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AD-COR Program inovativ de formare in domeniul cardiologiei pediatrice POSDRU/179/3.2/S/152012

Data: 19-11-2015

MODUL TEORETIC

PAEDIATRIC CARDIAC CRITICAL CARE NURSING

Imputernicit: Prof. Dr. Tammam Youssef

Activitate prestata de I.R.C.C.S. POLICLINICO SAN DONATO – MILANO, ITALIA in baza contractului nr.
18/22144/29.07.2015



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Acest material a fost documentat/ validat/ prezentat la sesiunile de formare în cadrul proiectului „AD-COR Program inovativ de formare în domeniul cardiologiei pediatrice” - POSDRU/179/3.2/S/152012, proiect cofinanțat din Fondul Social Operațional Sectorial Dezvoltarea Resurselor Umane 2007-2013.

Beneficiar: Universitatea de Medicină și Farmacie „Carol Davila” București



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PAEDIATRIC CARDIAC CRITICAL CARE
NURSING

Bucharest, November 19, 2015

Matthias Angrés, MD, PhD
RobinAid Foundation
Hamburg / Germany

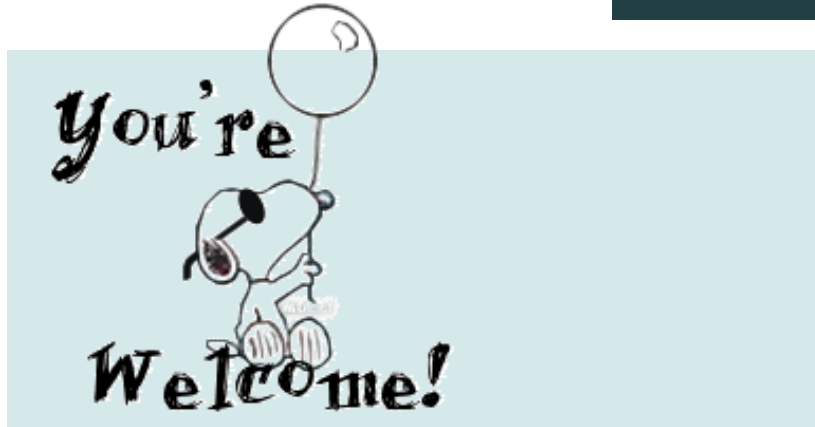


Declaration of Disclosure

I have no actual or potential conflict of interest
in relation to this presentation.



Today's agenda



Paediatric cardiac arrest;
Advanced Paediatric Life Support (APLS)



Let's continue our walk



Important topics in Paediatric Cardiac
Critical Care



14 important topics

1. *The importance of cardiac output and cardiovascular medications ✓*
2. Human factors in paediatric cardiac critical care
3. Receiving patient from OT: assessment, preparation and handing-over process
4. Invasive and non-invasive methods of monitoring in the PCICU
5. *Principles of mechanical ventilation and blood gas interpretation*
6. *Importance of pain management in paediatric cardiac critical care ✓*
7. Fluid management and treatment of metabolic disorders



14 important topics

8. Fast-track extubation in pediatric cardiac surgery
9. *Resuscitation: management of cardiac arrest*
10. Medistinal bleeding and cardiac tamponade
blood transfusion, coagulation disorders, and
postoperative anticoagulation
11. Infections in the cardiac intensive care unit
12. *Cardiac arrhythmias and care of patients with
temporary pacemaker*
13. Renal failure: prevention, identification,
management, and replacement therapy
14. Neurological complications, gastrointestinal
complications, and nutrition



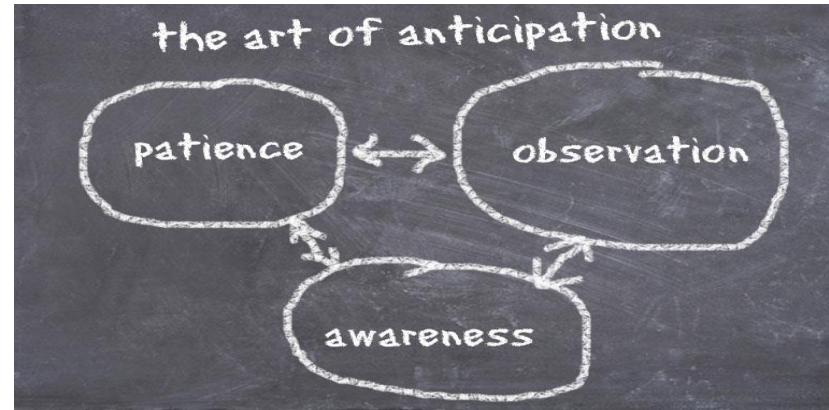
As you may remember

The highly complex paediatric patients with congenital or acquired heart disease require **interprofessional teamwork** and collaboration **to ensure high quality** outcomes **with low mortality and morbidity.**



As you may remember

Anticipation and prevention are the most important **keys for recognition, diagnosis, and successful management** of all potential risks and complications in the postoperative critical care of paediatric cardiac patients.



Introduction

Advanced **Paediatric Life Support** is designed to give the learner the ability **to assess and quickly respond to pediatric emergencies** including respiratory arrest and cardiac arrest.



