THE EMERALD COAST CONFERENCE

JUNE 5-8, 2023 • SANDESTIN GOLF & BEACH RESORT

"Earn Your CME in Your Sandals"

1

Pediatric Controversies

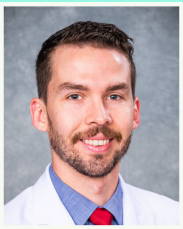
Michael Gerardi, MD, FAAP, FACEP

June 6, 2023

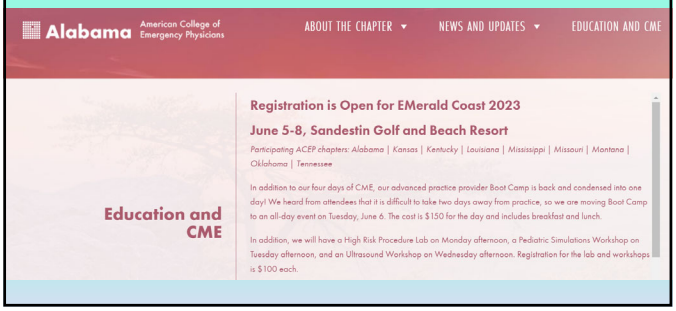
Disclosures

- BioXcel: Medical Advisor, Speaker's Bureau

Thank you, Annalise, Jaron, and Larry!


And Meghan Martin!



A Little History of this Conference (Other than Dave Garvey)

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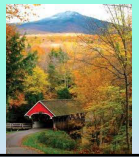
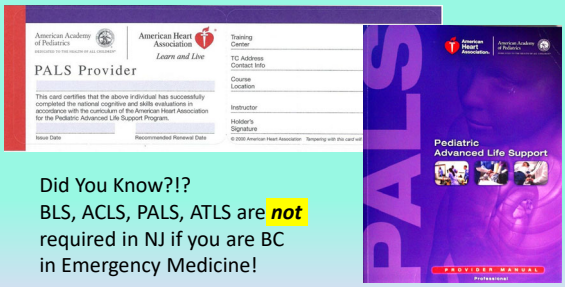
What do the Following 4 Have in Common?




PALS Tricks and Changes



Did You Know?!?
BLS, ACLS, PALS, ATLS are ***not*** required in NJ if you are BC in Emergency Medicine!

Laryngeal Spasm Trigger Point

- Larson P. Laryngospasm – the best Rx

- *Anesthesiology 1998*
  - Comments on >40 years experience in the use of pressure in the "laryngeal notch"
- Technique: Pressure with finger tips (long finger) applied to retroauricular depression
  - laryngeal spasm trigger point

while maintaining the oxygen mask over the face and elevating the mandible (jaw thrust)

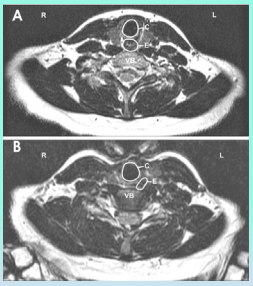
Laryngospasm Management

- Pressure in laryngeal spasm trigger point or laryngeal notch - along with jaw thrust Maneuver
- Initiate positive pressure ventilation with bag-mask device
- If cannot maintain oxygenation and ventilation, then RSI

- Burgoyne LL, et al. Intervention steps for treating laryngospam in pediatric patients
- *Pediatric Anesthesia 2008; Rate of laryngospasm 1/1000*

Cricoid Pressure aka Sellick Maneuver

Cricoid Pressure – What really happens



Cricoid Pressure-Conclusion

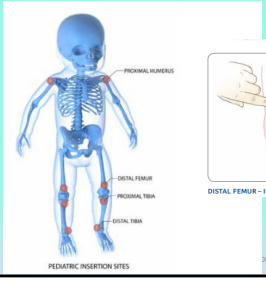
- **No strong evidence** to support prevention of aspiration with cricoid pressure
- No strong evidence to prove that it is harmful
- However there are some bad case reports
  - Decreases the effectiveness of BVM
  - Trachea Compression 80% of pts.
  - Impedes use of LMA/ILMA
  - Can fracture cartilage
  - **Laterally displaces** esophagus as opposed to complete occlusion

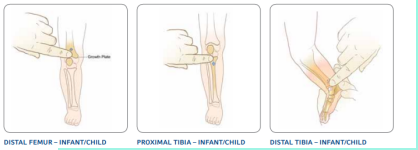
Positioning of the Airway-Bimanual Laryngoscopy

- External laryngeal manipulation
- Two person approach
- Improved POGO scores by 25%
  - Cricoid Pressure-5% improvement
  - BURP-4% improvement

Note: The **POGO Score** represents the percentage of glottic opening seen, defined by the linear span from the anterior commisure to the interarytenoid notch (Fig. 1). A 100% POGO score is a full view of the glottis

IO: Infant Child Site Identification
Size, anatomy, presenting condition, clinical judgement





SVT Single Syringe Technique


Academic Emergency Medicine
Research Letter
Single-syringe Administration of Diluted Adenosine

- Place dose of adenosine INTO saline flush
- Single push
- **Does not dilute adenosine**
- Adenosine stable in NS

2020 UPDATE

- CPR
  - For infants and children with a pulse but absent or inadequate respiratory effort & CPR in infants and children with an advanced airway it is reasonable to give 1 breath every 2 to 3 seconds (20-30 breaths/min
  - **Epi: For Peds (any setting) reasonable to administer 1st dose of epi within 5 min from start of chest compressions**
  - **Every min delay** of epinephrine = significant **decrease in ROSC**, survival at 24 hours, survival to discharge, and survival with favorable neurological outcome

Top 10 Take-Home Messages 2020 Circulation

1. High-quality cardiopulmonary resuscitation (CPR) is the foundation of resuscitation.
   1. Providing adequate chest compression **rate and depth**
   2. Minimizing interruptions in CPR
   3. Allowing full chest **recoil** between compressions
   4. Avoiding excessive ventilation.

