



Update in Paediatric Resuscitation

**2005 International Guidelines:
Recommendations from NRC**

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Outcomes by Utstein category: overall patient set, including National Pediatric Trauma Registry data.

<u>Outcome</u>	<u>Proportion (%)</u>
ROSC	751/2,438 (30.8)
Sustained ROSC*	165/594 (27.8)*
Survival to admit	340/1,423 (23.9)
Survival to discharge	647/5,363 (12.1)
Neurologically intact survival	131/3,272 (4.0)

Outcomes by Utstein category: overall patient set excluding National Pediatric Trauma Registry data.

<u>Outcome</u>	<u>Proportion (%)</u>
ROSC	422/1,850 (22.8)
Sustained ROSC*	165/594 (27.8)*
Survival to admit	340/1,423 (23.9)
Survival to discharge	253/3,752 (6.7)
Neurologically intact survival	50/2,315 (2.2)

5 phases of Cardiac Arrest

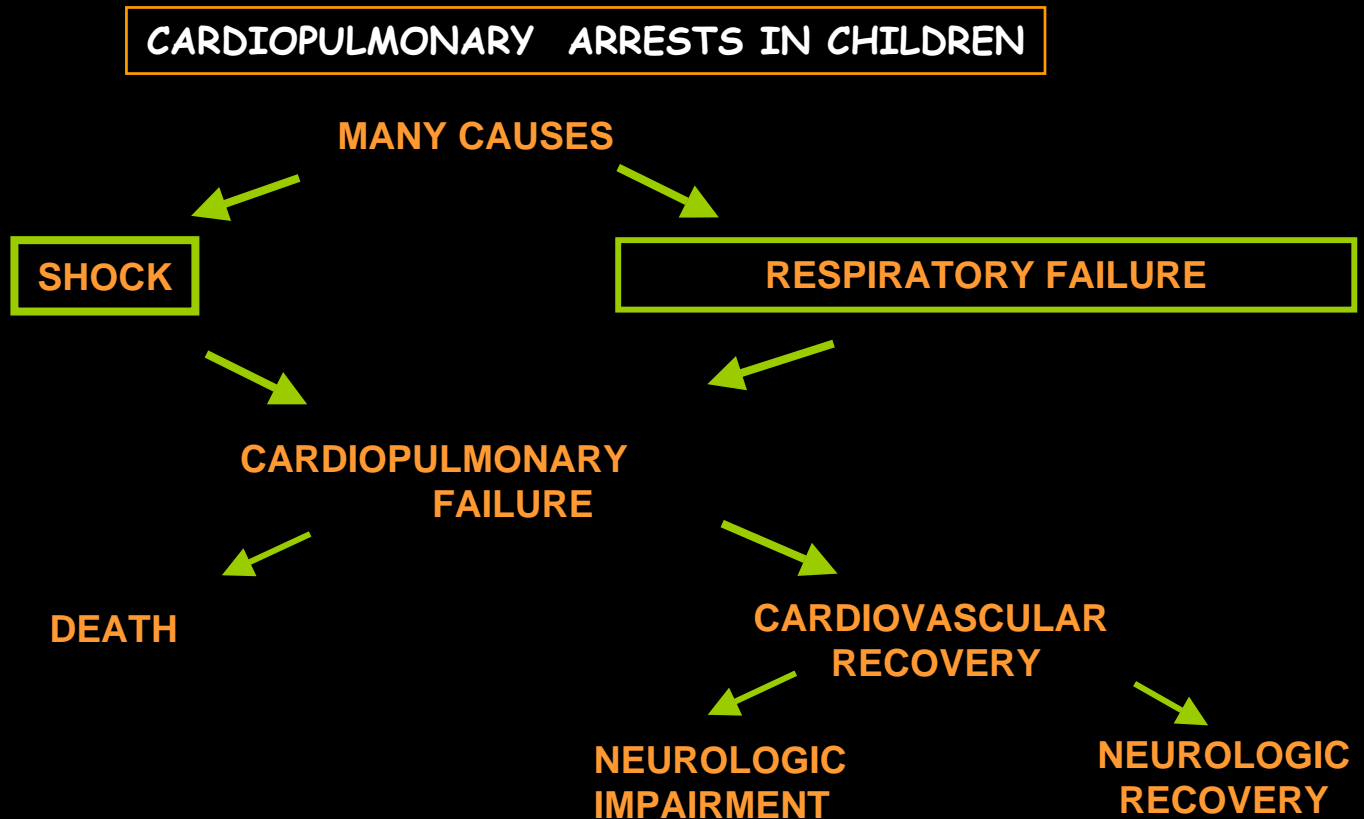
- **Pre-arrest**
- **No Flow**
- **Low Flow**
- **Resuscitation**
- **Long term rehabilitation**