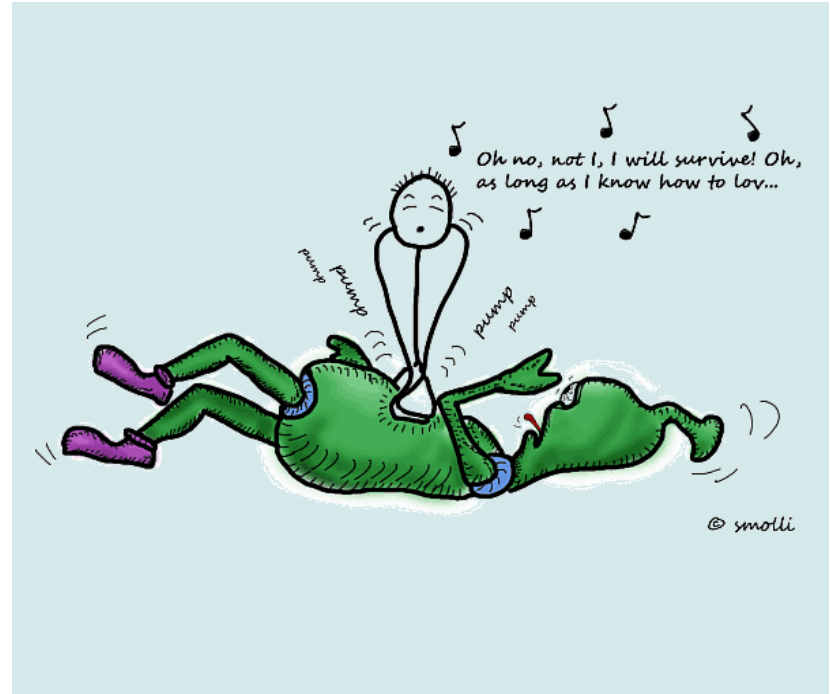
Purpose



- Acquire the ability to recognize an infant or child whom requires advanced life support.
- Learn the importance and technique for quality and effective CPR and advanced life support.
- Learn effective team coordination and team member roles in resuscitation.

Key points

- The first step in cardiac arrest is prevention.
- If cardiac arrest does occur, effective high quality CPR is the most important aspect in successful resuscitation.
- Studies show that poor skills by healthcare workers lead to increased incidences of death and brain death.



Definition

- Cardiac arrest is defined as “cessation of cardiac mechanical activity, determined by the inability to palpate a central pulse, unresponsiveness and apnea.”



Definition

- This definition was proposed in the paediatric Utstein guidelines in 1995, the first pediatric guidelines that established definitions and templates for reporting of events surrounding cardiac arrest.



Zaritsky A, Nadkarni V, Hazinski MF, Foltin G, Quan L, Wright J, et al. Recommended guidelines for uniform reporting of pediatric advanced life support: The Pediatric Utstein Style: A statement for healthcare professionals from a task force of the American Academy of Pediatrics, the American Heart Association, and the European Resuscitation Council. *Resuscitation*. 1995;30:95–115

4 phases of cardiac arrest

- The are four phases of cardiac arrest:
 - pre-arrest
 - no-flow
 - low flow
 - post-resuscitation (with distinct pathology and therapy)

Berg MD, Nadkarni VM, Zuercher M, Berg RA. In-hospital pediatric cardiac arrest. Pediatr Clin North Am. 2008;55:589–604



4 phases of cardiac arrest

1. Pre-arrest phase

- The pre-arrest phase consists of events leading to cardiac arrest.
- These events include environmental risk factors and paediatric pathologic conditions.
- The goal of this phase is to identify and treat precipitating factors for cardiac arrest.

4 phases of cardiac arrest

2. No-flow phase

- The no-flow phase represents untreated cardiac arrest prior to recognition by a lay bystander in the community or a medical provider in the hospital setting

4 phases of cardiac arrest

3. Low-flow phase

- The low-flow phase begins at the initiation of CPR.
- Chest compressions combined with ventilation provide coronary and cerebral perfusion.

4 phases of cardiac arrest

4. Post-resuscitation phase

- The post-resuscitation phase begins with ROSC (return of spontaneous circulation).
- ROSC is the initial therapeutic goal in CA and is a measure of the initial success
- Post-resuscitation care must be focused on reducing neuronal loss.

Out-of-hospital pediatric cardiac arrest

- The incidence of out-of-hospital cardiac arrest is between 7.5 and 11.2 patients per 100,000 person-years.
- A prospective multicenter study determined that the incidence of paediatric cardiac arrest is greater in infants versus children and adolescents (72.7 vs. 3.7 vs. 6.3 per 100,000 person-years).



Atkins DL, Everson-Stewart S, Sears GK, Daya M, Osmond MH, Warden CR, et al. Epidemiology and outcomes from out-of-hospital cardiac arrest in children: The resuscitation outcomes consortium epistry-cardiac arrest. *Circulation*. 2009;119:1484–91.