2. Respiratory rate of 20 to 30 bpm is new for infants and children who are (a) receiving CPR with an advanced airway in place or (b) receiving rescue breathing and have a pulse.

3. For patients with non-shockable rhythms, the **earlier epinephrine** is administered after CPR initiation, the more likely the patient is to survive.

PEDIATRIC CARDIAC ARREST

Top 10 Take-Home Messages 2020 Circulation

4. Using a **cuffed endotracheal tube** ↓ the need for ETT changes.

5. Routine use of cricoid pressure does not ↓ regurgitation during BVM and may impede intubation success.

6. For out-of-hospital cardiac arrest, BVM results in the same resuscitation outcomes as advanced airway interventions

7. Resuscitation does not end with return of spontaneous circulation (ROSC).

Excellent post–cardiac arrest care is critically important to achieving the best patient outcomes. For children who do not regain consciousness after ROSC, this care includes targeted temperature management and continuous electroencephalography monitoring. The prevention and/or treatment of hypotension, hyperoxia or hypoxia, and hypercapnia or hypocapnia is important.

PEDIATRIC CARDIAC ARREST

Top 10 Take-Home Messages 2020 Circulation

8. After discharge from the hospital, cardiac arrest survivors can have physical, cognitive, and emotional challenges and may need ongoing therapies and interventions.

9. Naloxone can reverse respiratory arrest due to opioid overdose, but there is no evidence that it benefits patients in cardiac arrest.

10. Fluid resuscitation in sepsis is based on patient response and requires frequent reassessment. Balanced crystalloid, unbalanced crystalloid, and colloid fluids are all acceptable for sepsis resuscitation. Epinephrine or norepinephrine infusions are used for fluid-refractory septic shock.
    - Most recent child got 120ml/kg in resuscitation

PEDIATRIC CARDIAC ARREST

Case Presentation

- You are called to a suburban home for toddler found submerged in backyard pool.
- A sobbing mother is performing CPR on 15-month-old girl on pool deck.
- As you take over resuscitation, the mother tells you, "The phone rang; I was only gone for 5 minutes!"

What if ???

- 4-year-old presents sleepy – hard to arouse
- Mother notes that he was off balance and then she was unable to wake him – does not nap

VS P 120, RR 20, Bp 80/62, T 37.5

Glc 110

PE: Cannot arouse w/ stim
Pupils 6mm to 4mm
CHEST: CTA but shallow breaths
CARD: RRR; ABD: (-) HSM

What's the diagnosis ?

- Dilated pupils:
  - Cocaine, methamphetamine, LSD, and marijuana.

THC and you and ME

- Smoking or inhaling marijuana
  - onset of symptoms is within 5 - 30 min
  - Symptoms typically do not last long (a couple of hours).
  - Ingestion of marijuana in the form of food or beverage
    - onset take as long as 1-4 hrs.
    - Symptoms can last for several hours.

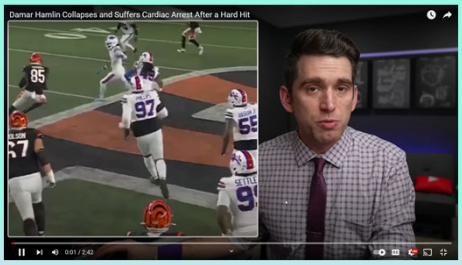
Summary

- The primary cause of cardiopulmonary arrest in children is severe hypoxia associated with respiratory failure.
  - Asystole or profound bradycardia is the most common arrest rhythm on EMS arrival.

Summary

- Rapid intervention and return of vital signs in the field are associated with good outcome.
  - Patients with ventricular fibrillation who have return of sinus rhythm have good survival rates.
  - Children with asystole as the presenting rhythm on scene rarely survive.

CPR – Remember This?



PEDIATRIC CARDIAC ARREST

Crying Child

- Corneal Abrasion?

http://www.pediatricsconsultant360.com/sites/default/files/images/0606fcfpPCCorneaIA.jpg

Fluorescein to eyes

- Fluorescein Slurry!

GOAL DIRECTED THERAPY

- Median volume of fluid delivered over five minutes

"Push-pull"
20.2 mL/kg

Gravity
6.2 mL/kg

Ann Emerg Med. 2007 Nov;50(5):601-7. Epub 2007 Aug 30.
Rapid fluid resuscitation in pediatrics: testing the American College of Critical Care Medicine guideline.
Stoner MJ[1], Goodman DG, Cohen DM, Fernandez SA, Hall MW.

GOAL DIRECTED THERAPY

- Median volume of fluid delivered over five minutes

ACCM guideline met:
58% of the pressure bag
68% of the push-pull group,
NONE of the gravity group.

"Push-pull"
20.2 mL/kg

Pressure bag
20.9 mL/kg

0 of children > 40 kg met the guideline in any groups

Ann Emerg Med. 2007 Nov;50(5):601-7. Epub 2007 Aug 30.
Rapid fluid resuscitation in pediatrics: testing the American College of Critical Care Medicine guideline.
Stoner MJ[1], Goodman DG, Cohen DM, Fernandez SA, Hall MW.

