NRP/PALS Update: Saving Tiny Lives in 2017

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November 2017

The Beauty of NRP & PALS

- **A well-run code is a work of art.**
- **Simple** interventions save lives. Kids respond gratifyingly fast to the **right** interventions (e.g. effective PPV in NRP).
- And yet… **skills decay fast** and **time** is of the essence: many tasks, all at once…
  - **Systematic Approach** helps
  - **Team Dynamics**/Human Factors/CRM help

Objectives:

1. **Refresh & rehearse** steps to take when resuscitating critically ill newborns (NRP) and children (PALS)
2. Describe the **main changes** to NRP and PALS guidelines in 2015 updates and more recent findings
3. Strengthen good practices in **team dynamics** & **"crew resource management"** to **optimize outcomes**
4. **Review frequent errors** NRPers and PALSies make

Does NOT replace an official course; opinions my own; evidence mostly low-quality, but will be mentioned

Method: Resuscitation Game

- We're going to play a **game**.
- Step-by-step "**walkthrough**", imaginary 'codes': 1 NRP, 1 PALS

- At each step : "One Cue ➔ X Responses"
- Give **your best guess**, short answer (a few words)
- ONE answer per person. Allowed to "pass"
- Quick answers please! Keep It Moving! **Mistakes are expected – & part of the fun.**

Introductions

- CCFP (McGill), FP-Anesthesia (U. of T.)
- PALS Instructor (HSFC)
- NRP Instructor (CPS)

- **Professional Interests:** family medicine; medical education; anesthesia; simulation; crisis resource mgmt
- **Conflicts of Interest:** none

Warm-up Round:

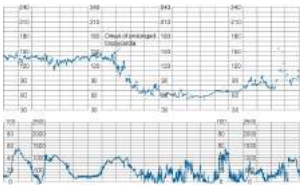
"A Code Blue/Pink/Trauma/Outdoor Emergency is unfolding. What are your **basic steps** to **prepare**?" (3 key responses)

1. **Scene Safety:** Fire/wire/gas/glass/guns/thugs/drugs
2. **Team Briefing:** Take Lead! Assign Roles! Get Help!
   "**I'll** take the Lead role.
   "**Jeff-**can you be the Airway person, start checking pulse&breathing;"
   "**Sandra-**can you put on the Monitors now;"
   "**Laura-**please start an IV and get Meds ready…"
3. **Assign Equipment Check**: e.g. STATICS-MIMM

SCENARIO 1: NRP

Cue 1: You Arrive @ Delivery. "Baby Coming Soon, You Ready?" (4 key responses)

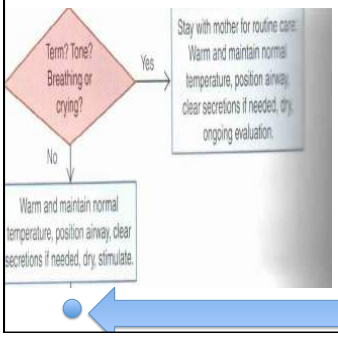
1. **(Scene Safety)**
2. **Team Briefing:**
   - Take Lead Role! Assign Team Roles!
3. **Equipment Check:** "STATICS-MIMM +4"
4. **Ask FOUR pre-birth questions:**
   - Multi-baby?
   - Gestational Age?
   - Risk Factors?
   - Meconium?



Cue 2: Birth (!) (3 key responses)

- Ask 3 **post**-birth questions:
  - "Term?" (i.e."is GA approx. correct?")
  - "Tone?"
  - "Breathing or Crying?"
- IF all "YES"es:
  - … relax … routine care
- IF any "NO"s:
  - **BRING TO WARMER and**…

Cue 3: Baby Hits Warmer (4)



- Position for open A/W ≈ Sniffing (≈ "shldr roll")
- "Clear Airway If Needed"
- "Dry-Stimulate-Remove Wet Towels"

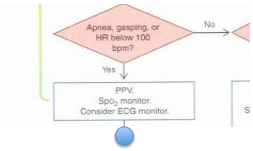
(Hidden step:)