In-hospital pediatric cardiac arrest

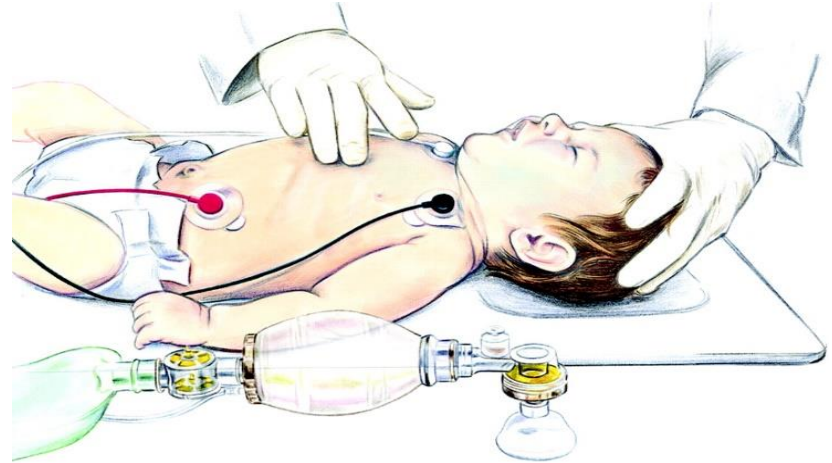
- In-hospital cardiac arrest occurs in 2 - 6% of the patients admitted to a paediatric intensive care unit.
- As expected, a majority (71–88%) of the patients with in-hospital cardiac arrest have chronic pre-existent conditions, most commonly pulmonary, cardiac, gastrointestinal, neurologic and oncologic.



Moler FW, Meert K, Donaldson AE, Nadkarni V, Brilli RJ, Dalton HJ, et al. In-hospital versus out-of-hospital pediatric cardiac arrest: A multicenter cohort study. Crit Care Med. 2009;37:2259–67

In-hospital pediatric cardiac arrest

- The first documented rhythms in a majority of pediatric patients with in-hospital cardiac arrest are asystole and bradycardia.
- Ventricular fibrillation or pulseless ventricular tachycardia is reported in 10–14% of the patients with in-hospital cardiac arrest.



Moler FW, Meert K, Donaldson AE, Nadkarni V, Brilli RJ, Dalton HJ, et al. In-hospital versus out-of-hospital pediatric cardiac arrest: A multicenter cohort study. *Crit Care Med.* 2009;37:2259–67

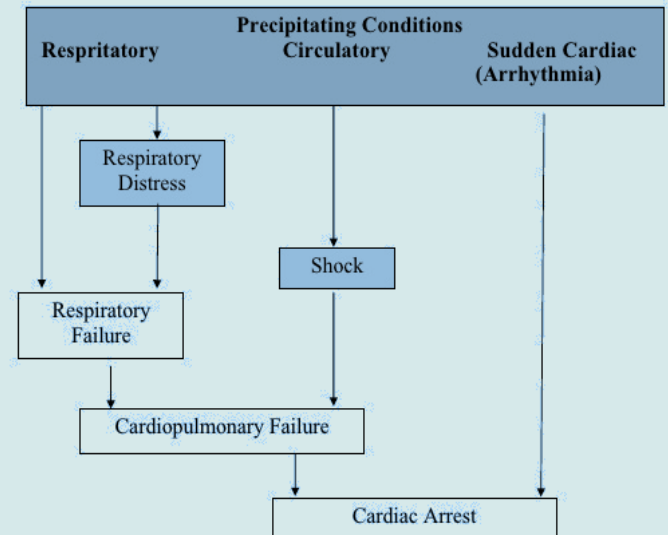
- About 50 to 65% of children requiring CPR are < 1 yr;
- of these, most are < 6 mo.
- About 6% of neonates require resuscitation at delivery.
- The incidence increases significantly if birth weight is < 1500 g.

age.

Cause of cardiac arrest

- In contrast to adults, cardiac arrest in infants and children does not usually result from a primary cardiac cause.
- More often it is the terminal result of progressive respiratory failure or shock, also called an asphyxial arrest.

Pathway to pediatric cardiac arrest



Cause of cardiac arrest

RESPIRATORY

OH: Respiratory Failure (upper & lower airway obstruction, submersion)

IH: Respiratory Failure (airway obstruction, acute pulmonary edema, disordered breathing)

SHOCK

OH: Hypotension (hypovolemic, cardiogenic & distributive shock)

IH: Hypotension (metabolic/electrolyte, acute ischemia, toxicologic, pulmonary embolism)

SUDDEN

OH: SIDS, arrhythmia

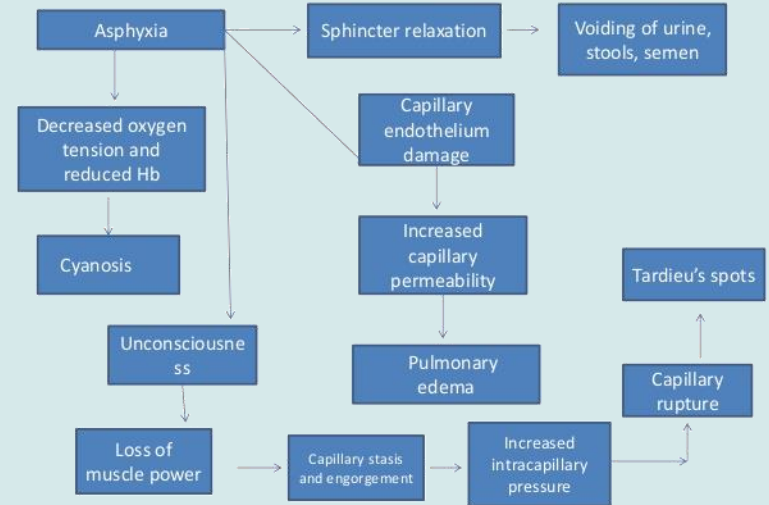
IH: Arrhythmia

Asphyxial arrest

Cause of cardiac arrest

- Asphyxia begins with a variable period of systemic hypoxemia, hypercapnea, and acidosis, progresses to bradycardia and hypotension, and culminates with cardiac arrest

