European Resuscitation Council

GUIDELINES 2005

EPLS

Dominique Biarent
ERC Paediatric Working Group

International Liaison Committee On Resuscitation

- American Heart Association
- European Resuscitation Council
- Australian Resuscitation Council
- Heart and Stroke Foundation of Canada
- Inter American Heart Foundation
- New Zealand Resuscitation Council
- Resuscitation Council of South Africa
- Observers from Japan & China

ILCOR Evidence Evaluation

- 281 experts, 276 topics, 403 worksheets, 2000 references
- State the proposal
  - Gather the evidence
- Determine level of evidence
  - Critically assess research methodology
  - Determine direction of results
  - Cross tabulate critical papers
- Formulate treatment recommendation

Supporting evidence table

Supporting evidence

Vasopressin leads to better outcome from paediatric cardiac arrests than epinephrine

Quality of Evidence									
	Excellent	Wenzel 2004 ABC (Nolan 2004)					Mayr 2001 AE Voelckel 2002 E -		
	Good		Lindner 1997 A					Ito 2004 E Lindner 1992 E Lindner 1996a E	
	Fair			Morris 1997 E		Lindner 1996b ABCD Mann 2002 ABCD	Voelckel 2000b B	Paradis 1993 E	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

Level of Evidence

A = Return of spontaneous circulation C = Survival to hospital discharge B = Survival of event C = Survival to hospital discharge
D = Intact neurological survival ²E = Other endpoint

denotes key article

Underlined: peds

CoSTR

Consensus on Science and Treatment Recommendations

- Published in Circulation and Resuscitation on 28th Nov 2005
- Individual resuscitation councils formulated guidelines
- ERC guidelines published on 28th Nov 2005 on Resuscitation

http://www.resuscitation.edu

What do we know for sure?

- Children usually suffer from secondary cardiac arrest
- Bradycardia precedes asystole/PEA
- Survival from respiratory arrest is good (circa 70% normal at 1 year)
- Rescuers often do nothing for fear of causing harm

- Rescue breathing is critically important for asphyxial arrest (low O2 content and high CO2 in the lungs) but not for VF

- In VF : O2 / CO2 content in lungs are N and hyperventilation is deleterious

- BLS not necessary fort short duration VF
- BLS crucial for prolonged duration VF

Piglet Model of Asphyxial Cardiac Arrest

Berg et al 1999. Crit Care Med;27:1893-99

	CC+V	CC	V	No CPR
ROSC	10 /10	6 /10	6 /10	4 /10
ROSC (<2 min)	10 /10	4 /10	6 /10	0 /10
1-h survival	10 /10	6 /10	6 /10	4 /10
24-h survival	8 /10	5 /10	6 /10	0 /10
24-h neurologically normal	8 /10	4 /10	6 /10	0 /10

So; doing anything is better than doing nothing

BUT

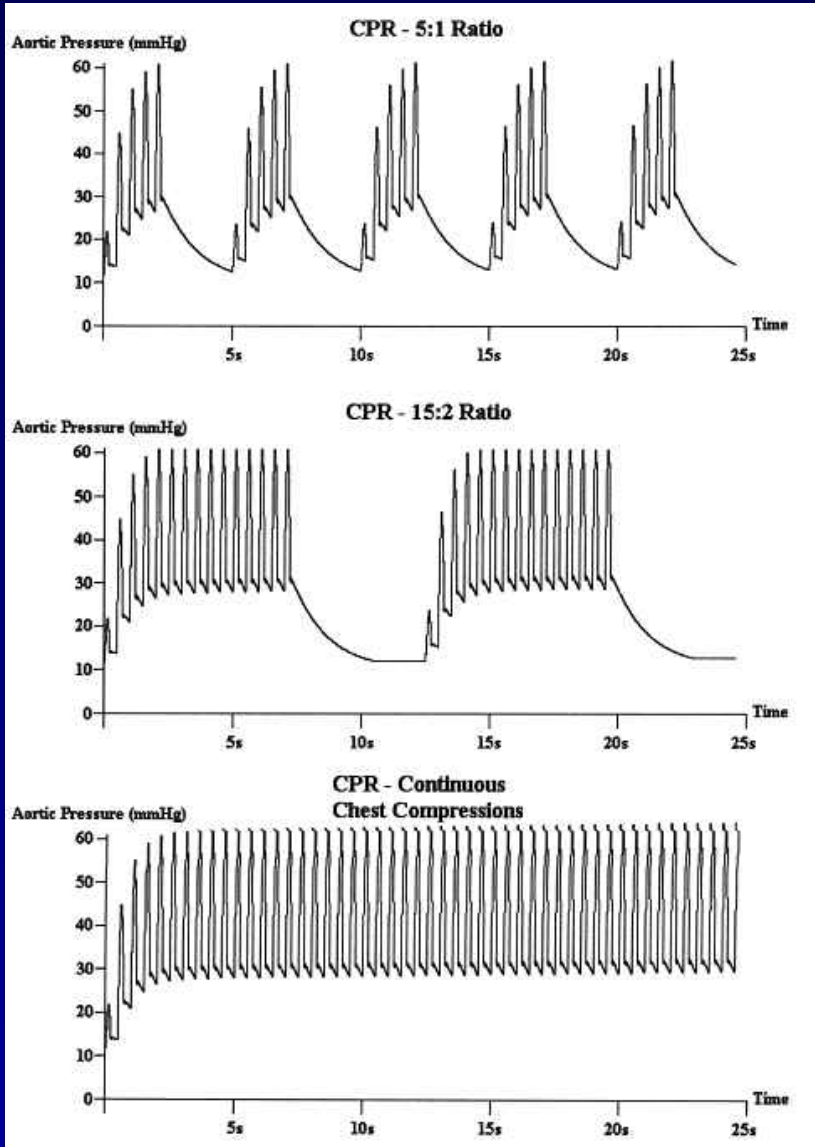
What is ideal ratio of compression to ventilation during CPR in children?