- **Ask** Monitors person to assess HR & BS (A/W person may be busy suctioning)

A Word On Meconium

- FORMERLY, NRP advised that ALL **"non-vigorous"** babies with **meconium** be intubated and suctioned through the ETT prior to giving PPV.
- 7th edition NRP recommends **not routinely** intubating and suctioning such babies
- BUT it's still an option
- SHOULD be *considered* (at the S of MRSOPA) if trouble ventilating

Cue 4: "HR < 100" {OR} resps ineffective (1 key response + 3 secondary)



- **START PPV** with **room air (21-30% if < 35 wk GA)**
- Whenever PPV is started:
  - **think** "Mask on face? **Sat probe on Rt hand**; {AND **ECG leads on chest** a good idea too}"

Hidden step here:

- Immediately Ask **Monitors Person to auscultate** to confirm whether PPV is working:
- * HR rise sufficient to provisionally prove good PPV;
- other reassuring signs should be sought, e.g. audible BS, visible chest rise, ($ETCO_2$)

Cue 5: PPV started, but HR not rising <15 sec. What to do? (1)

- The problem is *always** lack of ventilation.
- So **assume your ventilation is faulty** first. Only break that assumption w/great caution, and if:
  - definite CHEST RISE
  - definite BREATH SOUNDS bilat
  - definite + $ETCO_2$ (rare exceptions) *

DON'T BLAME BABY.

Blame YOUR faulty PPV.

DO **MR SOPA**.

* Exceptions SO rare that you DO NOT worry about them for the first 15 seconds of PPV. **Do MRSOPA!**

Computer Help Desk Technicians

List "MR SOPA" steps. (6)

- **M**ask Seal
- **R**eposition (…the airway …≈ shoulder roll)
- **S**uction
- **O**pen the Mouth
- **P**ressure increase (to 30 cmH_2O, cautiously to ≤ 40)
- **A**lternate airway (ETT recommended, or LMA)

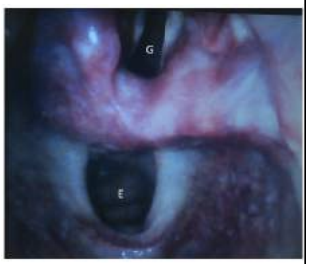
MRSOP**A**: "**A**lternative Airway"

… @ "A" of MRSOPA,
you decide to intubate…

Cue 5B: "MR SOPA" complete, but no HR rise <15 sec. What to do?

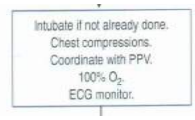
Cue 5B: "MR SOPA" complete, but no HR rise <15 sec. What to do?

- R/O **esophageal** intubation (sustained +$ETCO_2$ best r/o; also chest rise, br snds, mist)
- R/O **endobronchial** intubation (tube slipped in too far?) – check ETT depth
- Consider LMA
- As always: first & only & constantly-to-be-repeated question is are you SURE you're ventilating the lungs: $ETCO_2$? Chest rise? Breath sounds?



Glottic impersonation
Kovacs et al., Can J Anesth (2017) 64:320

Cue 6: definitely-good PPV x 30 s, but HR stays <60
(1 response, +5 linked actions)



- **START Chest Compressn's**
- Whenever CC's started: "Thumbs on the chest =>

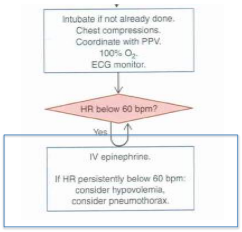
1. (TUBE in the TRACHEA,)
2. **100% O_2** on BLENDER,
3. **ECG leads on CHEST**…

And probably a good time to

4. Get 'M/M' **starting a UVC**
5. **Call for MORE HELP/** NEONATOLOGY

*** CRM point:** Tiger country ahead; anticipating; getting slow tasks started early, offloading future

Cue 7: Definitely good PPV & CCs. When to recheck HR? Still <60… what to do? (3)



Epinephrine ; recall this is only indicated if HR remains < 60 **after:**

- At least **30 sec EFFECTIVE PPV** (w/chest mvt, ± ETCO2)
- FOLLOWED BY **addnl 60 sec of CC's w/100% O2**