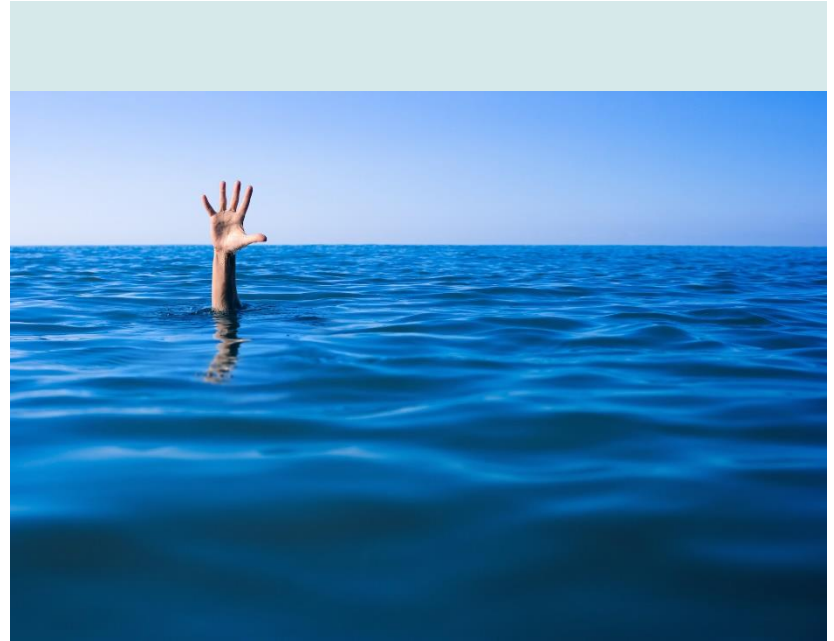
CLINICAL EFFECTS OF ASPHYXIA



Cause of cardiac arrest

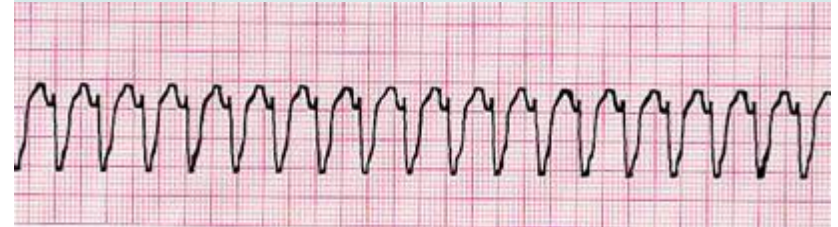
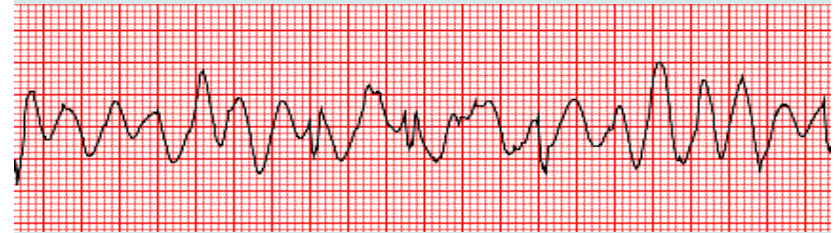
- Non cardiac Causes for cardiac arrest in children:

- bronchospasm
- burns
- drowning
- foreign body aspiration
- gastroenteritis (vomiting / diarrhea)
- sepsis
- seizures



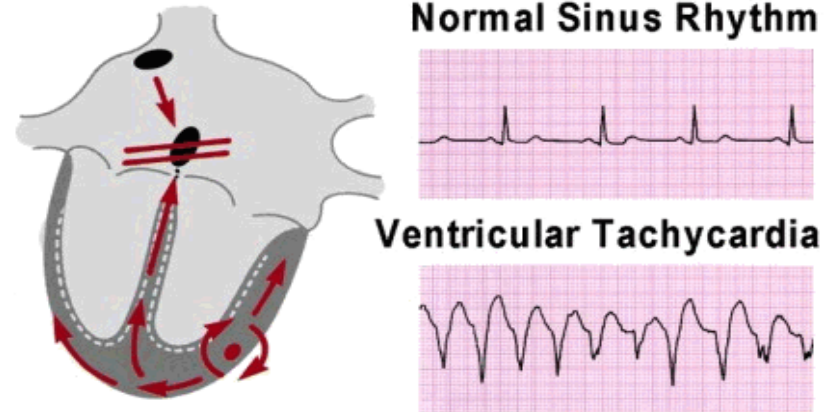
Cardiac causes

- Another mechanism of cardiac arrest, ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), is the initial cardiac rhythm in approximately 5% to 15% of pediatric in-hospital and out-of-hospital cardiac arrests.



Cardiac causes

- The incidence of VF / pulseless VT cardiac arrest rises with age.
- Increasing evidence suggests that sudden unexpected death in young people can be associated with genetic abnormalities in myocyte ion channels resulting in abnormalities in ion flow.



Survival from In-hospital cardiac arrest

Table 4. Risk-Adjusted Rates* of Survival Outcomes by Calendar Year

	2000 (n=28)	2001 (n=37)	2002 (n=64)	2003 (n=89)	2004 (n=98)	2005 (n=149)	2006 (n=125)	2007 (n=154)	2008 (n=193)	2009 (n=94)	Adjusted RR per 1 y (95% CI)	P for Trend
Survival to discharge, %	14.3	22.5	37.9	31.0	30.8	24.3	44.5	42.0	42.1	43.4	1.08 (1.01–1.16)	0.02
Acute resuscitation survival, † %	42.9	64.3	74.9	55.6	72.3	63.3	79.7	74.6	80.3	81.2	1.04 (1.01–1.07)	0.006
Postresuscitation survival, ‡ %	33.3	36.3	49.8	53.1	42.4	38.9	56.4	56.7	52.5	53.6	1.04 (0.98–1.09)	0.17

CI indicates confidence interval; RR, rate ratio.