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 2002;54:259

	Ratio 1:5	Ratio 2:15	*P*-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

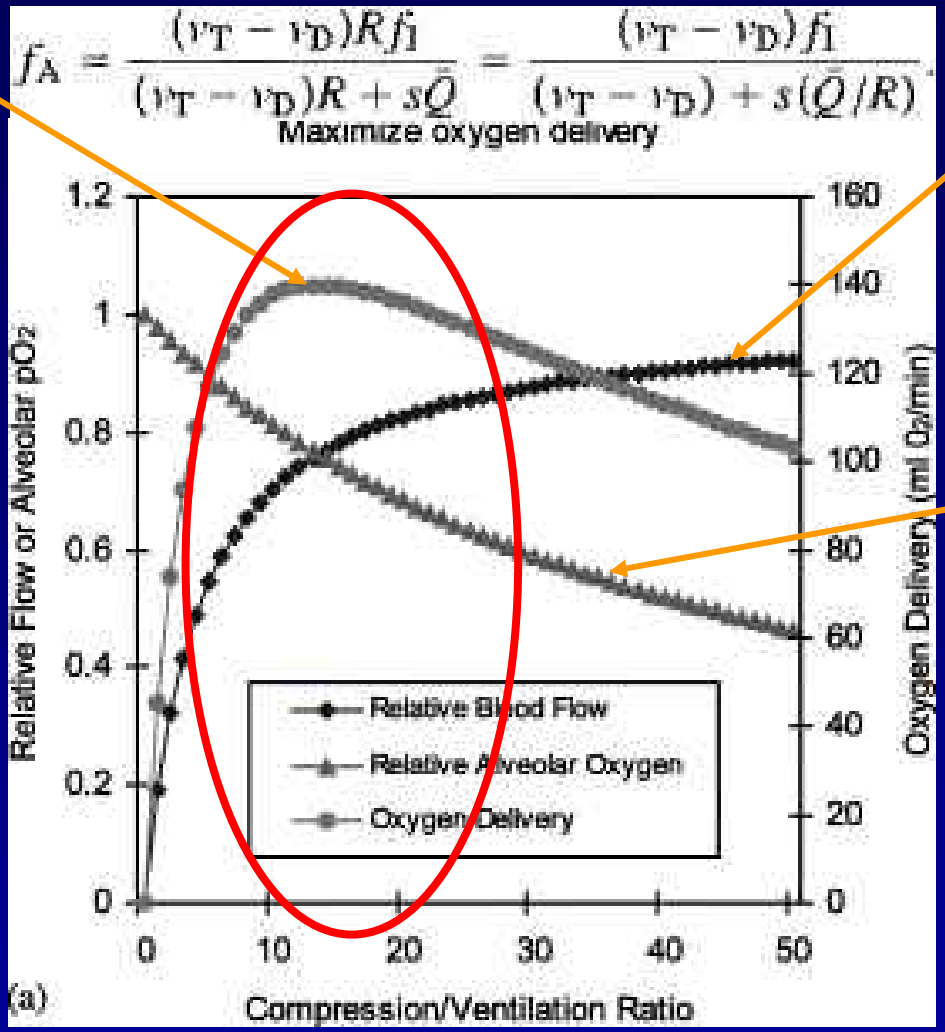
Optimum Compression:Ventilation ratio



- More compressions, better CPP
- More ventilation better oxygenation
- Optimum Balance?