1: Pre-arrest

- **Optimize community education regarding child safety**
- **Optimize patient monitoring**
- **Prioritize interventions to avoid progression of respiratory failure to cardiac arrest**

Pre-arrest

- Prompt recognition of shock and respiratory failure and early intervention



2. No Flow(Arrest)

- 30% children receive bystander CPR in US
- In Singapore, only 22.9% of children received bystander CPR (*Tham and Chan 2005*)
- One of the positive predictor of survival was bystander CPR
 $p=0.03$

DO SOMETHING!

Characteristics of Paediatric Patients with OOH Arrest

	No. (%)	N = 85
Age-year		
Median	1.5	
Sex		
Male	42 (49.4)	
Female	43 (50.6)	
Location		
Home	67 (78.8)	
Public area	9 (10.7)	
Clinic	3 (3.5)	
Ambulance	6 (7)	
EMS activation		
Ambulance	54 (63.5)	
Private transport	31 (36.5)	
Arrest witnessed		
Bystander – layperson	20 (23.5)	
Medical professionals	3 (3.5)	
Ambulance personnel	6 (7)	
None	56 (66)	
Bystander CPR		
Layperson	9 (10.6%)	
Medical professional	11 (12.9%)	
Cardiac rhythm		
Asystole	82 (96.5)	
VT/VF	2 (2.4%)	
Pulseless electrical activity (PEA)	1 (1.1)	

Call first vs Call fast

- **If alone, do 5 cycles of CPR before activation of EMS**
- **If arrest is witnessed and sudden, Guidelines 2005 recommends calling first before starting CPR**

NRC:

For simplicity of teaching, 2 minutes CPR before calling EMS for all children and infants

3. Low Flow (CPR)

- **Push Hard**
- **Push Fast**
- **Full chest recoil**
- **Minimise interruptions**
- **Don't overventilate**