*Risk-adjusted rates and adjusted RRs per year for the study outcomes of survival to discharge, acute resuscitation survival, and postresuscitation survival are reported for the overall cohort by calendar year.

‡Risk-adjusted rates for each calendar year were obtained by multiplying the observed rate for the reference year (2000) with the corresponding RRs for 2001 through 2009.

- Overall survival in children with an in-hospital cardiac arrest has improved substantially over the past decade without higher rates of significant neurological disability
- *Girotra et al Survival (2013): Trends in Pediatric In-hospital Cardiac Arrests; Circ Cardiovasc Qual Outcomes*

‡Postresuscitation survival was determined by the number of patients with acute resuscitation survival who survived to hospital discharge divided by the number surviving the acute resuscitation.

Survival from In-hospital cardiac arrest

- Children with surgical-cardiac disease have significantly better survival to hospital discharge after an in-hospital cardiac arrest compared with children with medical-cardiac disease and non-cardiac disease.



Survival from Out-hospital cardiac arrest

Journal List > J Emerg Trauma Shock > v.3(3); Jul-Sep 2010 > PMC2938493



J Emerg Trauma Shock. 2010 Jul-Sep; 3(3): 273–276.

doi: [10.4103/0974-2700.66531](https://doi.org/10.4103/0974-2700.66531)

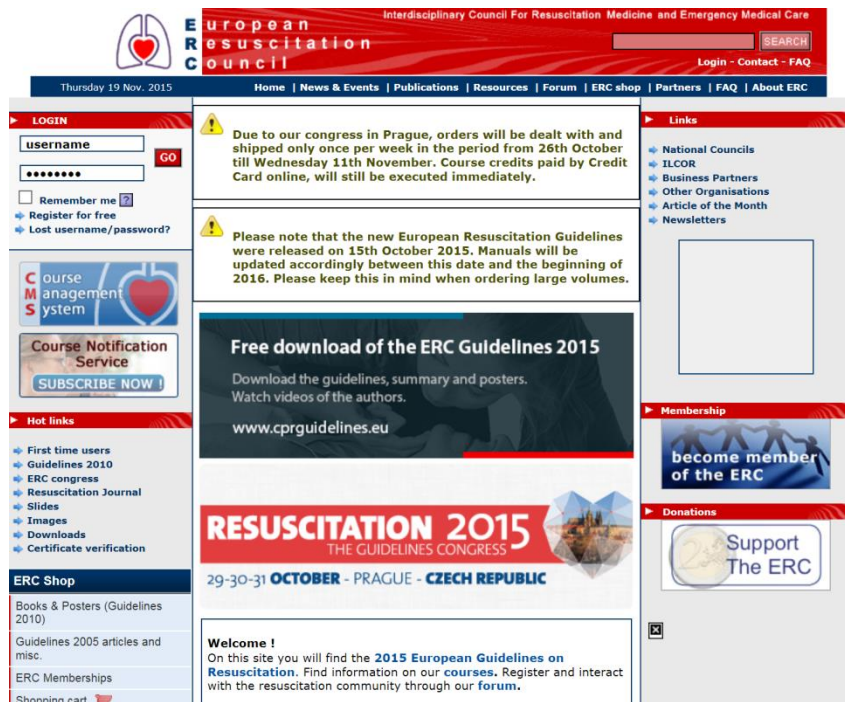
PMCID: PMC2938493

Out-of-hospital cardiac arrests in children

[Antti Kämäräinen](#)

- The outcome is generally poor, as only 2 - 9.6% of patients survive to hospital discharge.
- The neurologic outcome of survivors is good only in 24–31% of patients.

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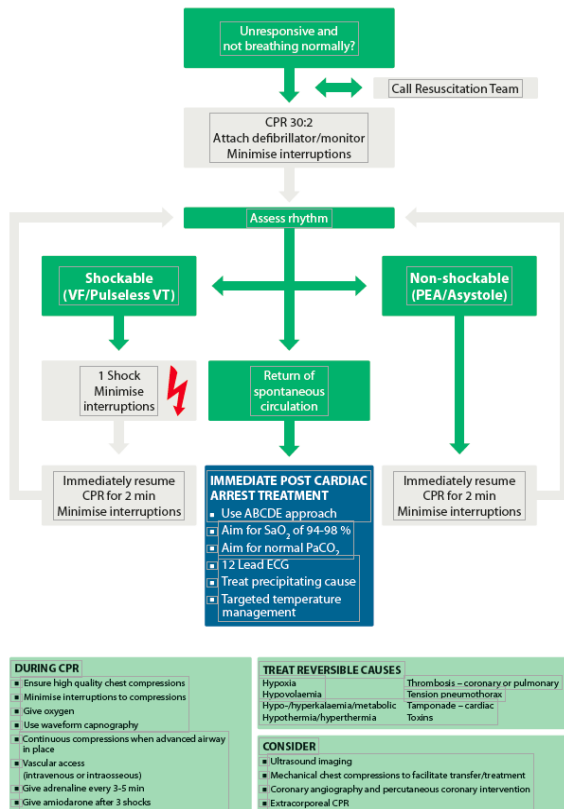


The screenshot shows the European Resuscitation Council (ERC) website interface. The header includes the ERC logo and navigation links: Home, News & Events, Publications, Resources, Forum, ERC shop, Partners, FAQ, About ERC. The main content area features a login section, a course management system, and a free download of the ERC Guidelines 2015. The sidebar contains links to national councils, business partners, and other resources. The footer includes a shopping cart and a welcome message.

