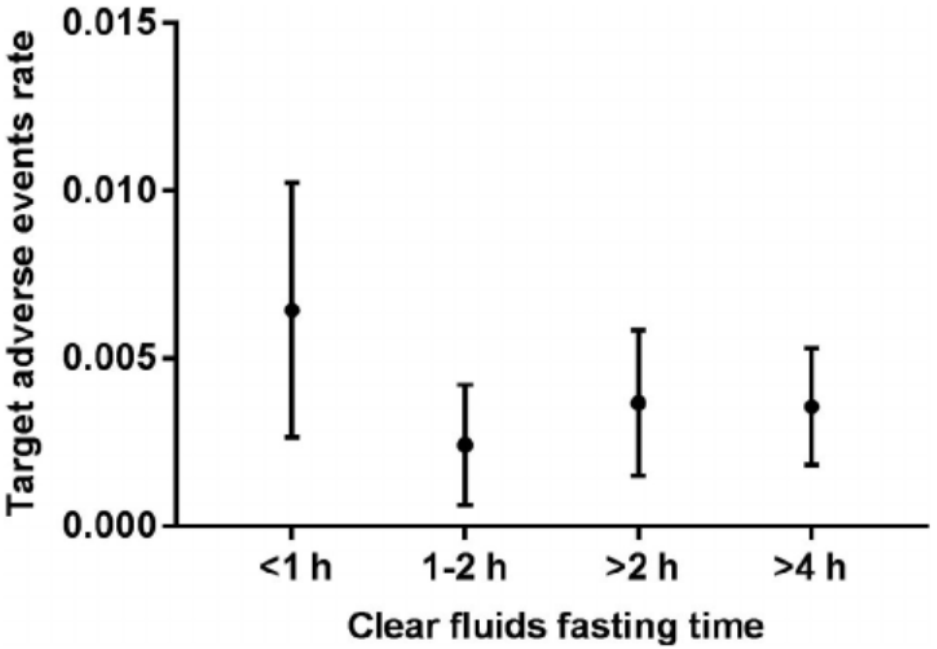



FIGURE 2 Targetadverse events rate expressed as mean and 95% CI related to cohorts with different clear fluid fasting times

6-4-2

6-4-1

6-4-0

C. Beck. et al., Impact of clear fluid fasting on pulmonary aspiration in children undergoing general anesthesia: Results of the German prospective multicenter observational (NiKs) study. Paediatr Anaesth (2020).

1 h!

Acta Anaesthesiol Scand. 2021 Sep;65(8):1011-1012. doi: 10.1111/aas.13809.

# Pre-operative fasting for clear fluids in children: Is 1 hour the answer?

Tom G Hansen [1] [2], Thomas Engelhardt [3]

# Outcomes, Safety and Education

- Beyond mortality
- Safetots
- Continuing education and training

# Anaesthesia related mortality data at a Tertiary Pediatric Hospital in Western Australia

*Acta Anaesthesiol Scand.* 2023;67:142–149.

# Beyond mortality: definitions and benchmarks of outcome standards in paediatric anaesthesiology

**Curr Opin Anesthesiol** 2023, 36:000–000

| Elements | Description |
|---|---|
| Standardized processes | Standardization of metrics to establish targets and benchmarks for care delivery.<br>Standardization of outcomes reporting.<br>Standardization of reporting of outcome measures in the literature.<br>Standardization of care pathways for common procedures derived from evidence-based practices.<br>Consistent outcomes regardless of patient race, ethnicity, sex, socioeconomic status, location and so on<br>Universal access to outcomes data. |
| Equipment expectations | Minimum standards for availability of equipment when caring for children, including emergency equipment (e.g. video laryngoscopy). |
| Provider qualifications | Paediatric anaesthesia certification when possible.<br>Delineated, standardized credentialing process, including education, knowledge assessment, skills assessment and ongoing maintenance of credentialing. |
| Onsite verification | Occurring in a repeat, cyclical pattern (e.g. every 3 years). |