Optimum Compression:Ventilation ratio

Oxygen delivery



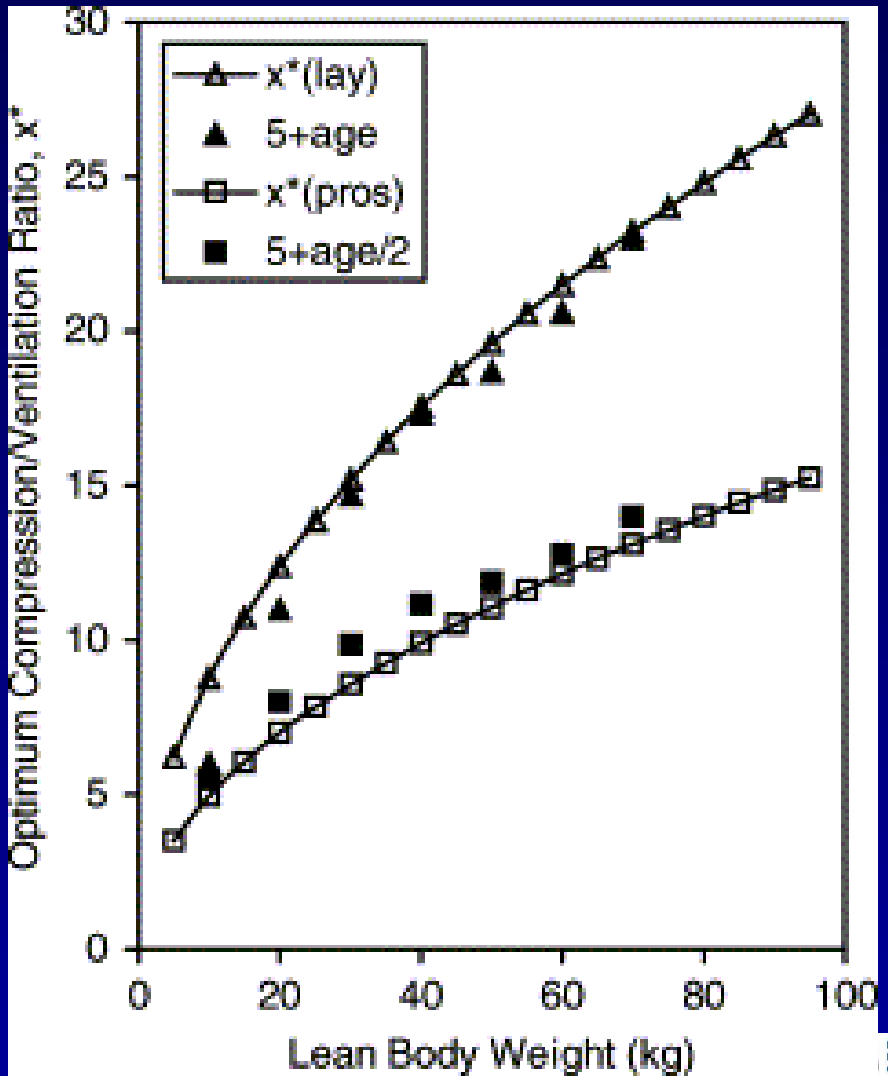
Blood flow

Alveolar oxygen

Optimizing chest compression to rescue ventilation ratios during one-rescuer CPR by professionals and lay persons: children are not just little adults

Babbs CF, Nadkarni V. Resuscitation 2004;61:173

"C:V ratios should gradually increase as a function of body weight.
Optimal CPR in children requires relatively more ventilation than optimal CPR in adults"



"For every complex problem there is an answer that is simple, neat and wrong."

H L Menken

What is the simple answer?