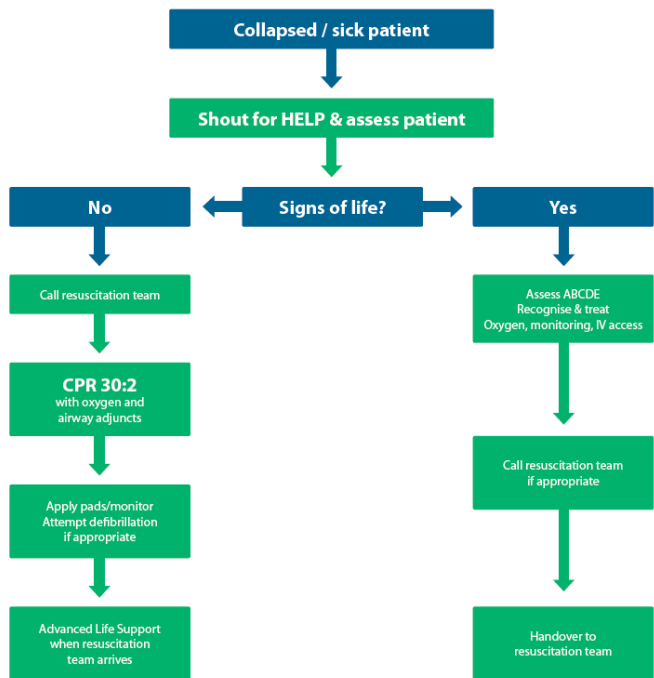
www.erc.edu



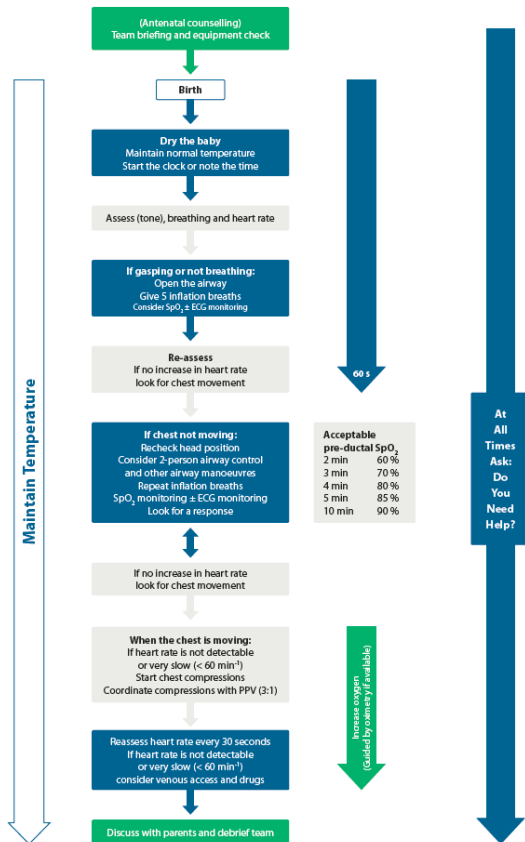
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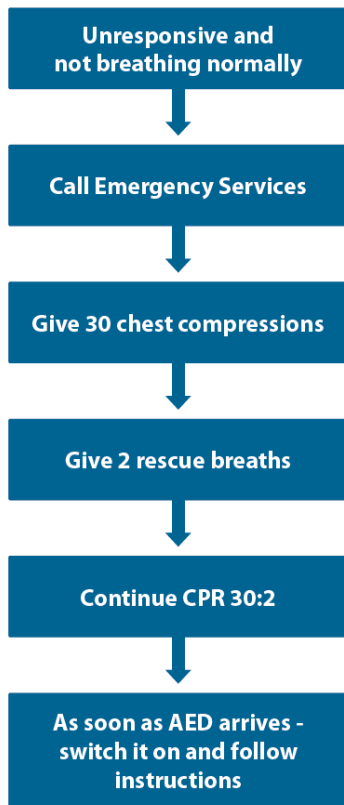


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Basic Life Support and Automated External Defibrillation (AED)