- Incidence of severe critical events 5.2%
- Large variation of critical events across centres (20-30x)
- Large variability of practice and interventions

Need for more standardised perioperative management guidelines for neonates and infants

Target education and training and implement strategies for QI in paediatric anaesthesia

Suggestion that children < 3 years managed by more experienced teams with specific paediatric training and support

# Harmonising paediatric anaesthesia training in Europe

## *Proposal of a roadmap*

Tom G. Hansen, Laszlo Vutskits, Nicola Disma, Karin Becke-Jakob, Jochen Elfgren, Peter Frykholm, Andreas Machotta, Markus Weiss and Thomas Engelhardt, on behalf of the Safetots Initiative (www.safetots.org)

*Eur J Anaesthesiol* 2022; **39:**642–645

| Minimum recommended exposure | Clinical skills and grade of competence for the paediatric anaesthetist |
|---|---|
| Preoperative assessment | Neonates and children < 1 year |
| General anaesthesia in children > 1 year | Regional anaesthesia central blocks |
| Paediatric surgery | Regional anaesthesia peripheral blocks |
| ENT and airway surgery | Airway management |
| Ophthalmology | Advanced and invasive airway management |
| Orthopaedic surgery | Advanced resuscitation |
| Neurosurgery | Fluid management and nutrition |
| Neonatal surgery | Transfusion strategies |
| Dental surgery | Vascular access included ultrasound-guided |
| Nonoperating room anaesthesia | Advanced acute pain management |
| Acute pain management | Chronic pain management |
| | Stabilisation and transport |
| | Neonatal and paediatric intensive care |
| | Organ transplant |
| | Cardiac and thoracic anaesthesia |

# Recent Media Posts

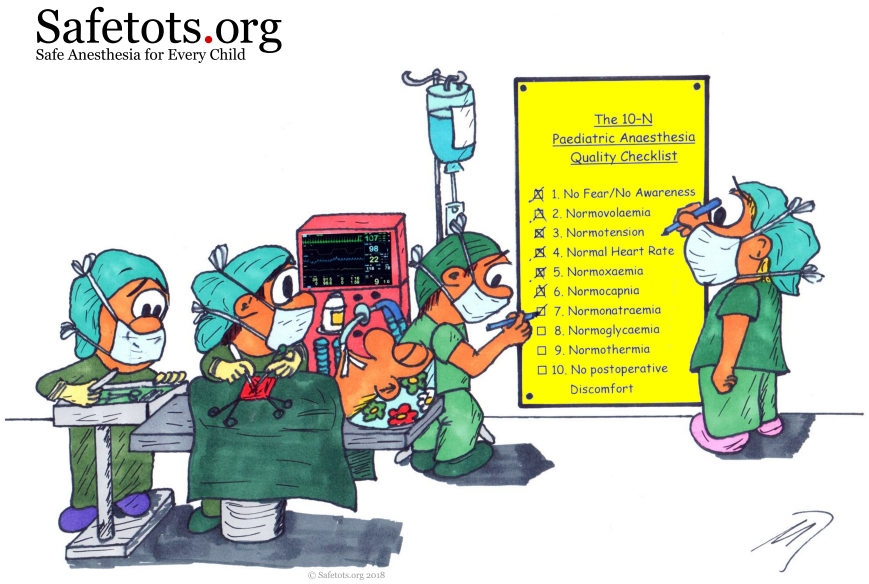
- Safetots Podcasts (Audio, EN)

  March 4, 2023
- Die Rechte des Kindes im Krankenhaus – wo stehen wir in Deutschland? (Video, DE)

  June 3, 2022
- Safe Pediatric Procedural Sedation and Analgesia by Anesthesiologists (Video, EN)

  May 3, 2022
- Neonatal anaesthesia outcomes – the NECTARINE studies, BJA June 2021 (Video, EN)