Airway Breathing

LISTEN

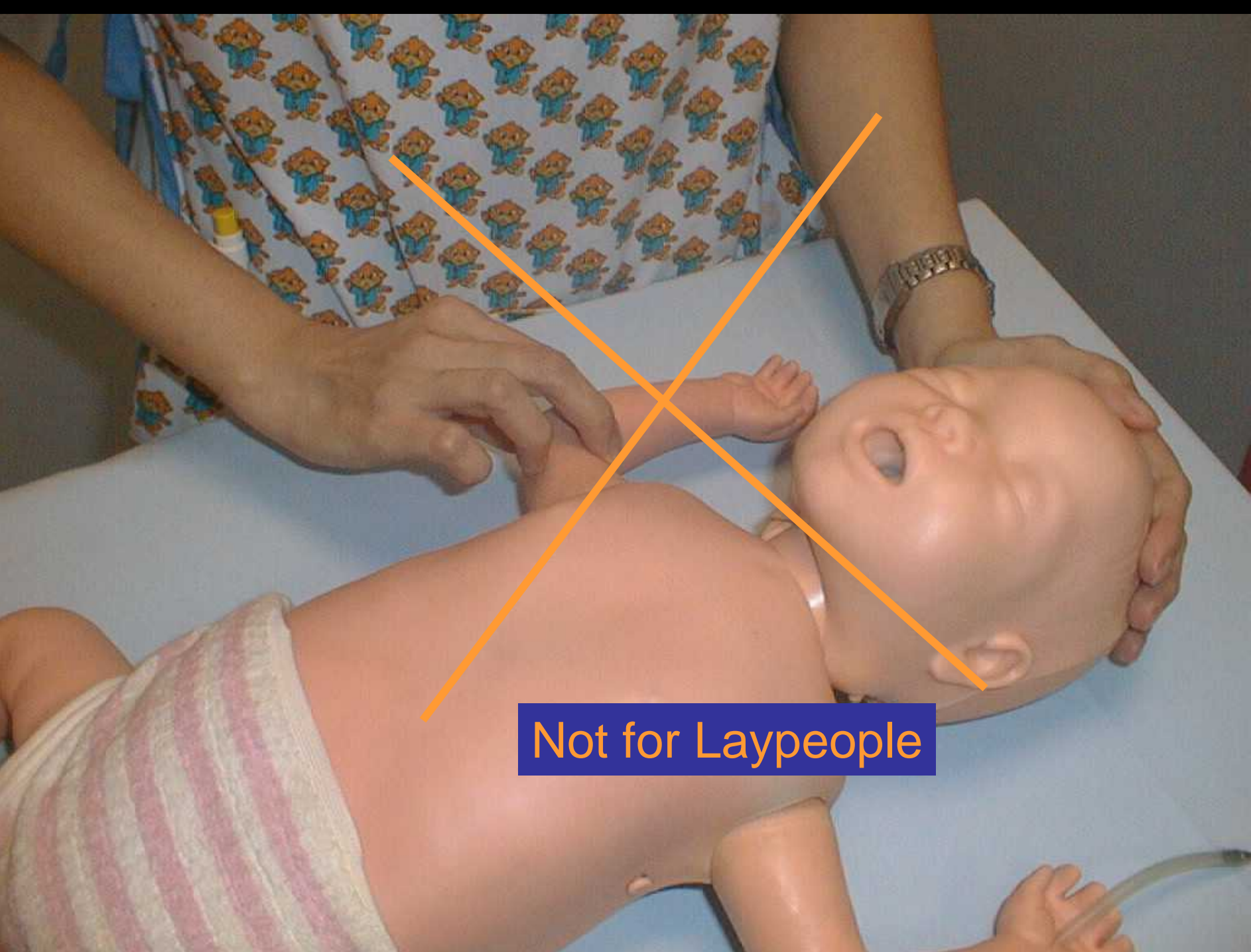
FEEL

LOOK





**No breathing, occasional gasps:
2 initial breaths at 1 second per breath**



Not for Laypeople

PUSH HARD

**One hand or both depending on size of child.
Depth $\frac{1}{2}$ to $\frac{1}{3}$ chest wall diameter**



ALLOW FULL CHEST RECOIL

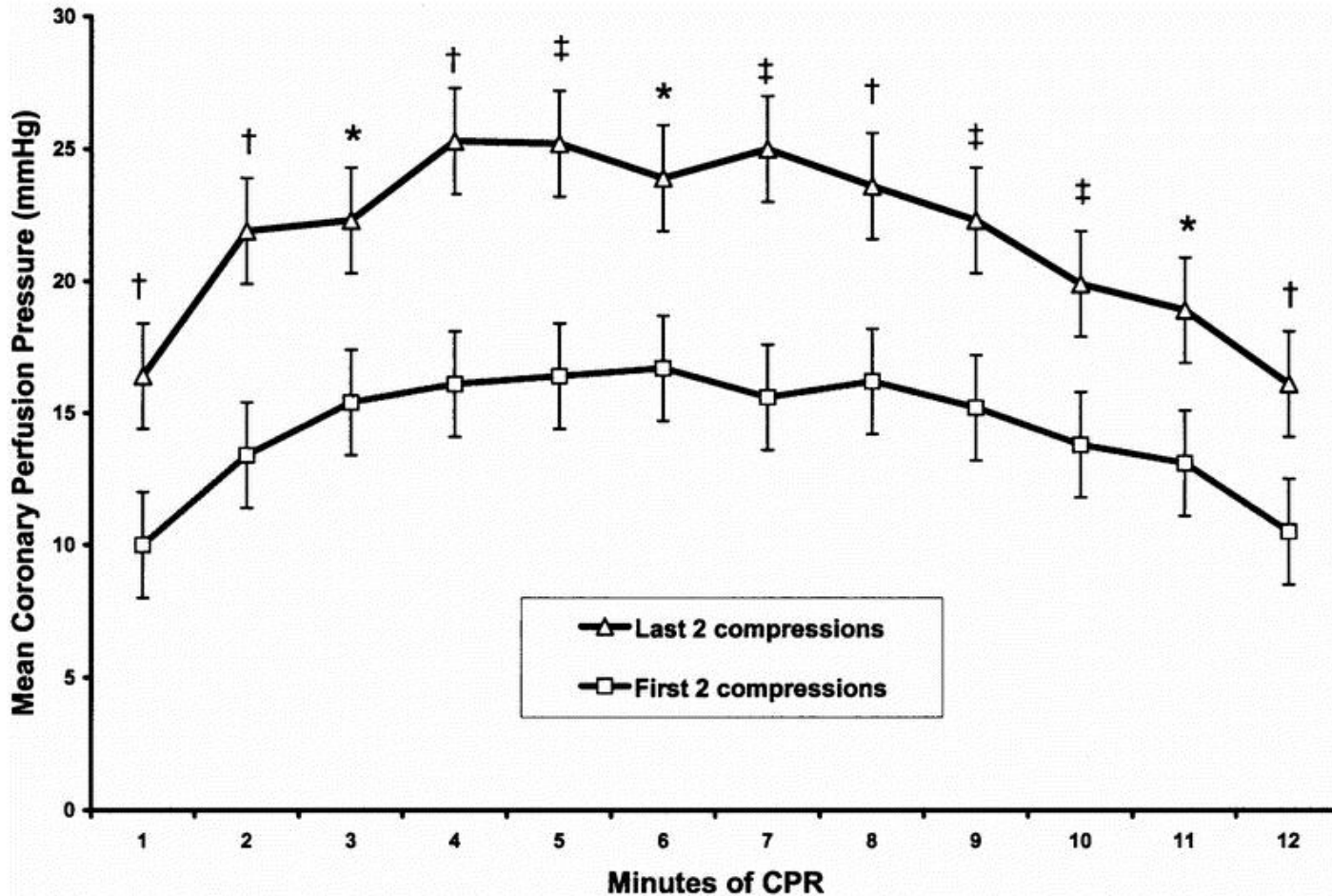
Lower half of sternum



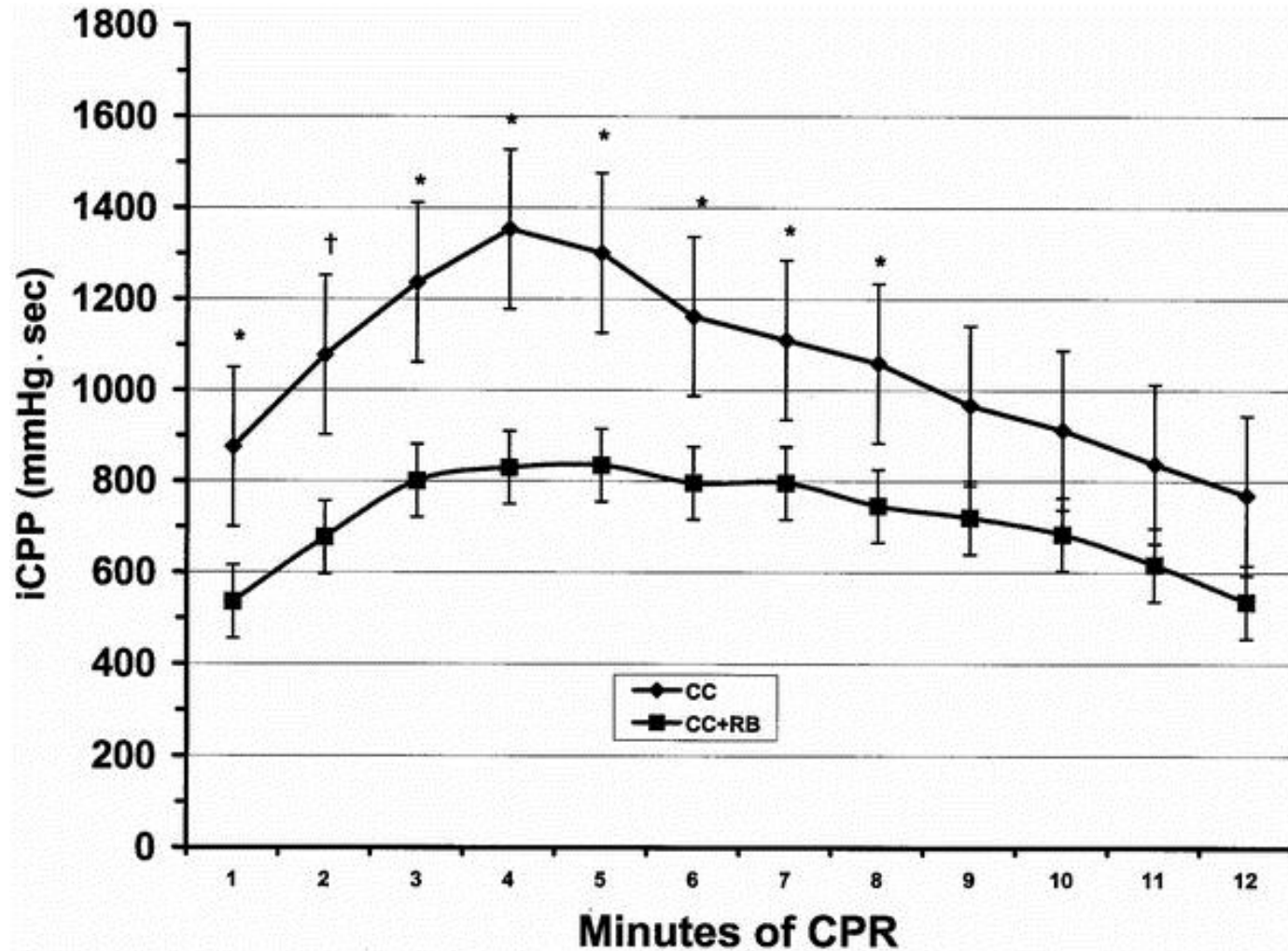


**2 thumbs for Healthcare workers in Neonates
Allow full chest recoil**

Mean CPP of first 2 compressions (bottom line) and last 2 compressions (top line) of each 15-compression cycle during CPR with CC+RB at a compression:ventilation ratio of 15:2.



iCPP over each minute in CC and CC+RB groups.
iCPP difference: * $P < 0.05$; † $P < 0.01$.



Mean±S.D. ventilation and chest compression variables with ventilation–compression ratios of 1:5 and 2:15

	Ratio 1:5	Ratio 2:15	<i>P</i> -value
Tidal volume (ml)	188 ± 80	195 ± 85	0.158
Minute volume (ml)	1479 ± 616	1417 ± 497	0.408
Inflations per minute	7.9 ± 1.5	7.4 ± 1.2	0.069
Proportion inflations too fast (%)	46 ± 32	47 ± 26	0.328
Chest compressions per min	41 ± 7	60 ± 9	0.001
Proportion effective chest compressions (%)	90 ± 11	93 ± 8	0.114
Average chest compression rate	123 ± 18	121 ± 12	0.432

Effectiveness of ventilation–compression ratios 1:5 and 2:15 in simulated single rescuer paediatric resuscitation
 E. Dorph, L. Wik and P. A. Steen