Volume 185, Issue Supplement_1
January-February 2020

Article Contents

Abstract

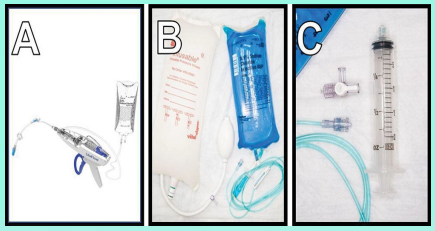
JOURNAL ARTICLE

Intravenous and Intraosseous Blood Transfusion With Three Different Pediatric Pressure Transfusion Strategies in an Immature Swine (*Sus scrofa*) Model of Hemorrhagic Shock: A Pilot Study

William Bianchi, LT, MC, USN, Taylor George, LT, MC, USN, Christian McEvoy, LT, MC, USN, Mark Piehl, MD, MPH, Ana Manzano, BS, Michael Boboc, BS, Gregory J Zarow, PhD, Ramesh Natarajan, PhD, Micah J Gaspary, CDR, MC, USN, Jonathan Auten, CDR, MC, USN ... Show more

Military Medicine, Volume 185, Issue Supplement_1, January-February 2020, Pages 121–129,
https://doi.org/10.1093/milmed/usz200
Published: 19 February 2020

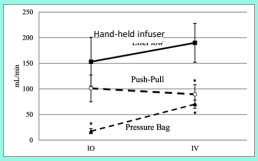
Figure 1 (A) Lifeflow rapid infuser, (B) pressure bag, and (C) push-pull.



Mil Med, Volume 185, Issue Supplement_1, January-February 2020, Pages 121–129, https://doi.org/10.1093/milmed/usz209

What's next :fluid infusion?

Intravenous and Intraosseous Blood Transfusion With Three Different Pediatric Pressure Transfusion Strategies in an Immature Swine (*Sus scrofa*) Model of Hemorrhagic Shock: A Pilot Study



- Hand-held (172 ± 28 mL/kg)
- Push Pull (95 ± 28 mL/kg, $P < 0.02$)
- Pressure bag (44 ± 13 mL/kg, $P < 0.001$)

- Downsides: Blood Products:
  - ↑hemolysis = 6-fold more plasma-free hemoglobin than other conditions ($P < 0.0001$)

2020 UPDATE

- SHOCK
  - In infants and children with fluid-refractory septic shock, it is reasonable to use either epinephrine or norepinephrine as an initial vasoactive infusion

Pediatric FLUIDS! FLUIDS! But Limited Response?

Titrate Epinephrine 0.05 – 0.3 µg/kg/min for Cold Shock.
(Titrate central Dopamine 5 – 9 µg/kg/min if Epinephrine not available)
Titrate central Norepinephrine from 0.05 µg/kg/min and upward to reverse Warm Shock.
(Titrate Central Dopamine ≥ 10 µg/kg/min if Norepinephrine not available)

EPI: 0.05 – 0.3µg/kg/min Cold
Norepi: 0.05 µg/kg/min Warm

Davis, A. L., Carcillo, J. A., Aneja, R. K., Deymann, A. J., Lin, J. C., Nguyen, T. C., … Zuckerberg, A. L. (2017). American College of Critical Care Medicine Clinical Practice Parameters for Hemodynamic Support of Pediatric and Neonatal Septic Shock. *Critical Care Medicine, 45*(6), 1061. https://doi.org/10.1097/CCM.0000000000002425

Titrate Epinephrine 0.05 – 0.3 µg/kg/min for Cold Shock.
(Titrate central Dopamine 5 – 9 µg/kg/min if Epinephrine not available)
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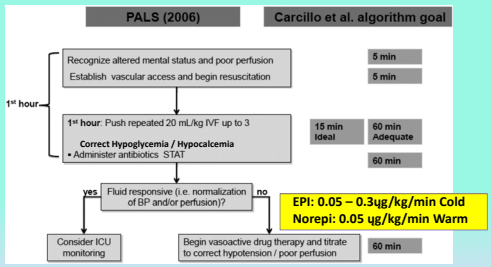


Normal saline

- Saline
  - Potential hyperchloremic non-gap acidosis
  - Balanced fluids
    - Higher rates of renal injury – ADULTS
    - NNT 94
- Lactated Ringers
- Plasmalyte – another option

- Semler NEJM - 5 Vanderbilt ICU's looked at balanced crystalloidsand found diminished renal injury

What else could we use ?

- Hypo-oncotic albumin solutions
  - Patients requiring large volume resuscitation
- Hydroxyethyl starches
  - Increase mortality
  - Do not be used in patients with septic shock
- Whole blood in hemorrhagic shock
  - Whole blood for Trauma patient in lieu of 1:1:1

Too much of a good thing? For Some

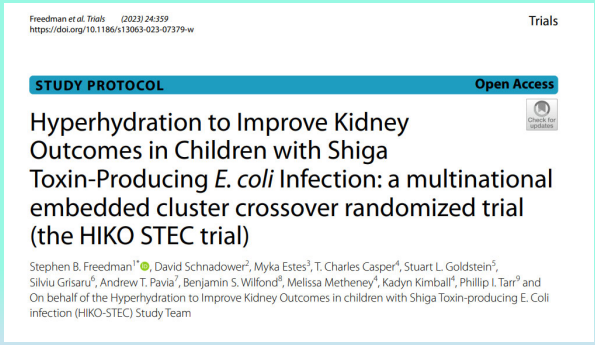
- Fluid Expansion as Supportive Therapy (FEAST) trial
  - ↑ mortality in children who received fluid boluses as compared to maintenance fluids,
    - Malnourished and anemic children.
    - Aggressive fluid resuscitation suggest excessive fluid (septic shock) leads to fluid overload
    - Increased morbidity and mortality
  - Ongoing trial compares goal-directed fluid-sparing strategy vs usual aggressive fluid strategy might provide more knowledge on this issue