  November 3, 2021




# Crisis (10Cs)

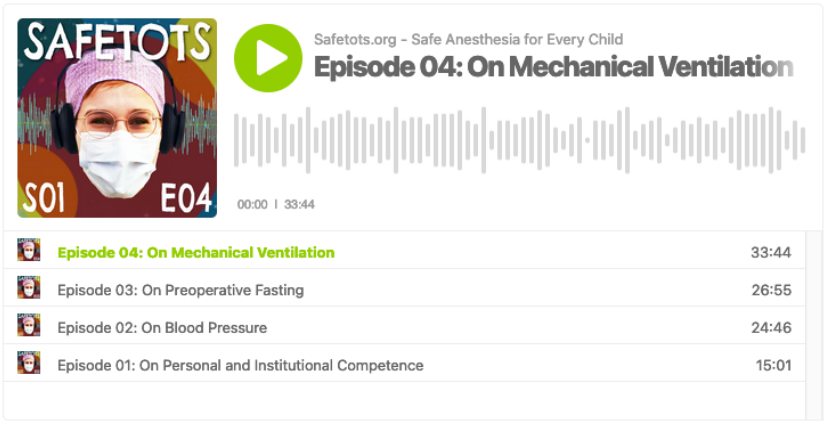
—

# Safetots Podcasts (Audio, EN)

March 4, 2023 By Jochen Elfgen — Leave a Comment

—

Back to Safetots.org media library ...



# Development of a Structured Regional Analgesia Program for Postoperative Pain Management

Teresa D. Puthoff, PharmD, BCNSP,[a] Giorgio Veneziano, MD, FAAP,[a,b] Afif N. Kulaylat, MD, MSc,[a] Ruth B. Seabrook, MD,[a,b] Karen A. Diefenbach, MD,[a,b] Greg Ryshen, MS, MBA, CQE,[a] Sarah Hastie, BSN, RNC-NIC,[a] Autumn Lane, MS, APRN, NNP-BC,[a] Lauren Renner, APRN, CPNP,[a] Roopali Bapat, MD, FAAP[a,b]

*Pediatrics*. 2021;147(3):e20200138

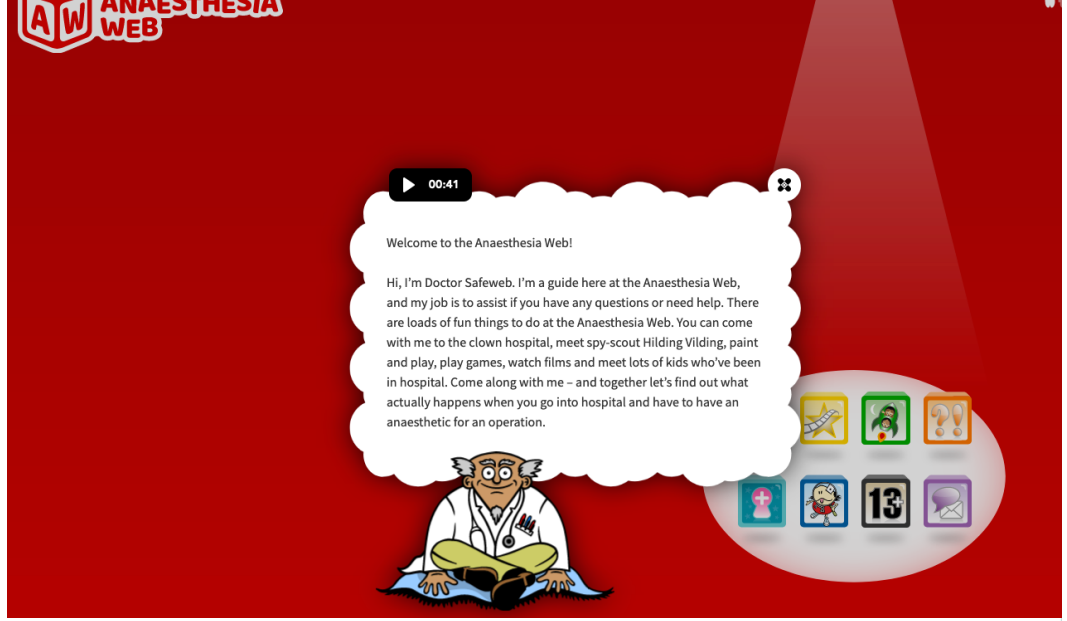
# The German guidelines for medication safety in pediatric emergencies