Resuscitation Sep 2002

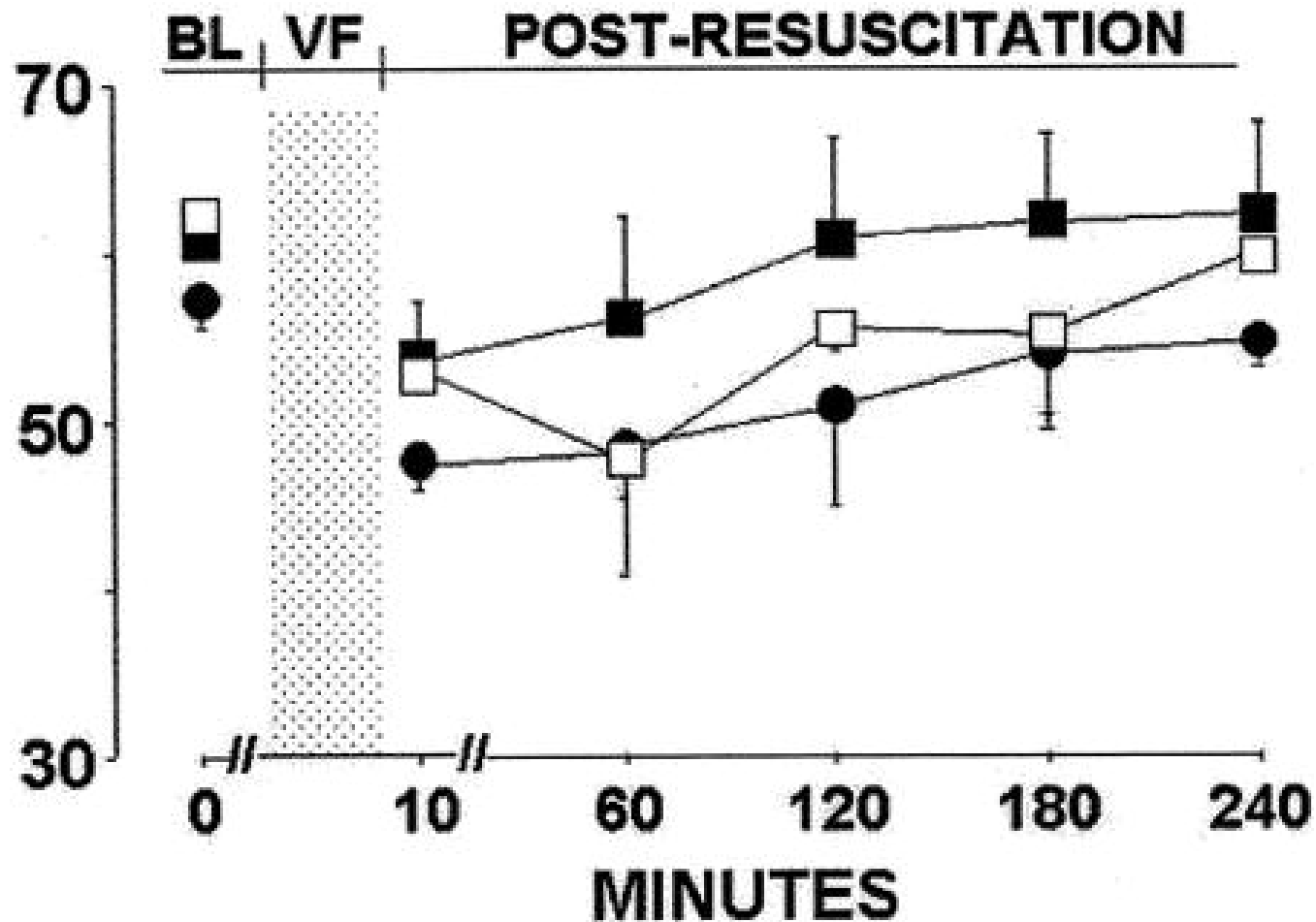
PUSH FAST, MINIMISE INTERRUPTIONS

Recommends 30:2





Survival in Paeds arrest is poor, but survival from VF arrest about 30%



Phase II: effects of fixed 50-J biphasic defibrillation waveform on postresuscitation left ventricular ejection fraction in piglets weighing 3.7, 13.5, and 24.2 kg.

Values are mean \pm sd. BL, baseline; VF, ventricular fibrillation.

From: Tang: Crit Care Med, Volume 30(12).December 2002.2736-2741

Outcome data of monophasic & attenuated shocks

	4 Kg		14 kg		24 Kg	
	Wt- Based	Atten Adult	Wt- Based	Atten Adult	Wt- Based	Atten Adult
ROSC	6/8	8/8	6/8	8/8	3/8	7/8
24-hr good neurologic Outcome	3/8	7/8	5/8	7/8	0/8	6/8

Bob Berg CCM 2004


**NRC: Use Paeds AED if available, for children 1-8 yrs old
> 8 yrs, use adult AED**

4. Resuscitation(Immediate):

- **Quality of CPR**
(rate of 100/min, 10 ventilations/min)
- **Airway:**
 - Cuff vs uncuff ETT**
 - Room air vs 100%**
- **Circulation:**
 - SDE vs HDE**
- **Post resus management**
eg hypothermia