Restricted fluid bolus volume in early septic shock: results of the Fluids in Shock pilot trial. *Arch Dis Childh.* (2018). doi: 10.1136

- 2 pediatric studies exist; UK and Canada (SQUEEZE on-going)
- UK randomized (n=75) after 20 ml/kg to 10 or 20 ml/kg per bolus for subsequent boluses.
  - After 4-h study period the mean difference in volume was −11.2 ml/kg (95% CI −16.6 to −5.8 mL/kg; $p < 0.001$).
  - ~2/3 received only 1 further bolus.
  - No differences in hospital or PICU based outcomes.
- Conclusion: “lower than expected severity of illness precludes conduct of a larger study”

Restricting volumes of resuscitation fluid in adults with septic shock after initial management: the CLASSIC randomised, parallel-group, multicentre feasibility trial. 2016 Nov;42(11): Epub 2016 Sep 30

- CLASSIC study (n=151) septic shock adults
  - Showed a significant reduction of resuscitation fluid at 5d
    - [500 ml (IQR;0–2,500) vs. 2,000 ml (IQR; 1,000–4,100) $p < 0.001$]
  - No difference in total administered fluid but a trend toward lower fluid accumulation
  - Fluid restriction = less AKI but no changes in rates of renal therapy, respiratory support, or mortality



Freedman *et al. Trials* (2023) 24:359
https://doi.org/10.1186/s13063-023-07379-w

Trials

STUDY PROTOCOL Open Access

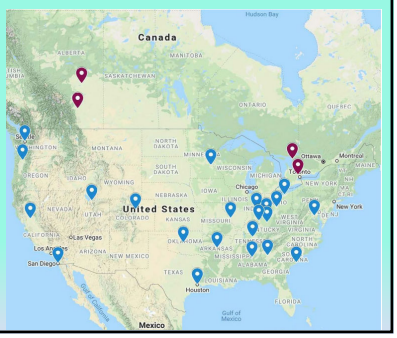
Hyperhydration to Improve Kidney Outcomes in Children with Shiga Toxin-Producing *E. coli* Infection: a multinational embedded cluster crossover randomized trial (the HIKO STEC trial)

Stephen B. Freedman[1*], David Schnadower[2], Myka Estes[3], T. Charles Casper[4], Stuart L. Goldstein[5], Silviu Grisaru[6], Andrew T. Pavia[7], Benjamin S. Wilfond[8], Melissa Metheney[4], Kadyn Kimball[4], Phillip I. Tarr[9] and On behalf of the Hyperhydration to Improve Kidney Outcomes in children with Shiga Toxin-producing E. Coli infection (HIKO-STEC) Study Team

Consent Information for Parents

- Shiga-toxin producing E. Coli (STEC) are bacteria (germs) that cause gut infections.
- Most commonly, STEC infections begin with diarrhea that becomes bloody. These infections can be painful.
- The bacteria produce a toxin that causes up to 20% of infected children to develop a serious complication called the hemolytic uremic syndrome (HUS).
- **HUS leads to kidney failure in about 60% of children who develop this complication.**
- **It can also affect many other organs. In rare cases (1 to 3%), HUS can cause death**

HIKO STEC Trial



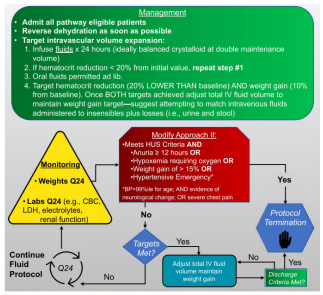
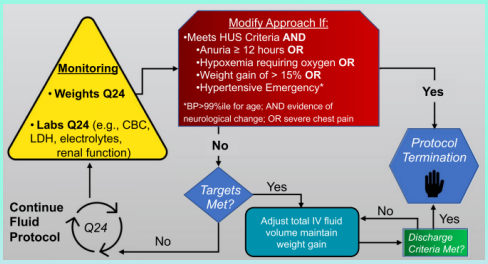


Fig. 3 The hyperhydration care pathway recommends the infusion of 200% maintenance fluids until a hematocrit reduction of 20% and weight gain of 10% occur. Patients may be discharged if the following criteria are met even if the targets are not achieved: (1) platelet count is > 50 × 10⁹/L (in absence of transfusion) AND they have increased by ≥ 5%* since the preceding test AND (2) absence of diarrhea (loose or watery stool) ✕ 24 h AND (3) ≥ 5 days since the onset of diarrhea. *If > 10 days since the onset of diarrhea, up to a 5% decrease in platelet count since preceding test is acceptable

Management
- **Admit all pathway eligible patients**
- **Reverse dehydration as soon as possible**
- **Target intravascular volume expansion:**
  1. Infuse fluids x 24 hours (ideally balanced crystalloid at double maintenance volume)
  2. If hematocrit reduction < 20% from initial value, **repeat step #1**
  3. Oral fluids permitted ad lib.
  4. Target hematocrit reduction (20% LOWER THAN baseline) AND weight gain (10% from baseline). Once BOTH targets achieved adjust total IV fluid volume to maintain weight gain target—suggest attempting to match intravenous fluids administered to insensibles plus losses (i.e., urine and stool)



Primary Outcome: MAKE30 (major adverse kidney events by 30 days)

1. Death OR
2. Provision of dialysis OR
3. Sustained loss of kidney function (at 30 days) reflected by a 100% increase(i.e., doubling) of serum creatinine from baseline

RESUSCITATION 185 (2023) 109741

Available online at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

The effect of hand position on chest compression quality during CPR in young children: Findings from the Videography in Pediatric Resuscitation (VIPER) collaborative

Karen J. O'Connell[a], Alexis Sandler[a], Anuj Dutta[a], Ramzy Ahmed[a], Tara Neubrand[b], Sage Myers[c], Benjamin Kerrey[d], Aaron Donoghue[c,e,]*

Table 2a – Chest compression depth by hand position stratified by age category.