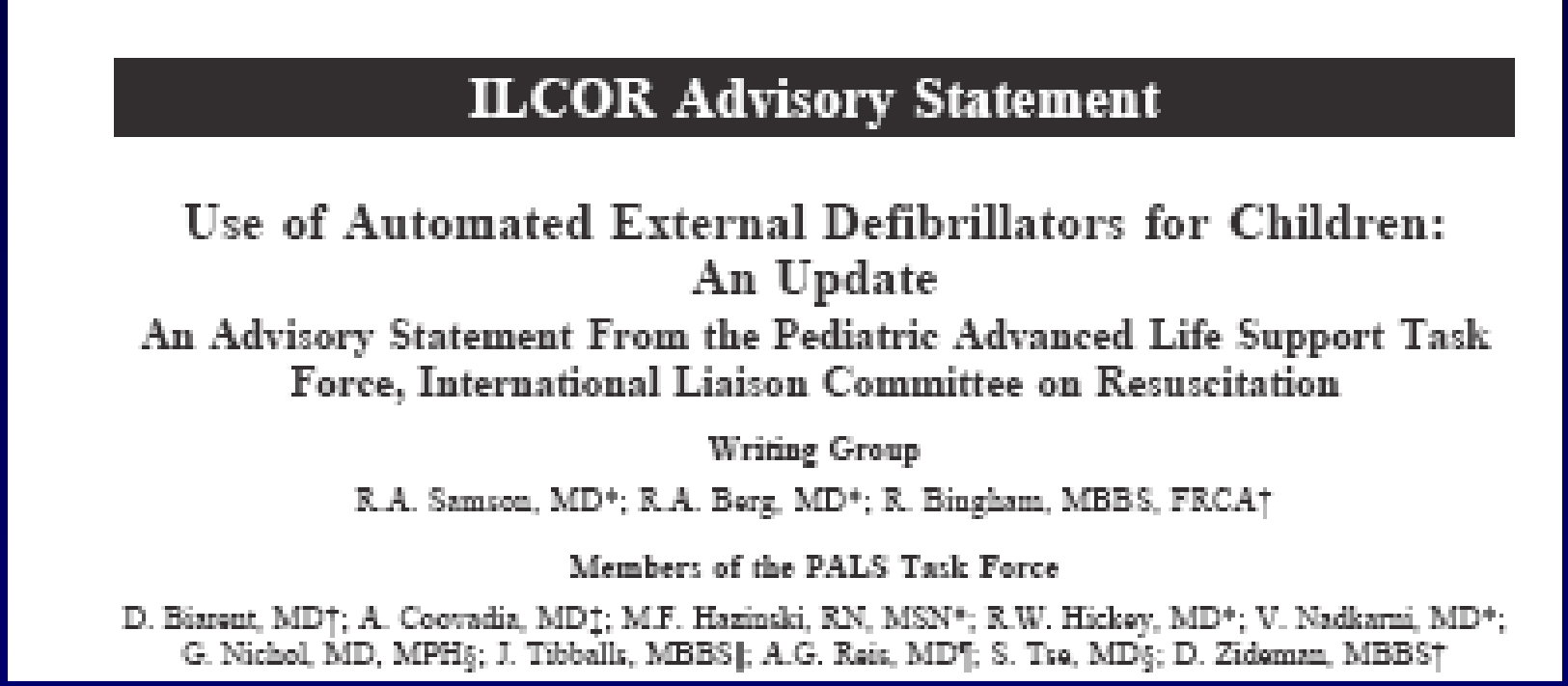
- 15:2 for health care professionals with a duty to respond (to children) and thus the EPLS course
- 30:2 for single lay responders; allowing them to use the same techniques as they've been taught for adult resuscitation

Health Care Professional for Adults

- Start with Rescue Breaths if it is a child
- Start with External Chest Compressions if it is an adult
- Do SOMETHING
- Do 30:2 Adult sequence

Other changes

- Age definition: “if the rescuer thinks it’s a child, they should use the paediatric algorithm”
- Chest compression position: one fingers breadth above the lower costal margin in infants and children
- One or two hands to achieve adequate compression depth
- 1/3rd A-P diameter of chest



ILCOR Advisory Statement

Use of Automated External Defibrillators for Children: An Update

An Advisory Statement From the Pediatric Advanced Life Support Task Force, International Liaison Committee on Resuscitation

Writing Group

R.A. Samson, MD*; R.A. Berg, MD*; R. Bingham, MBBS, FRCA†

Members of the PALS Task Force

D. Biarent, MD†; A. Coovadia, MD‡; M.F. Hazinski, RN, MSN*; R.W. Hickey, MD*; V. Nadkarni, MD*; G. Nichol, MD, MPH§; J. Tibballs, MBBS‖; A.G. Rais, MD¶; S. Tse, MD§; D. Zideman, MBBS†

- Use AED with paediatric pads or programs which attenuate the energy output between 1 and 8 years
- Standard AED over 8 years of age
- Unmodified adult AED may be used for children older than 1 year if nothing else is available

FBAO management

Ineffective cough?

Unconscious
Open airway
5 Breaths
Start CPR

Conscious
5 back blows
5 “thrusts”
(chest for infant
Abdominal for child >1)

Effective cough?

Encourage cough
Continue to check for deterioration to ineffective cough or relief of obstruction

Airway

Data suggests that using cuffed tracheal tubes in critically ill children results in complication rates that are no different from those for uncuffed tubes, provided that there is appropriate attention to monitoring cuff pressure.