NRC: Cuff or uncuff
CO2 detector if available



NRC: In transport, use ET CO₂ to detect early dislodgement if available

SDE vs HDE

68 children double blind



Survival after 24 hours
SDE 20.6% vs HDE 2.9%



**NRC: High dose adrenaline no longer routinely recommended
except ET dose**

Hypothermia

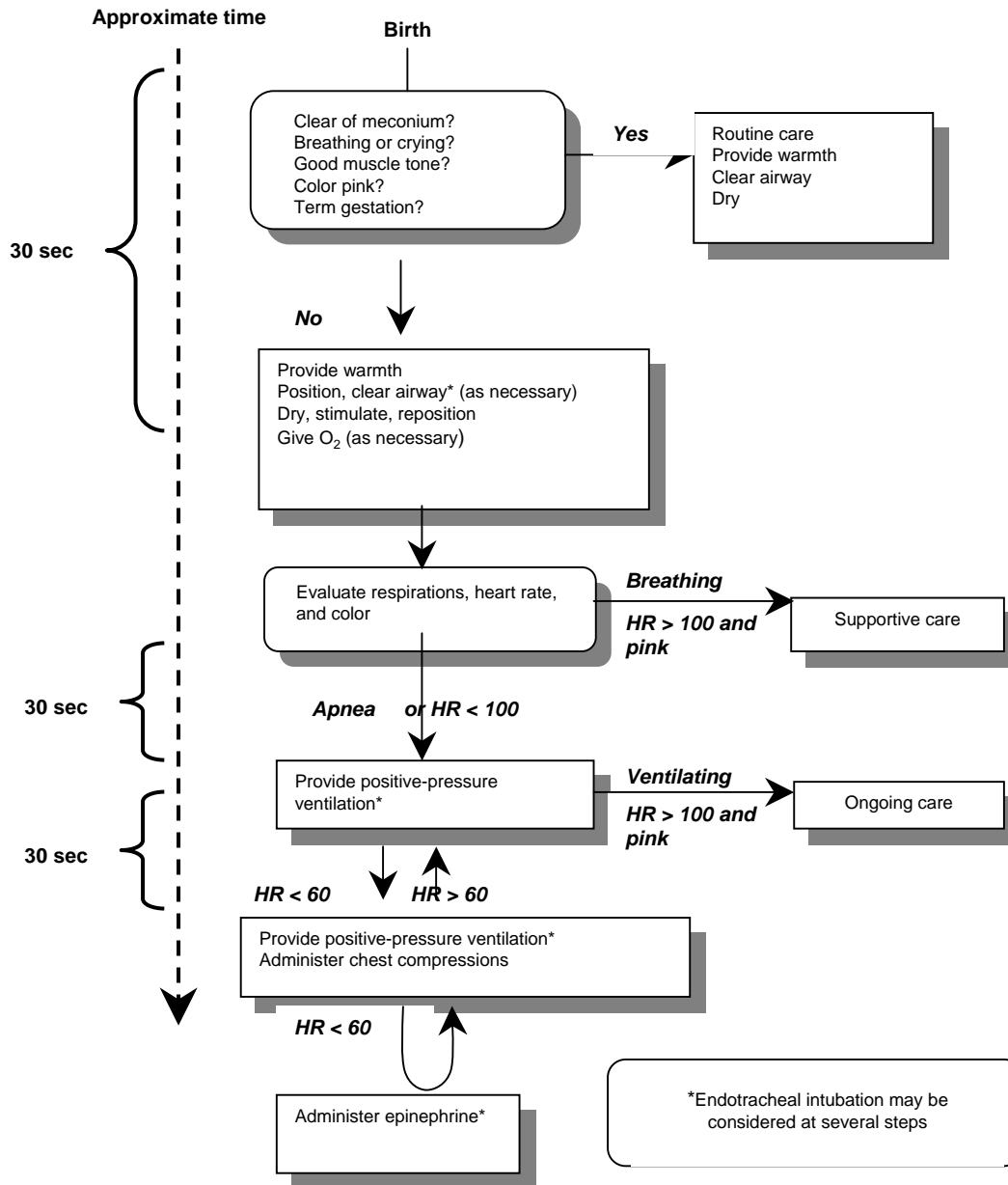
Good neurological outcome at 6 months:
55% in hypothermia vs 39% normothermia