Dose: 0.1 ml/kg of 0.1 mg/ml epinephrine (≈ usual dose is ≈ 0.3 ml), via UVC/IV/IO

In these situations,

- Consider hypovolemia
- Consider PTX
- Re-eval whether ETT really well-placed/$ETCO_2$…

Cue 8: Baby's HR improves, they start to cry. You saved them, congrats… any final actions? (2)

Postresusc. Care

Team debriefing

Talk with parents

Give self high-five

NRP: Summary / 7th ed Δs

- **Scene Safety**
- Take **Lead Role**! **Assign Team** Roles! **(=Team Briefing)**
- **Equipment Check** (I suggest "STATICS-MIMM +4")
- 4 pre-birth Q's
- 3 post-birth Q's
- Initial Steps (position, clear airway PRN, dry, stimulate); assess HR/BS; meconium suction not routine, but OK PRN. If HR<100 or apnea/gasping:
- **PPV:** 21% O_2, ~30% for <35wGA
  Mask on face → sat probe hand **& ECG**. **Immed. ChestRise/HR/BS check.**
- **MR SOPA** immediately **(<15 sec)** if PPV ineffective
- Chest Compressions (if 30 sec effective PPV & still <60): thumbs on chest → **O_2 to 100%** - **Tube in trachea** – **ECG on chest** – **Get a UVC rolling** (**IO** if unable) – **Call for more**/neonatology **help**
- Epinephrine; crystalloid, blood; explicitly consider PTX/hypovol.

Barriers & Solutions

- **Barriers:** Cost (ECG monitors, O_2 blenders), Challenging Skills, Infrequent Exposure
- **Solutions:** Budget,
  regular simulation (esp. UVC, ETT/LMA);
  support for recurrent training;
  collegial neighbourhood anesthetists
  interprofessional/regional/prov/nat support

MOVING ON FROM BABIES TO KIDS…

Image credit: https://www.highlights.com/parents/articles/helping-babies-deal-transitions

A Lovely Stroll Through the Mall

(Interrupted by a commotion)

- A small crowd milling around…

Cue 1: Commotion, ? Unconscious Child (3 Responses)

- **Scene Safety!**
- **Team Briefing:** Take Charge! Assign Team Roles! (?Parents?)
- **(Equipment Check!)** = get the equipment moving toward you
- **Check for Responsiveness**
- **Simultaneous Pulse&Breathing Check**

Cue 2A: Unresponsive, NO Brthg, NO Pulse (2)

- **Call 9-1-1, Send for AED**
- **Start CPR** as C-A-B : Compressions, then Ventilations; "I remember BLS!"
- **Ratio:** "**30:2** for everyone, except…"
  two-rescuer child&infant, in wh. case **15:2**
- **LEAVE to Phone first? or CPR-2-mins-Then-Leave-and-Phone?**
  - "**LEAVE to find phone first for everyone, except**…"
    One-Rescuer, Child&Infant, Unwitnessed: DO 2 cycles' CPR before leaving to phone. Kids burn O2 fast; UNWITNESSED implies possible prolonged hypoxia.
- **Depth:** 1/3 chest wall diameter ("4 cm infants, 5 cm child, 5-6 cm adults" seems silly to me)
- **Rate:** 100 ~ **120**/min
- **Other:** Minimize Interruptions; Full Chest Recoil
  - New in 2016: "consider a feedback device"

Cue 2B: Unresponsive, breathing NO, pulse YES (a freebie)

- **Rescue Breathing**
  - (1 breath q 3~5 sec) = 12~20/min

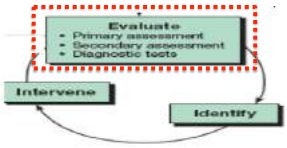
Cue 2C: Responsive, but poorly so,

and obviously he's breathing and has a pulse given that any responsiveness would be impossible without these (1 response)