Deakers TW, Reynolds G, Stretton M, Newth CJ. Cuffed endotracheal tubes in pediatric intensive care. *J Pediatr.* 1994;125:57–62.
Khine HH, Corddry DH, Kettrick RG, Martin TM et al. Comparison of cuffed and uncuffed endotracheal tubes in young children during general anesthesia. *Anesthesiology.* 1997;86:627–631.

- Prehospital (un)cuffed ETT
- Hospital: cuffed tube for stiff lungs, ARDS, leaks
- Monitor cuff pressure (20 cm H2O)

Ventilation during and after CPR

- Hyperventilation increases intrathoracic pressure, decreases cerebral & coronary perfusion
- Ideal tidal volume = modest chest wall rise
- Avoid hyperventilation
- Maintain normal pCO2 35-45 mm Hg
- Respiratory frequency 12-20/min

Monitoring of ET CO2

- In prehospital & in-hospital setting
- In any intubated child > 2 kg
- In any transportation
- Low or absent ET CO2
  - Oesophageal intubation / TT obstruction
  - Absence or low pulmonary BF (shock states or CA)

Vascular access

- IV & IO always better than ET
- Give adrenaline only once by ET access

Adrenaline

Infant and child

- IV-IO : 10 mcg/kg for every doses
- ET : 100 mcg/kg

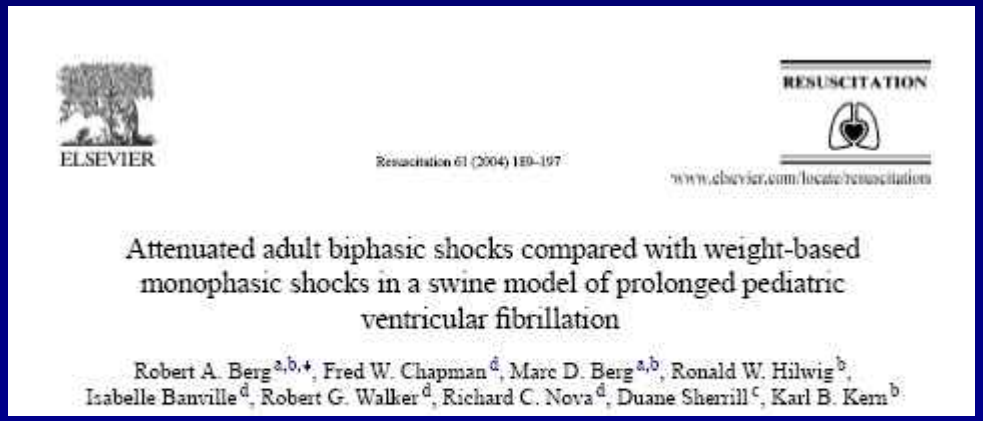
Newborn

- IV-IO : 10 - 30 mcg/kg
- ET : to avoid
  - if required 100 mcg/kg

- Avoid hyper and hypoglycaemia after ROSC
  - No glucose containing solutions during CPR
- Lidocaine is not the first line treatment of VF/pulseless VT
- Vasopressin : insufficient data
  - Rescue therapy? International protocol?

Defibrillation

- Biphasic waves (versus monophasic)
  - As effective
  - Less myocardial dysfunction



ELSEVIER

Resuscitation 61 (2004) 189–197

RESUSCITATION

www.elsevier.com/locate/resuscitation

Attenuated adult biphasic shocks compared with weight-based monophasic shocks in a swine model of prolonged pediatric ventricular fibrillation