SA Bernard NEJM 2002

SE: Shivering, increase O₂ demand
Rewarming-vasodilatation, hypotension

NRC: avoid hyperthermia

Algorithm for Newborn Resuscitation



Oropharyngeal and nasopharyngeal suctioning of meconium-stained neonates before delivery of their shoulders: multicentre, randomised controlled trial

Nestor E Vain

	Suction (n=1263)	No suction (n=1251)	Relative risk	p* (95% CI)
MAS	52 (4%)	47 (4%)	0.9 (0.6–1.3)	..
Need for mechanical ventilation for MAS	24 (2%)	18 (1%)	0.8 (0.4–1.4)	.
Mortality	9 (1%)	4	0.4(0.1–1.5)	..
Need for ETT, suction and PPV in the delivery room --	106 (8%)	113 (9%)	1.1 (0.8–1.4)	..
Other resp disorders	61 (5%)	79 (6%)	1.3 (0.9–1.8)	..
Pneumothorax	3	3	1.0 (0.2–5.0)	..
Duration of O2 rx (days) in infants with MAS (mean, SD)	5.7, 8.8 (n=52)	5.1, 7.1 (n=47)	..	0.91
Duration of mv (days) in infants with MAS (mean, SD)	5.1, 4.9 (n=21)	4.2, 4.6 (n=14)	..	0.49
Duration of hosp care (days) in infants with MAS (mean, SD)	8.2, 10.7 (n=50)	9.0, 8.6 (n=43)	..	0.14

NRC: may continue practice of NP suctioning provided delivery of baby not delayed

CPR Sequence (layperson)	Adult & Older children	Child (~1-8yrs)	Infant (< 1yr)
Establish Unresponsiveness, activate EMS	Immediately	After 5 cycles of CPR	After 5 cycles of CPR
Open Airway	Head-tilt, chin lift	Head tilt, chin lift	Head-tilt, chin lift
Check for breathing, if breathing, place in recovery position. If not breathing or agonal breathing: Initial breaths	2 breaths at 1 second per breath	2 breaths at 1 second per breath	2 breaths at 1 second per breath
Compression landmarks	Lower half of sternum	Lower half of sternum	1 FB below intermammary line
Compression method	Heel of 1 hand: other hand on top	Heel of 1 hand, with or without other hand on top	Ring and middle fingers
Compression depth	~1/2 to 1/3 depth of chest	~1/2 to 1/3 depth of chest	~1/2 to 1/3 depth of chest
Compression rate	About 100/min	About 100/min	About 100/min
Compression-ventilation ratio	30:2	30:2	30:2
Foreign Body: Conscious	Abdominal thrust	Abdominal thrust	5 back blow-5 chest thrust
Unconscious	CPR, but to look for FB before breaths		

CPR Sequence (healthcare)	Adult & Older children	Child (~1-8yrs)	Infant (< 1yr)
Establish Unresponsiveness, Activate Code	Activate code team	Activate Code Team	Activate Code Team
Open <u>A</u> irway	Head-tilt, chin lift (jaw thrust if neck/HI)	Head tilt, chin lift (jaw thrust if neck/ HI)	Head-tilt, chin lift (Jaw thrust if neck/HI)
Check for <u>B</u> reathing. If not breathing/ agonal breathing: Bag & Mask	12 breaths per minute	20 breaths per minute for rescue breathing	20 Breaths per minute In newly born:40-60/min
Check for <u>C</u> irculation: Pulse check Compression landmarks	Carotid pulse Lower half of sternum	Carotid pulse Lower half of sternum	Brachial pulse 1 FB below intermammary line
Compression method	Heel of 1 hand: other hand on top	Heel of 1 hand, with or without other hand on top	Infant: Ring and middle fingers Neonate: 2 thumbs
Compression depth	~1/2 to 1/3 depth of chest	~1/2 to 1/3 depth of chest	~1/2 to 1/3 depth of chest
Compression rate	About 100/min	About 100/min	About 100/min
Compression-ventilation ratio	Ventilate 8-10 breaths per minute without stopping compression	Ventilate at 10 breaths/min without stopping compression	Ventilate at 10 breaths/min without stopping comp. In newly-born, 3:1 ratio of about 90 compressions and 30 breaths per minute

Cardiac Arrest in Children (Advanced)