- PALS Primary (1°) Survey
  - A
  - B
  - C
  - D
  - E

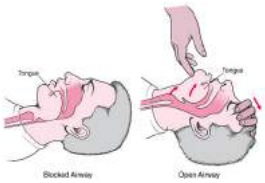
How To: Evaluate-Identify-Intervene

- Continuous cycle
- Doing ***Primary Survey +/- Secondary Surv. +/- Dx tests*** = "Evaluate"



PALS 1° Survey "A" (4 responses)

- **Look:** chest/abdomen movement
- **Listen:** Stridor, Gurgling
- **Feel:** if necessary
- **Fix** issues found – a/w patency will be **maintainable Spontaneously** or w/ **Simple** (jaw thrust, suction, Heimlich, OPA/NPA), or w/ **Advanced** (BMV, CPAP, ETT/LMA/cricothyrotomy)



PALS 1° Survey "B" (5 responses)

- **Rate / Pattern**
- **Volume:** chest expansion
- **Effort** (Work Of Breathing): retractions, etc.
- **Breath Sounds** (by auscultation)
- **O2Sat**

PALS 1° Survey "C" (5 responses)

- Heart **Rate** & Rhythm
- **BP**

- **Cap Refill**
- **Skin Temperature**
- **Periph Pulses**

PALS 1° Survey "D" (3 responses)

- **AVPU** or GCS
- **Pupils**
- **Glucose**

PALS 1° Survey "E" (2 responses)

- **Expose/Examine/ Extremities**:
  - Rash-purpura/Trauma/ Bruising
- **Core Temperature**

Your findings in this kid:

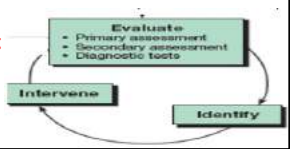
- PALS 1° Survey, "Evaluate":
  - **A:** stridor/snoring, AW needing jaw thrust to maintain; ? puffy face
  - **B:** RR 35, shallow Vt, diffuse wheezing, O2sat unk.
  - **C:** sweaty extremities, shock, cap refill 4 sec; PP weak
  - **D:** anxious, responsive to Pain, pupils OK, Gluc.unk
  - **E:** urticarial rash, temp unknown
- What can you "Identify" the problem as?

?

Image available at:
http://www.bbc.com/news/health-25950422

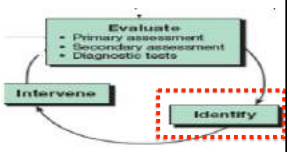
Cue 3: 1° Survey Done, Now What?

- Consider ***Interven*-ing**
- Or further ***Evaluat*-ion**, if still uncertain
- **Either way, a "SUMMARIZING" statement is helpful at this juncture (CRM!)**



Evaluate-Identify-Intervene

- State Type & Severity
- **Type :**
  - **"Respiratory" / "Circulatory" / "Both"**
    - Upper AW
    - Lower AW
    - Lung Tissue
    - Disordered Control
  - **Shock:** Cardiogen./Hypovol./ Obstructive/Distributive
- **Severity :**
  - Resp. **Distress** vs. Resp. **Failure**
  - Shock: **Compensated** vs. **Hypotensive**



CRM point: SUMMARIZING:
"OK folks, **this looks like some kind of shock** to me, because of his {slow cap refill and cold extremities w/normal BP}, and what 'Type' of shock, I'm not sure of yet …"

Effective Team Dynamics / CRM

- Summarizing Statements (SHARE your mental model!)
- Clear Roles & Responsibilities
- Clear Messages
- Closed-Loop Communication
- Mutual Respect
- Constructive Intervention
- Knowing One's Limitations

http://www.royalcollege.ca/rcsite/ppi/educational-resources-e

Cue 3: What's PALS 2° Survey? (2)

- *SAMPLE* History, plus
- *Head-to-toe* Exam

List SAMPLE hx? (6)

- **Signs & Symptoms**
- **Allergies**
- **Meds**
- **Past Med History**
- **Last Meal** ("Most recent meal")
- **Events**

- Then do **"Head-to-toe exam"** to finish 2° srvy

Intervene:

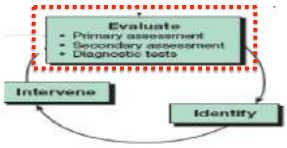
Epinephrine, 10 mcg/kg, IM

Cue 4: 2° Survey Finished… (1 response)

- Consider **Diagnostic Tests**

Cue 5: Diagnostic Tests Ordered… (1 response)

- **Re-"Evaluate" ABCDE**
- Summarize



- Post-Resusc. Care
- Consult colleagues
- Discuss with patient/ parents
- Team Debriefing…

The Kid Survives! … Congrats

PALS: Overall Algorithm

- **Initial Impression** / **Pulse & Brthg simultaneously; if +:**
- **1° Survey:**
  - A: look/listen/feel/fix
  - B: rate/volume/effort/auscultate/O2sat
  - C: HR/BP/CapRefill/SkinTemp/PeriphPulses
  - D: Pupils, GCS/AVPU, Glucose
  - E: Expose/Examine/Extremities
- **2° Survey:**
  - SAMPLE history
  - Head-to-toe exam
- **Diagnostic Tests**

Misc. Changes: 2015 PALS

- **Atropine premedication:** not recommended for emergency intubation (conflicting evid) – **still have it ready just in case**
- **Fluid resuscitation in septic shock:** DO use initial 20 ml/kg crystalloid for kids with shock, but **not** for 'severe febrile illness without shock'. Low-resource settings (i.e. non-ICU settings) should probably avoid excessive fluids – based on African study - kids with dengue/malaria
- **Targeted Temperature Management**: peds out-of-hospital cardiac arrest who are unresponsive after ROSC, either 32-34 or 36-37.5 Celsius are options; probably most important (& low-effort) to **avoid hypERthermia** (THAPCA-in/out-of-hospital trials)

Questions?

- ?

Recap

- Principles of NRP & PALS similar:
  - Arrests caused by **resp or shock** >> cardiovascular causes
  - **Pre-Arrest** (compensated/'distress' stage) >> **arrest** (hypotensive/decompensated/organ-'failure' stage)
  - Identify & Fix **"rapidly-fatal" threats first**
  - **Ventilation/Oxygenation** provide +++ benefit; circulatory support (fluids/inotropes) in 2nd place
  - **Capnography (ETCO2)** often a good idea
  - **BLS/Quality of CPR/Early Defib** more important than meds (e.g. epi); find & treat cause with specific Rx's
    - E.g. Hypovolemia? **Fluids.** Anaphylaxis? **Epinephrine.** Sepsis? **Antibiotics & source control**…
- **Systematic Aprch**, Organized **Team Dynamics / CRM**

Thank You

- Thank you for your commitment to excellent care of critically ill newborns and children
- THE END… now some fun topics for further discussion…

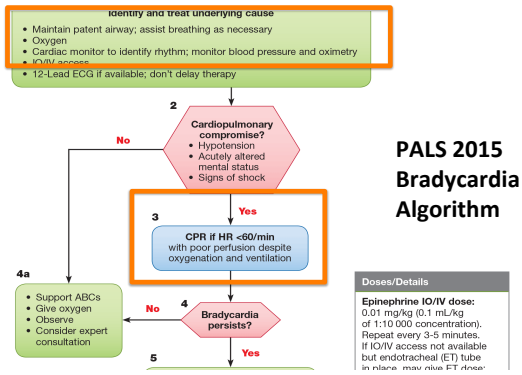
Our Kids Depend On Your Skills

Common Mistakes PALS/NRPers Make

1. **The Bradycardia Blunder**
2. **Systematic Assessment Slipups**
3. **Real Life Hesitation**
4. **Esophageal Intubations Unrecognized**
5. **Algorithm Confusion**
6. **Equipment Check Foibles**
7. **Communication Breakdowns**

Common Mistake 1: Bradycardia Blunder

- *"HR<60 with poor perfusion. That means I need to start CC's STAT!" Right?*
- **FALSE**.
- *Effective* PPV/O_2/CO_2 must be established 'x 30 sec' *before* CCs become an option. * common thread (NRP & PALS)!