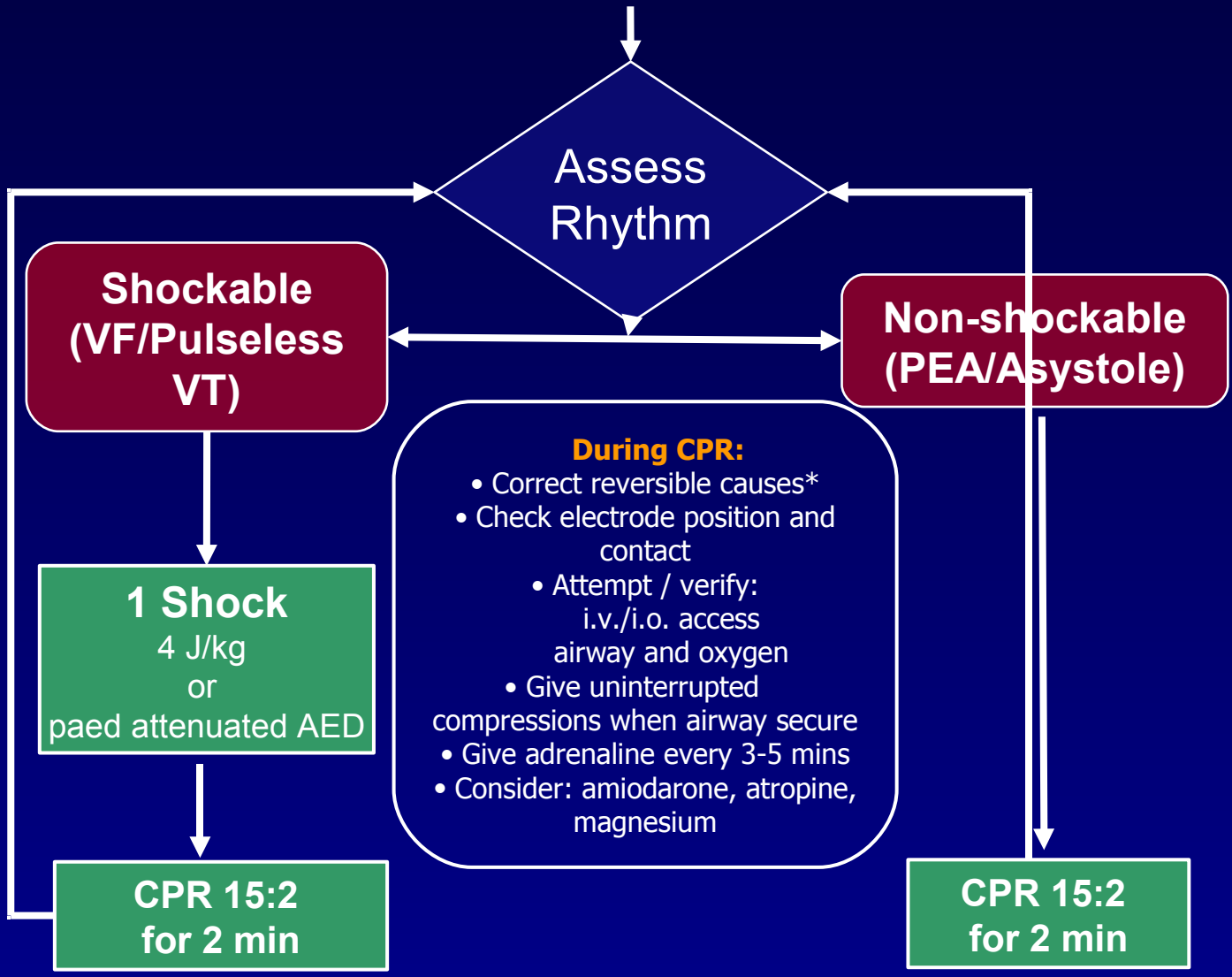
Robert A. Berg[a,b,*], Fred W. Chapman[d], Marc D. Berg[a,b], Ronald W. Hilwig[b], Isabelle Banville[d], Robert G. Walker[d], Richard C. Nova[d], Duane Sherrill[c], Karl B. Kern[b]

•Berg RA, Samson RA, Berg MD, et al. Better outcome after pediatric defibrillation dosage than adult dosage in a swine model of pediatric ventricular fibrillation. J Am Coll Cardiol 2005;45:786-9.

•Clark CB, Zhang Y, Davies LR, Karlsson G, Kerber RE. Pediatric transthoracic defibrillation: biphasic versus monophasic waveforms in an experimental model. Resuscitation 2001;51:159-63.

Defibrillation doses

- Uniformity with adult defibrillation algorithm
- No stacked doses
- Dose : 4 J/kg for every single shock
  - Monophasic or biphasic
- No escalation
- Animal model
  - better results with 3-4 J/kg than with lower or adult doses
  - No myocardial damage with dose ≥ 9 J/kg



*** Reversible Causes**

Hypoxia	**T**ension Pneumothorax
Hypovolaemia	**T**amponade, cardiac
Hypo/hyperkalaemia/Metabolic	**T**oxins
Hypothermia	**T**hrombosis (coronary or pulmonary)