Hand position	CC segments (n)	Depth (cm)			
		Median (IQR)	5th %ile	95th %ile	p*
< 1 year					
2 thumbs	72	2.57 (2.17 – 3.20)	1.68	4.72	Ref
2 fingers	9	2.79 (2.54 – 3.30)	1.78	3.04	0.67
1 hand	58	2.87 (2.54 – 4.88)	1.99	6.30	0.007
2 hands	70	3.01 (2.34 – 3.66)	1.65	4.34	0.76
Children aged 1 year to < 5 years					
1 hand	16	2.78 (2.40 – 3.38)	2.21	4.09	0.009
2 hands	63	3.63 (2.18 – 4.32)	2.18	5.84	
Children aged 5 years to < 8 years					
1 hand	33	2.92 (2.57 – 3.25)	2.06	3.71	<0.001
2 hands	77	3.96 (3.43 – 4.19)	2.74	4.90	

* Wilcoxon ranksum.

Table 2b – Chest compression rate by hand position stratified by age category.

Hand position	CC segments (n)	CC per min			
		Median (IQR)	5th %ile	95th %ile	p*
< 1 year					
2 thumbs	72	120 (107 – 130)	70	136	Ref
2 fingers	9	110 (100 – 117)	74	125	0.05
1 hand	58	117 (110 – 125)	96	135	0.52
2 hands	70	117 (111 – 123)	103	134	0.32
Children aged 1 year to < 5 years					
1 hand	16	116 (115 – 132)	84	158	0.97
2 hands	63	119 (115 – 128)	102	133	
Children aged 5 years to < 8 years					
1 hand	33	121 (116 – 127)	106	142	<0.001
2 hands	77	112 (107 – 116)	101	123	

* Wilcoxon ranksum.

Table 3 – Proportion of CC segments compliant with AHA PALS guidelines by hand position stratified by age group.[7]

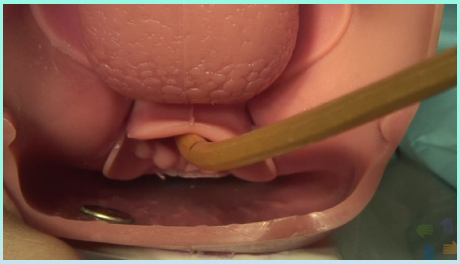
Hand position	CC segments (n)	Rate (100–120 cpm)	Minimum depth or greater (Infants: 3.4 cm; Children: 4.5 cm)
< 1 year			
2 thumbs	72	25/72 (35%)*	24/72 (33%)*
2 fingers	9	6/9 (67%)	0
1 hand	58	33/58 (57%)	27/58 (47%)
2 hands	70	41/70 (59%)	28/70 (40%)
Children aged 1 year to < 5 years			
1 hand	16	8/16 (50%)	1/16 (6%)*
2 hands	63	32/63 (51%)	15/63 (24%)
Children aged 5 years to < 8 years			
1 hand	33	14/33 (42%)*	0*
2 hands	77	66/77 (86%)	12/77 (16%)

* $\chi 2$: $p < 0.001$.

Conclusions

- During CPR of pediatric patients < 8 years of age;
  - **significant differences** in CC rate and depth dependent on hand placement.
  - **1H technique** was correlated with deeper CC in infants relative to the **2 T** technique currently recommended by AHA guidelines.
  - **2H technique yielded deeper** compressions than the **1H** technique in patients > 1 year old.
  - CC depth across all ages did not meet AHA recommended guidelines.
  - Using one or two hands for CC in infants and using two hands for all children older than 1 year may yield better depth without frequently exceeding a depth of 6 cm.
  - Future research should better characterize the relationship between CC depth and CPR-related injury in children.

Bougie Assisted Intubation



JAMA. 2018;319(21):2179-2189. doi:10.1001/jama.2018.6496
Published online May 16, 2018.

Research

JAMA | Original Investigation

Effect of Use of a Bougie vs Endotracheal Tube and Stylet on First-Attempt Intubation Success Among Patients With Difficult Airways Undergoing Emergency Intubation
A Randomized Clinical Trial

Brian E. Driver, MD; Matthew E. Prekker, MD; Lauren R. Klein, MD; Robert F. Reardon, MD; James R. Miner, MD; Erik T. Fagerstrom, BA; Mitchell R. Cleghorn, BS; John W. McGill, MD; Jon B. Cole, MD

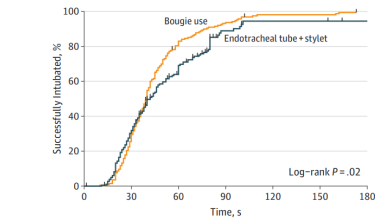
IMPORTANCE The tracheal tube introducer, known as the bougie, is typically used to aid tracheal intubation in poor laryngoscopic views or after intubation attempts fail. The effect of routine bougie use on first-attempt intubation success is unclear.

OBJECTIVE To compare first attempt intubation success facilitated by the bougie vs the endotracheal tube + stylet.