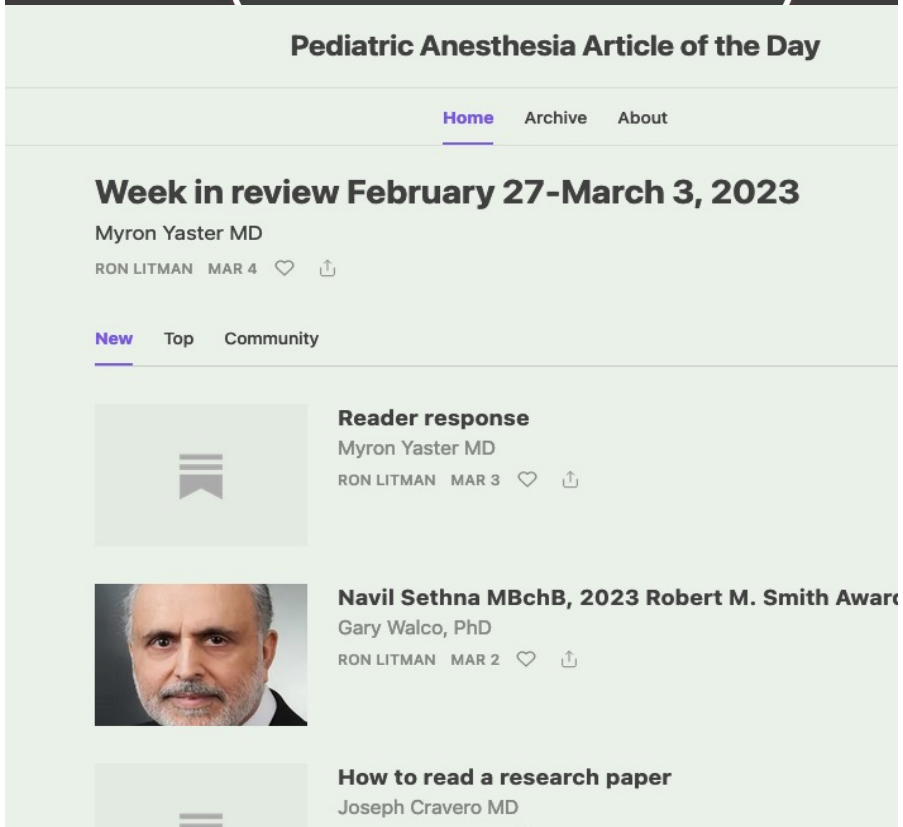
*Pediatric Anesthesia*. 2022;32:1084–1090.

# Improving Pediatric Drug Safety in Prehospital Emergency Care—10 Years on

*Jost Kaufmann, MD, PhD,*†‡ Stefanie Uhl,‡ Eva Singer,† Frank Eifinger, MD, PhD,§ Tobias Klein, MD,|| Alex Lechleuthner, MD, PhD,† Thomas Engelhardt, MD, PhD,¶ Frank Wappler, MD, PhD,*‡# and Andreas Böhmer, MD, PhD‡#*

*J Patient Saf* 2021;17: e1241–e1246



SAFETOTS.ORG

# Thank you

Clyde Matava, Toronto
Hanah Anderson, Peter Frykholm, Uppsala
Paul Stricker, Philadelphia
Nicola Disma, Genoa