PALS 2015 Bradycardia Algorithm

Common Mistake 2: Systematic Assessment Slipups

- "not-so-systematic"/ "Jumping to Cnclsns"
- *Fixation errors: "This must be sepsis!"*

- *Remedy: Ask yourself, "What else could this be?"*
- *Use written guide/checklist to help you not skip steps*

Common Mistake 3: Real Life Hesitation

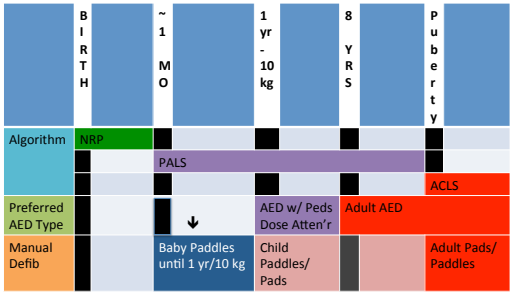
- *"I don't want to put a *tube* in this baby!"*
- *"An umbilical vein catheter? That seems drastic…"*
- Unexpected events, 'formerly'-healthy babies

- *Remedy:* Expect sometimes to have to provide invasive therapies to babies you didn't think were sick, if now they are sick
- If ETT/LMA indicated, better to use it than not
- UVC (placed correctly) is a few-cm-length catheter in an easily accessible vein, reliable, relatively safe, often faster than periph IV and safer than IO

Common Mistake 4: Esophageal Intubations Unrecognized

- Even experienced MDs put ETTs down the esophagus
- That's forgivable
- What's **not** forgivable is not **recognizing** it immediately
- Even less forgivable is continuing the resusc with 'false sense of security' that "the kid's been intubated, so A/B are OK" when they're not
- **Remedy:** Use ALL your clues (**especially +ETCO2**); Consider the ETT an untrustworthy, slippery creature that sometimes is in, sometimes slips out, doesn't stay where it's put; ANY problems recheck the ETT, ETCO2, chest rise
- Breath Sounds & "Chest Rise" are subjective & can be misperceived; "wishful thinking"

Common Mistake 5: Algorithm Confusion Ages & Breakpoints



Algorithm Confusion: Compression/Ventilation Ratios

- 30:2 for everybody!
- *Except* 2-RESCUER CHILD & INFANT, in which case it's 15:2.

Algorithm Confusion: "Should I Stay, Or Should I Go?"

- If ALONE with NO PHONE
- "LEAVE all victims to run, call EMS & come back!"
- *except* UNWITNESSED CHILD & INFANT,
- in which case you do 2' (5 cycles) CPR first, THEN run & call EMS & come back.
  - (We do these "kickstarter" compressions without delay because it was UNWITNESSED, so they may have been hypoxic for a long time, and they're CHILD/INFANT, therefore they burn O2 rapidly.)

6: Equipment Foibles:
Suggested Checklist: "STATICS-MIMM"

- **S** – "Scopes"
- **T** – "Tubes"
- **A** – "Airways"
- **T** – "Tape"
- **I** – "Introducer" (Stylet)
- **C** – "Circuit" = src of PPV (± O2)
  - Blender @ 21%, 21-30% blo 35wGA
- **S** – "Suction"
  - Bulb, Flex, MecAsp
- **M** – "Monitors"
  - SaO2, ECG, ETCO2; (BP, temp, art line…)
- **I** – "IV"/UVC
- **M** – "Meds"
- **M** – "Mask"/LMA

PLUS (NRP):

- Warmer
- Baby Baggie < 32 wks
- NG tubes
- Blankets

Common Mistake 7: Communication Breakdowns

- Can "somebody" get the monitors on?
- "Let's" get oxygen on this patient?
- Does "anyone" have the chart?
- Can we give "some" epinephrine?