Supplemental content

CME Quiz at jamanetwork.com/learning and CME Questions page 2229

Figure 2. Duration of the First Intubation Attempt Until Successful Intubation Using a Bougie vs Endotracheal Tube + Stylet Among Patients With 1 or More Difficult Airway Characteristics



No. at risk

Bougie	198	146	37	13	3	3	0
Endotracheal tube + stylet	182	127	56	9	3	3	1

AIRWAY/ORIGINAL RESEARCH

The Pediatric Bougie for the First Tracheal Intubation Attempt in Critically Ill Children

Matthew E. Prekker, MD, MPH*; Ashley R. Bjorklund, MD; Carrie Myers, MD; Lauren Harvey, BS; Gabriella B. Horton, MPH; Jack Goldstein, BA; Sarah C. Usher, MD; Robert F. Reardon, MD; Aaron Robinson, MD, MPH; Ashley M. Strobel, MD; Brian E. Driver, MD

*Corresponding Author. E-mail: matthew.prekker@hcmed.org.

Study objective: Bougie use during emergency tracheal intubation has not been well studied in children.

Methods: This was a 10-year observational study of pediatric intubations (<18 years of age) in the emergency department (ED) of an academic institution. Bougie training and use are standard in our ED, including for emergency medicine residents. Study data were collected by a combination of charts and video reviews. We compare first-attempt intubation success and procedural complications between pediatric patients with and without bougie use during tracheal intubation in the ED. In addition, we evaluate the independent association of bougie use with first-attempt intubation success using multivariable logistic regression.

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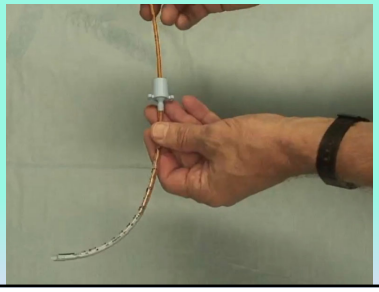
Annals of EM - Editor's Capsule Summary

- **What is already known on this topic:** Bougie use for emergency tracheal intubation in children is not well studied.
- **What question this study addressed:** This observational study, conducted at a single center where bougie use is often used, compared bougie and stylet for procedural success and complications in children undergoing emergency intubation.
- **What this study adds to our knowledge:** Bougie use was not associated with intubation success or procedural complications, although the study was underpowered.
- **How this is relevant to clinical practice:** The study informs the design of future clinical trials of bougie use in children.

Pediatric Bougie – 4-0 ETT Can Accommodate



Intubation Outcomes

Outcome	Bougie N=126	No Bougie N=69
Primary outcomes		
Total attempts		
1 (First-attempt success)	91 (72)	54 (78)
2	23 (18)	8 (12)
3	10 (8)	4 (6)
≥4	2 (2)	3 (4)
Peri-intubation complications		
Any complication associated with intubation[a]	48 (38)	35 (51)
Hypoxemia during the first attempt	25/85 (29)	20/43 (47)
Mainstem intubation	23 (18)	22 (32)
Witnessed aspiration during an attempt	4 (3)	1 (1)
Esophageal intubation	1 (1)	2 (3)

Table 4. Multivariable model for the primary outcome, successful intubation on the first attempt, among patients in the analysis cohort (N=190).

Variable	Adjusted Odds Ratio	95% CI
Bougie use	0.54	0.24 to 1.19
Age (months)	1.02	1.01 to 1.03
Intubation reason: trauma vs. medical	1.83	0.75 to 4.51
Video laryngoscope use	1.00	0.48 to 2.11
One or more difficult airway characteristics	0.33	0.15 to 0.73

Table 5. Primary reasons for first-attempt failure.

Primary reason for first-attempt failure	Bougie N=35	No Bougie N=15
Poor view of airway because of patient anatomy	5 (14)	1 (7)
Poor view of airway because of fluids/vomit in mouth	9 (25)	3 (20)
Poor view of airway because of laryngoscope technique	4 (11)	0
Adequate view of airway - attempt duration limited by hypoxemia	1 (3)	0
Adequate view of airway - unable to pass bougie into the laryngeal inlet	3 (8)	0
Adequate view of airway - bougie passed into the laryngeal inlet but could not pass into the trachea	3 (8)	0
Adequate view of airway - bougie passes into the trachea, but tube catches on arytenoids	3 (8)	0
Adequate view of airway - unable to pass styletted endotracheal tube into the airway	0	8 (53)
Other*	6 (17)	3 (20)
Unable to determine, not documented	1 (3)	0

*Other reasons for the bougie group included: bougie pulled before the endotracheal tube was inside the airway (2 patients); patient clenching jaw despite neuromuscular blockade; patient gagging and vomiting; inexperienced intubator; laryngoscope blade incorrect size. Other reasons for the no bougie group included: video laryngoscope malfunction, foreign body in the airway, and patient movement.

Pediatric “Heat” Fever!

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CLINICAL PRACTICE GUIDELINE

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

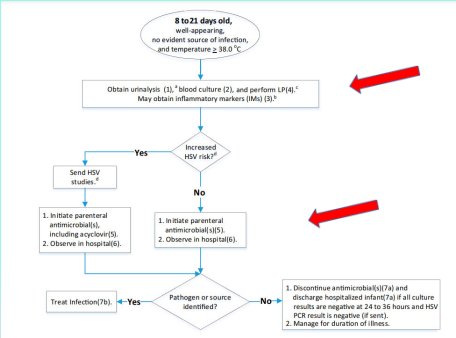
Clinical Practice Guideline: Evaluation and Management of Well-Appearing Febrile Infants 8 to 60 Days Old

Robert H. Pantell, MD, FAAP,[a] Kenneth B. Roberts, MD, FAAP,[b] William G. Adams, MD, FAAP,[c] Benard P. Dreyer, MD, FAAP,[d] Nathan Kuppermann, MD, MPH, FAAP, FACEP,[e] Sean T. O'Leary, MD, MPH, FAAP,[f] Kymika Okechukwu, MPA,[g] Charles R. Woods Jr, MD, MS, FAAP,[h] SUBCOMMITTEE ON FEBRILE INFANTS