VF/ pulseless VT

Shock 4J/Kg

CPR for 2 minutes

Assess rhythm/Change rescuer

Shock 4J/Kg

CPR for 2 minutes

Assess rhythm/Change rescuer

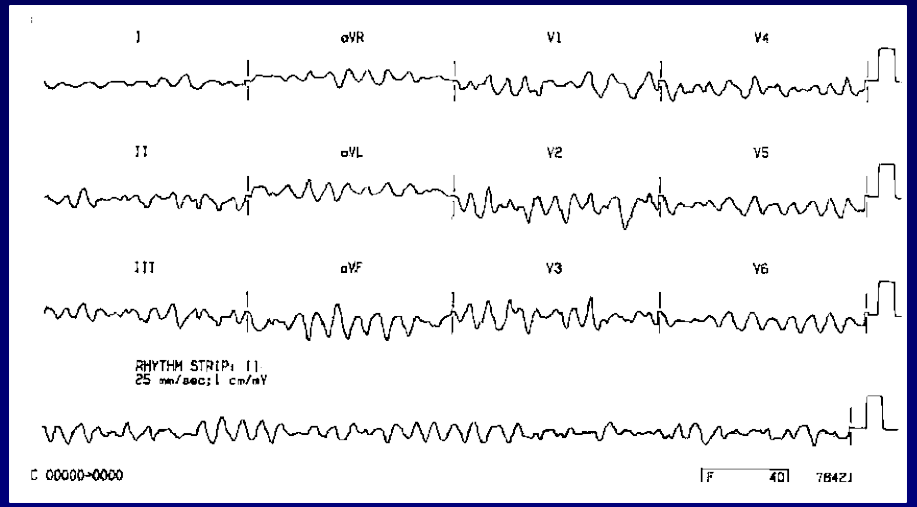
Adrenaline every 2 loops

Shock 4J/Kg

CPR for 2 minutes

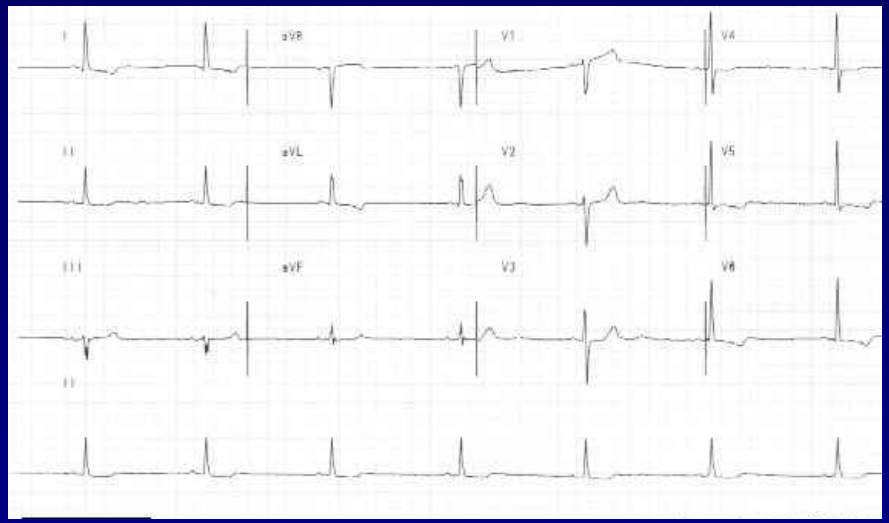
Assess rhythm/Change rescuer

Amiodarone 5 mg/kg IV/IO



drug, shock, CPR, rhythm check

- ✓ Adrenaline circulated by CPR after shock
- ✓ Adrenaline every two loops
- ✓ Change individual providing compression every 2 min



Non VF/ pulselessVT

Asystole

Pulseless Electrical Activity (PEA)

Extreme bradycardia

↓

Adrenaline every 2 loops

↓

CPR for 2 minutes

↓

Assess rhythm/Change rescuer

↓

CPR for 2 minutes

↓

Assess rhythm/Change rescuer

↑ (return to Adrenaline every 2 loops)

Circulation: minimise CPR interruption

Palpate briefly a pulse only if :

- modification of the arrest rhythm
- non-shockable / organised rhythm
- Verify rhythm only after the 2 min CPR
- Exception: signs of life
- In doubt resume CPR