Communication: Adapting Air Traffic Lingo to NRP
Yamada & Halamek (J Peds 2015)

Table III. Representative sample of air traffic control terms and proposed adaptation to neonatal resuscitation

Air traffic control term	Definition of adaptation in neonatal resuscitation	Examples of adaptation to neonatal resuscitation
Abort	Abort a procedure/intervention	"Abort intubation."
Acknowledge	To request a read-back if not given spontaneously	"Give a 30 mL normal saline bolus." No response. "Acknowledge normal saline bolus."
Affirm/affirmative	Yes	
Cancel	Annul the previously transmitted order	"Cancel normal saline bolus."
Confirm	To request verification of information, vital signs, patient status, position of endotracheal tube, equipment checked and working, etc.	"Confirm heart rate above 100."
Correction	An error has been made in this message. The correct version is_____.	"Continue chest compressions until heart rate above 100. Correction: Until heart rate above 80."
Hold short	Stop before reaching the specified setting	"Continue weaning oxygen and hold short of 30%."
I say again	I repeat for clarity or emphasis	"I say again: blood transfusion 30 mL immediately."
Negative	"No," or "permission not granted," or "that is not correct"	
Read back	Repeat all, or the specified part, of my message back to me exactly as received	"Read back adrenaline dose."
Request	I would like to know or wish to obtain	"Request heart rate."
Resume	Resume the intervention	"Resume intubation attempt."
Stand by	Wait for a few seconds so speaker (eg, team leader) can attend to other duties of higher priority. Note: Does not indicate an approval or denial.	"Do you want 20 mL or 30 mL of normal saline?" "Stand by."
Time	To request time of resuscitation.	
Unable	Indicates inability to comply with a specific instruction, request, or order	"Umbilical venous catheter unable."

Other resusc studies since 2015

- "Balanced fluids" Crit Care Med. 2017 Apr 21. doi: 10.1097/CCM.0000000000002365. [Epub ahead of print] Resuscitation With Balanced Fluids Is Associated With Improved Survival in Pediatric Severe Sepsis. *Compared to "unbalanced fluids" (NS), "balanced fluids" had better mortality (12.5%vs16%),AKI prevalence (16vs19%) and 3.0 vs 3.3 days on pressors*
- Two-thumb "more useful" than two-finger (J Matern Fetal Neonatal Med. 2017 Mar 5:1-12)
- Curr Opin Crit Care. 2016 Dec;22(6):527-532. **Fluid resuscitation for acute kidney injury: an empty promise.** *– rather than EGDT, a new conceptual model is proposed: "Rescue – Optimization – Stabilization – Deescalation".*
- **Time Perception during Neonatal Resuscitation.** J Pediatr. 2016 Oct;177:103-7. *We underestimate time elapsed – whether we report feeling stressed or prepared or not.*
- Resuscitation. 2016 Oct;107:25-30. doi: 10.1016/j.resuscitation.2016.07.231. Epub 2016 Aug 2. **Ventilation fraction during the first 30s of neonatal resuscitation.** *– Norwegian study showing that time spent not ventilating is about 40% in first 30s*
- J Paediatr Child Health. 2016 Feb;52(2):141-6. doi: 10.1111/jpc.13085. **Fluid resuscitation therapy for paediatric sepsis.:** *balanced solutions preferred; colloids => renal dysfunction, should be avoided for sepsis*
- Targeted temperature management: - ? **Avoid hyperthermia**, but in-hospital cardiac arrest study called THAPCA-IH compared 33 vs 36.8 degC, in-hospital arrests: discontinued early for lack of difference being found
- Debriefing Framework: "REFLECT": Review the event, Encourage team participation, Focused feedback, Listen to each other, Emphasize key points, Communicate clearly, and Transform the future (Pediatr Emerg Care. 2017 Apr 18)

PICU Pearls

1. If ever unsure a subtle sign indicates severe illness, JUST ASK a pediatrician/PICU. Happy to chat.
2. Most common subtle signs of "sick" kid:
   1. Tachycardia
   2. Silent tachypnea (a sign of acidosis)
   3. Subtle changes in mentation
3. Kids DECOMPENSATE quickly: **"terrifying"**
4. Hypotension LATE, VERY OMINOUS, don't doubt it; ACT STAT.
5. Even teens, when septic, often + myocardial dysfunxn, not vasoplegia: need inotropy, not pure pressor
6. Myocarditis can present like sepsis

Thank You

Available upon request