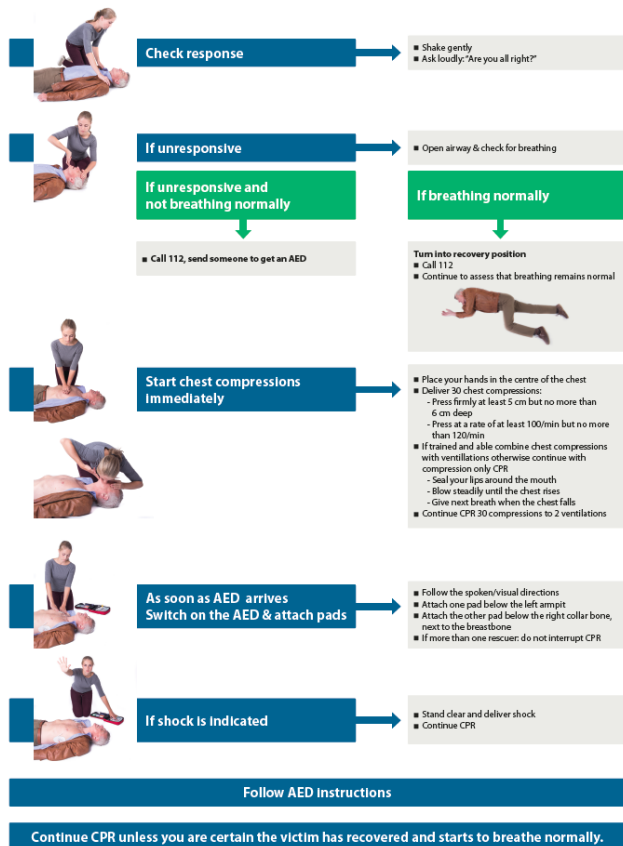
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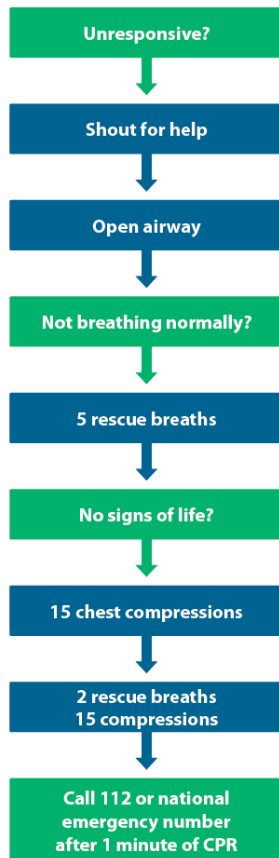
Basic Life Support with the use of an Automated External Defibrillator (AED)

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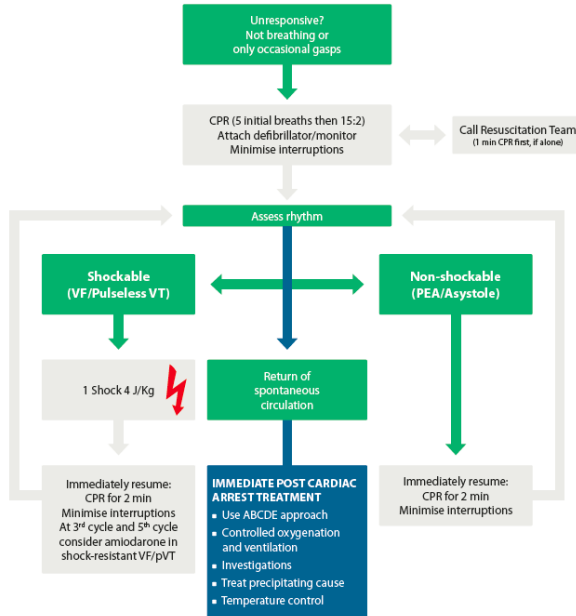


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DURING CPR

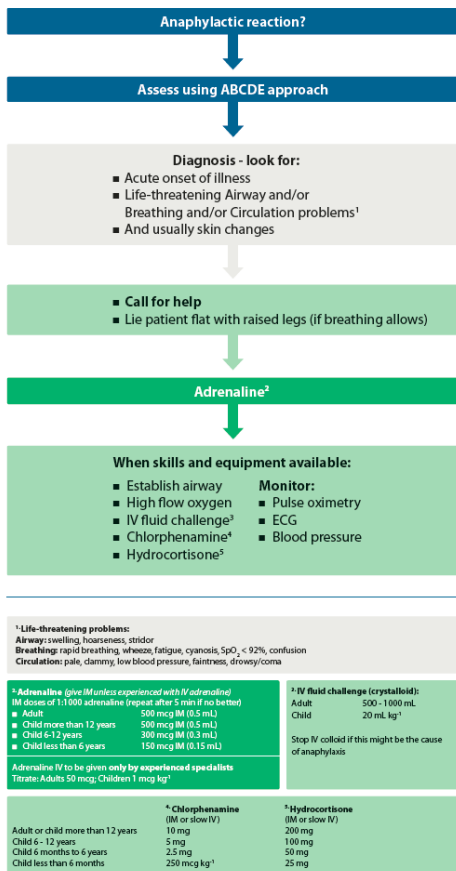
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Vascular access (intravenous, intraosseous)
- Give adrenaline every 3-5 min
- Consider advanced airway and capnography
- Continuous chest compressions when advanced airway in place
- Correct reversible causes

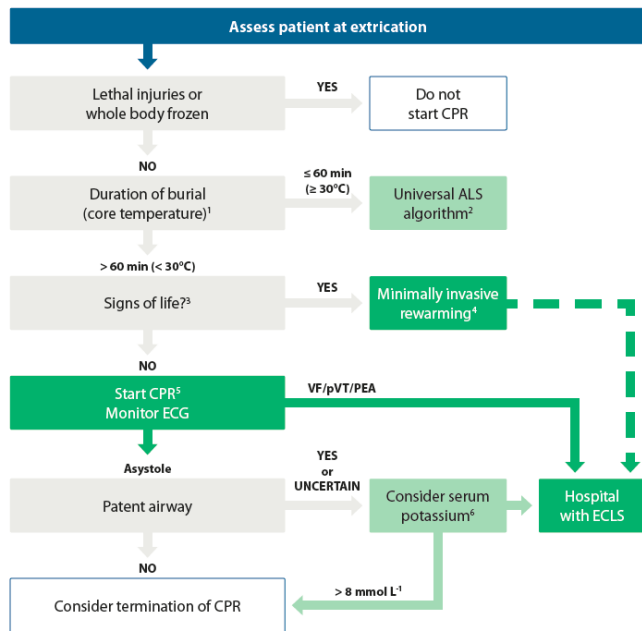
REVERSIBLE CAUSES

- Hypoxia
- Hypovolaemia
- Hyper/hypokalaemia, metabolic
- Hypothermia
- Thrombosis (coronary or pulmonary)
- Tension pneumothorax
- Tamponade (cardiac)
- Toxic/therapeutic disturbances