This guideline addresses the evaluation and management of well-appearing, term infants, 8 to 60 days of age, with fever ≥38.0°C. Exclusions are noted. After a commissioned evidence-based review by

abstract

[a]Department of Pediatrics, School of Medicine, University of California San Francisco, San Francisco, California; [b]Department of Pediatrics,

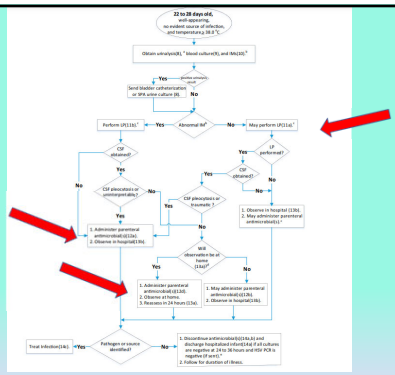


Algorithm for 8- to 21-day-old infants.

- Laboratory values of inflammation are considered elevated at the following levels: (1) procalcitonin >0.5 ng/mL, (2) CRP >20 mg/L, and (3) ANC >4000, >5200 per mm3
- Although we recommend all infants in this age group have a complete sepsis workup, receive parenteral antimicrobial agents, and be monitored in a hospital, knowing IM results can potentially guide ongoing clinical decisions.
- Send CSF for cell count, Gram stain, glucose, protein, bacterial culture, and enterovirus PCR (if available) if pleocytosis is present and during periods of increased local enterovirus prevalence.
- **HSV should be considered** if the mother has genital HSV lesions or fever from 48 hours before to 48 hours after delivery and in infants with vesicles, seizures, hypothermia, mucous membrane ulcers, CSF pleocytosis in the absence of a positive Gram stain result, leukopenia, thrombocytopenia, or elevated alanine aminotransferase levels.
- Recommended HSV studies are CSF PCR; HSV surface swabs of the mouth, nasopharynx, conjunctivae, and anus for an HSV culture (if available) or PCR assay; alanine aminotransferase; and blood PCR.

Infants 8 to 21 d of age (KASs 1-7)

KAS 1: Should obtain urine specimen by catheterization or suprapubic aspiration (SPA) of bladder for urinalysis and, if urinalysis result is positive, for culture.
KAS 2: Should obtain a blood culture.
KAS 3: May assess IMs.
KAS 4: Should obtain CSF for analysis (WBC count, protein, glucose, Gram stain) and culture for bacteria. See notes for viral testing.
KAS 5: Should initiate parenteral antimicrobial therapy.
KAS 6: Should actively monitor infants while awaiting results of bacterial cultures in a hospital setting with nurses and staff experienced in the care of neonates/young infants.
KAS 7a: Should discontinue parenteral antimicrobial agents and discharge hospitalized patients when all of the following criteria are met: (1) culture results are negative for 24–36 h or only positive for contaminants; (2) the infant continues to appear clinically well or is improving (eg, fever, feeding); (3) there are no other reasons for hospitalization.
KAS 7b: Should treat infants' positive bacterial pathogens in urine, blood, or CSF with targeted antimicrobial therapy for the duration of time consistent with the nature of the disease, responsible organism, and response of the infant to treatment.

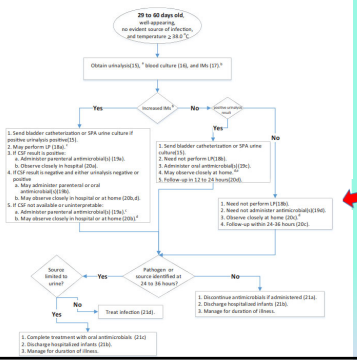


Algorithm for 22- to 28-day-old infants

- If available, procalcitonin (PCT) should be obtained along with ANC. If PCT is unavailable, ANC and CRP should be obtained, and a temperature >38.5C is considered abnormal.
- PCT is considered abnormal at >0.5 mg/mL; CRP is considered abnormal at >20 mg/L; ANC is considered **abnormal at >4000 when used in conjunction with PCT or >5200 when PCT is unavailable**
- **LP is recommended before administration** of antimicrobial agents because interpreting CSF after the administration of antimicrobial agents is difficult.
- However, the risk of meningitis in **22- to 28-day-old infants is lower than that in infants**

Infants 22 to 28 d of age (KAS's 8–14):

KAS 8: Should obtain urine specimen by catheterization or SPA of bladder for urinalysis and, if urinalysis result is positive, for culture.
OR Should obtain urine specimen by bag, spontaneous void, or stimulated void for urinalysis and, if urinalysis result is positive, obtain a catheterization or SPA specimen for culture.
KAS 9: Should obtain a blood culture.
KAS 10: Should assess IMs.
KAS 11a. Clinicians may obtain a CSF analysis on infants 22–28 d of age even if all of the following criteria are met: (1) urinalysis result is negative or positive; (2) no IM obtained is abnormal; (3) blood and urine cultures have been obtained; (4) infant is hospitalized.
KAS 11b. Should obtain CSF for analysis (WBC count, protein, glucose, Gram stain), and bacterial culture if any IM obtained is abnormal.
KAS 12a. Should administer parenteral antimicrobial therapy in a hospital if either of the following apply: (1) CSF analysis suggests bacterial meningitis; (2) urinalysis result is positive.
KAS 12b. May administer parenteral antimicrobial therapy in a hospital if ALL of the following apply: (1) CSF analysis is normal; (2) urinalysis is normal; (3) Any IM obtained is abnormal.
KAS 12c. May administer parenteral antimicrobial therapy to hospitalized infants even if ALL of the following are met: (1) urinalysis is normal; (2) no IM obtained is abnormal; (3) CSF analysis is normal or enterovirus-positive.
KAS 12d: Should administer parenteral antimicrobial therapy for infants who will be managed at home even if ALL of the following are met: (1) urinalysis is normal; (2) No IM obtained is abnormal; (3) CSF analysis is normal.