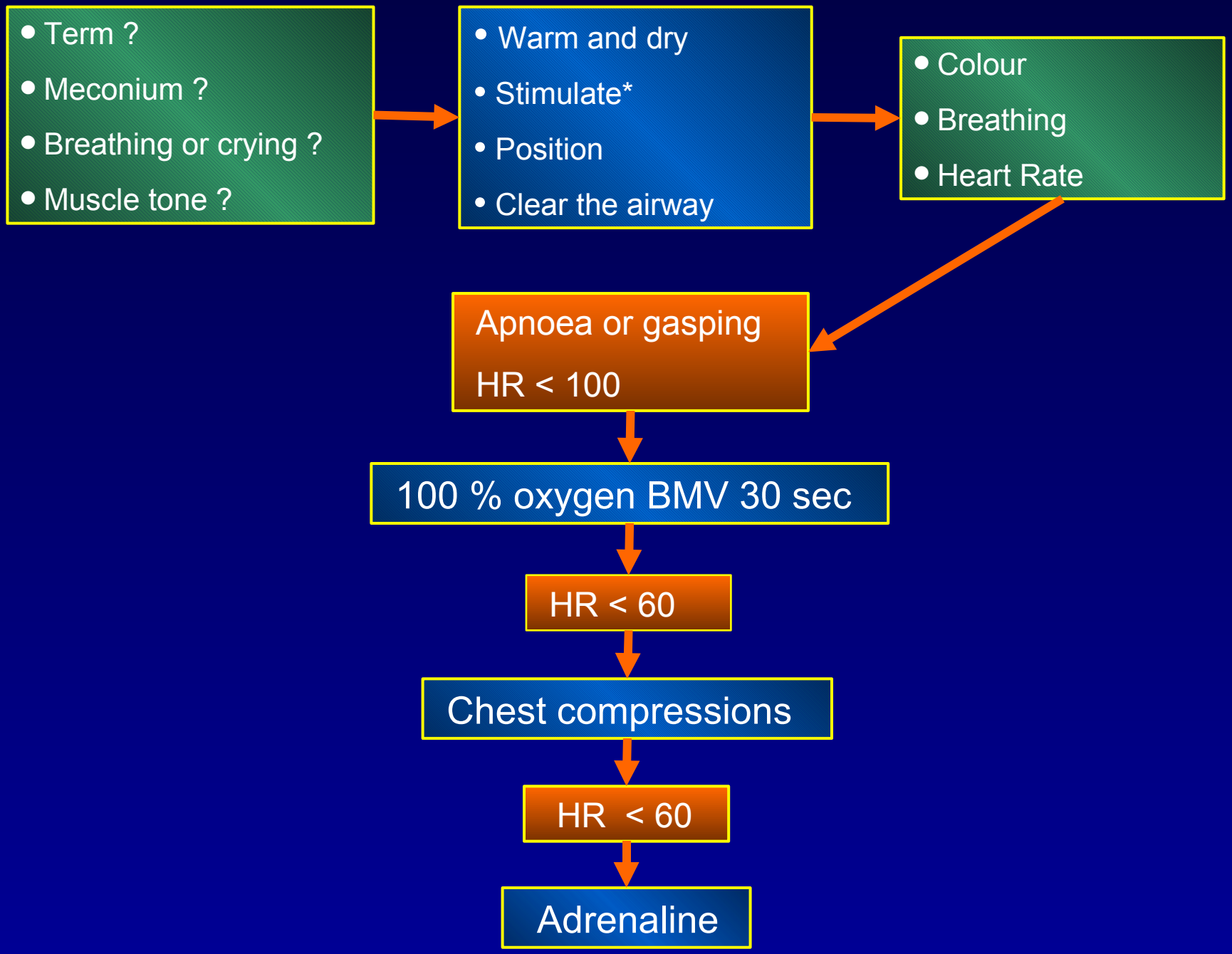
Hypothermia in ROSC state

- Hypothermia After Cardiac Arrest Study Group. Mild therapeutic hypothermia to improve the neurologic outcome after cardiac arrest. NEJM 2002;346:549-56.
- Bernard SA et al. Treatment of comatose survivors of out-of-hospital cardiac arrest with induced hypothermia. NEJM 2002;346:557
- Gluckman PD et al. Selective head cooling with mild systemic hypothermia after neonatal encephalopathy: multicentre randomised trial. Lancet 2005;365:663-70.
- Compagnoni G et al. Hypothermia reduces neurological damage in asphyxiated newborn infants. Biol Neonate 2002;82:222

Temperature management

For child comatose after ROSC :

- ✓ Aggressively control hyperthermia
- ✓ Do not rewarm if hypothermic (if >32°C)
- ✓ Cooling down to 32-34°C for 12-24 hours
- ✓ Avoid shivering (analgesia, NM blockade)
- ✓ After 12-24 hours, rewarm by 0.25-0.5°C per hour
- ✓ Check for infection, CV instability, coagulopathy, hyperglycaemia, electrolytes abnormalities


• Term ?
• Meconium ?
• Breathing or crying ?
• Muscle tone ?
• Warm and dry
• Stimulate*
• Position
• Clear the airway
• Colour
• Breathing
• Heart Rate
Apnoea or gasping
HR < 100
100 % oxygen BMV 30 sec
HR < 60
Chest compressions
HR < 60
Adrenaline

Conclusion

- New guidelines 2005
- Based on CoSTR document
- Evidence Based Medicine when evidences exist
- If not
  - Simple to learn and remember
  - Effective
  - Based on paradigms