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¹ Core temperature may substitute if duration of burial is unknown

² Transport patients with injuries or potential complications (e.g. pulmonary oedema) to the most appropriate hospital

³ Check for spontaneous breathing and pulse for up to 1 min

⁴ Transport patients with cardiovascular instability or core temperature < 28°C to a hospital with ECLS (extracorporeal life support)

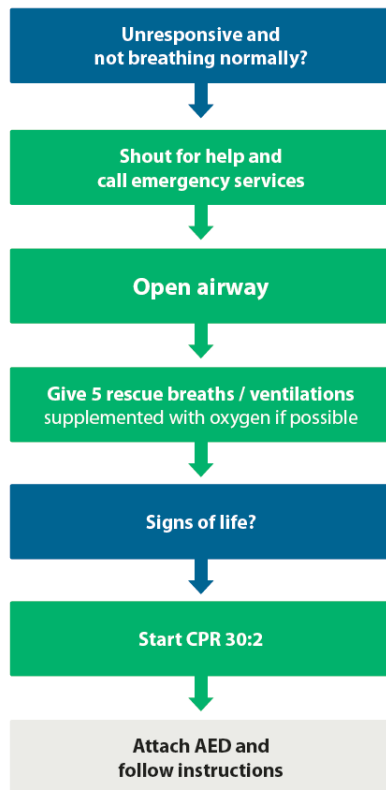
⁵ Withhold CPR if risk to the rescue team is unacceptably high

⁶ Crush injuries and depolarising neuromuscular blocking drugs may elevate serum potassium

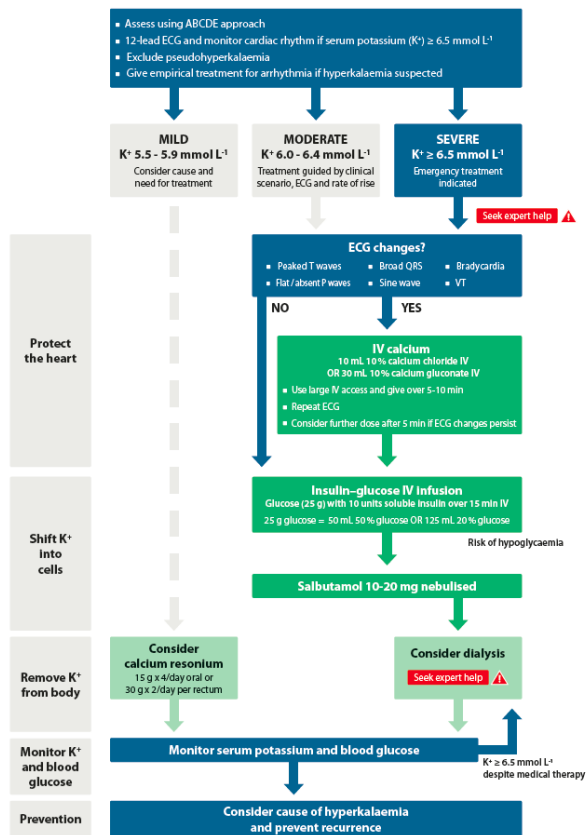


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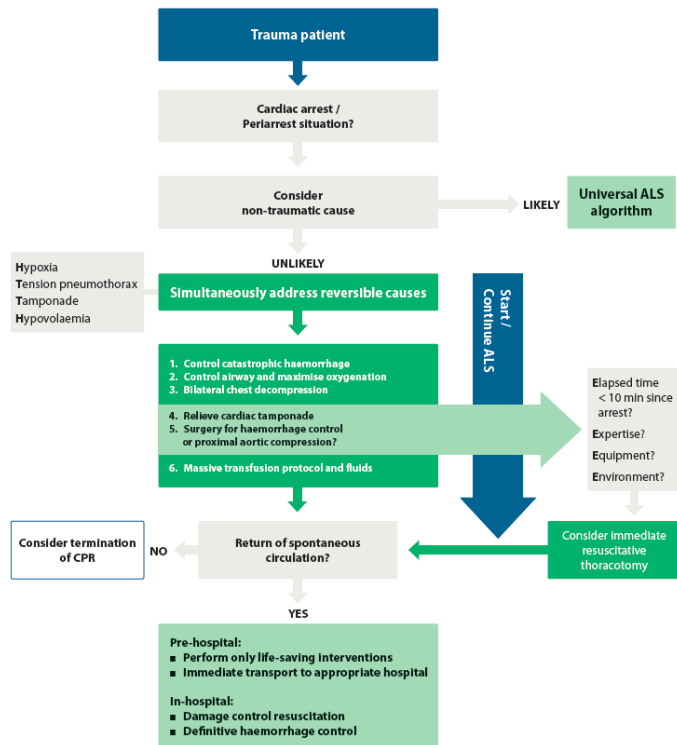
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Thank you for your attention