Algorithm for 29- to 60-day-old infants.

- If available, procalcitonin (PCT) should be obtained along with ANC. If PCT is unavailable, ANC and CRP should be obtained, and a temperature >38.5C is considered abnormal. PCT is considered abnormal at >0.5 mg/mL; CRP is considered abnormal at >20 mg/L; ANC is considered abnormal at >4000 when used in conjunction with PCT or >5200 when PCT is unavailable
- Send CSF for cell count, Gram stain, glucose, protein, bacterial culture, and enterovirus PCR (if available) if CSF pleocytosis is present and during periods of increased local enterovirus prevalence. Although uncommon in this age group, HSV should be considered when there is a maternal history of genital HSV lesions and in infants with vesicles, seizures, hypothermia, mucous membrane ulcers, CSF pleocytosis in the absence of a positive Gram stain result, leukopenia, thrombocytopenia, or elevated alanine aminotransferase levels.
- Recommended HSV studies are CSF PCR; HSV surface swabs of mouth, nasopharynx, conjunctivae, and anus for HSV culture (if available) or PCR assay; alanine aminotransferase; and blood PCR. If CSF is unobtainable or uninterpretable, there are insufficient data to make a specific recommendation.
- Options include the following: observe without treatment for a period of time and, depending on infant clinical condition, repeat LP and/or laboratory markers; begin empirical antimicrobial agents and reassess in 24 hours on the basis of infant response and results of blood culture; if CSF is bloody or antimicrobial agents have previously been started, analysis by multiplex PCR can add additional information; consult with local a pediatric infectious disease specialist.
- Infant may be managed at home if parent and clinician agree that the following are present: reliable phone and transportation, parent willingness to observe and communicate changes in condition, and agreement to the infant being reevaluated in 24 hours.
- Most 29- to 60-day-old infants with negative IM and urinalysis results may be observed at home. However, hospital observation is an option for infants when there are barriers to follow-up

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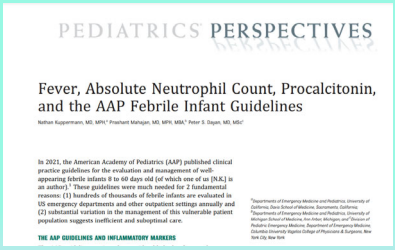

PEDIATRICS PERSPECTIVES

Fever, Absolute Neutrophil Count, Procalcitonin, and the AAP Febrile Infant Guidelines

Nathan Kuppermann, MD, MPH,[a] Prashant Mahajan, MD, MPH, MBA,[b] Peter S. Dayan, MD, MSc[c]

In 2021, the American Academy of Pediatrics (AAP) published clinical practice guidelines for the evaluation and management of well-appearing febrile infants 8 to 60 days old (of which one of us [N.K.] is an author).[1] These guidelines were much needed for 2 fundamental reasons: (1) hundreds of thousands of febrile infants are evaluated in US emergency departments and other outpatient settings annually and (2) substantial variation in the management of this vulnerable patient population suggests inefficient and suboptimal care.

THE AAP GUIDELINES AND INFLAMMATORY MARKERS

AAP Febrile Infant Guidelines 2021

- Much needed for 2 fundamental reasons:
  - (1) 100K's of febrile infants are evaluated in US emergency departments and other outpatient settings annually and
  - (2) substantial variation in the management of this vulnerable patient population suggests inefficient and suboptimal care.
- 4 different inflammatory markers with "high risk" thresholds are provided:
  - T >38.5˚C
  - procalcitonin (PCT) >0.5 ng/mL
  - C-reactive protein (CRP) >20 mg/L (2023 - "insufficient evidence to address")
  - absolute neutrophil count (ANC) either >4000 or >5200/mm3)

Height of Fever: 38.0°C/38.2°C vs. 38.5°C

- Earlier guidelines identified temperatures 38.0°C or 38.2°C
- "If procalcitonin is unavailable, both ANC and CRP should be obtained, and a temperature >38.5°C is considered abnormal."
  - Trigger a more comprehensive evaluation
- Earlier studies recommending 38.5°C did not include PCT to make adjustments
- Height of temperature should not be the driver of more aggressive management, including LPs, empirical antibiotics, or hospitalization in the face of normal biomarker values, including PCT
  - Increase sensitivity but **not specificity**

Do NOT have PCT?

- In contrast, if NO access to PCT testing, height of temperature should be considered an inflammatory marker and should be incorporated as a risk factor for bacterial infections.

Routine Measures & Pediatric Emergency Care Applied Research Network

- In the **CBC, the ANC is the most accurate** for identifying febrile infants at high and low risk for invasive bacterial infections and enhances the test accuracy beyond serum PCT
- PECARN identified an ANC threshold of 4100 cells/mm3 using recursive partitioning (although an ANC threshold of 4000 cells/mm3 is easier to use)
- **No PCT or CRP** in the model? Then ANC threshold of **5200 cells/mm3**
  - Again – **increase specificity!**

"However, to be clear…"

- 4000/mm^3 threshold should be used in conjunction with **serum PCT and the urinalysis**
- 5200/mm^3 threshold should be used with height of temperature and the urinalysis when **PCT is unavailable**
- AAP Guidelines need careful interpretation, especially based on the availability or non-availability of PCT with regard to height of fever and ANC

Thank you!
Questions?