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

*A4 - Planificarea, organizarea si desfasurarea activitatilor de formare a **medicilor** in domeniul cardiologiei pediatrice*

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PAEDIATRIC CARDIAC CRITICAL CARE

Bucharest, December 14, 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.

Let‘s finish our walk

Important topics in Paediatric Cardiac Critical Care

Today‘s agenda

- Management of Paediatric Cardiac Arrest: Paediatric Life Support (2015)

Do you 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.**

Do you 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.

Let‘s start with the first lecture

- Management of Paediatric Cardiac Arrest: Paediatric Life Support (2015)

What is cardiac arrest?

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

What is cardiac arrest?

- This definition was proposed in the paediatric **Utstein Guidelines** in 1995, the first paediatric 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. (1995): 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 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 (2008): In-hospital pediatric cardiac arrest. Pediatr Clin North Am. 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

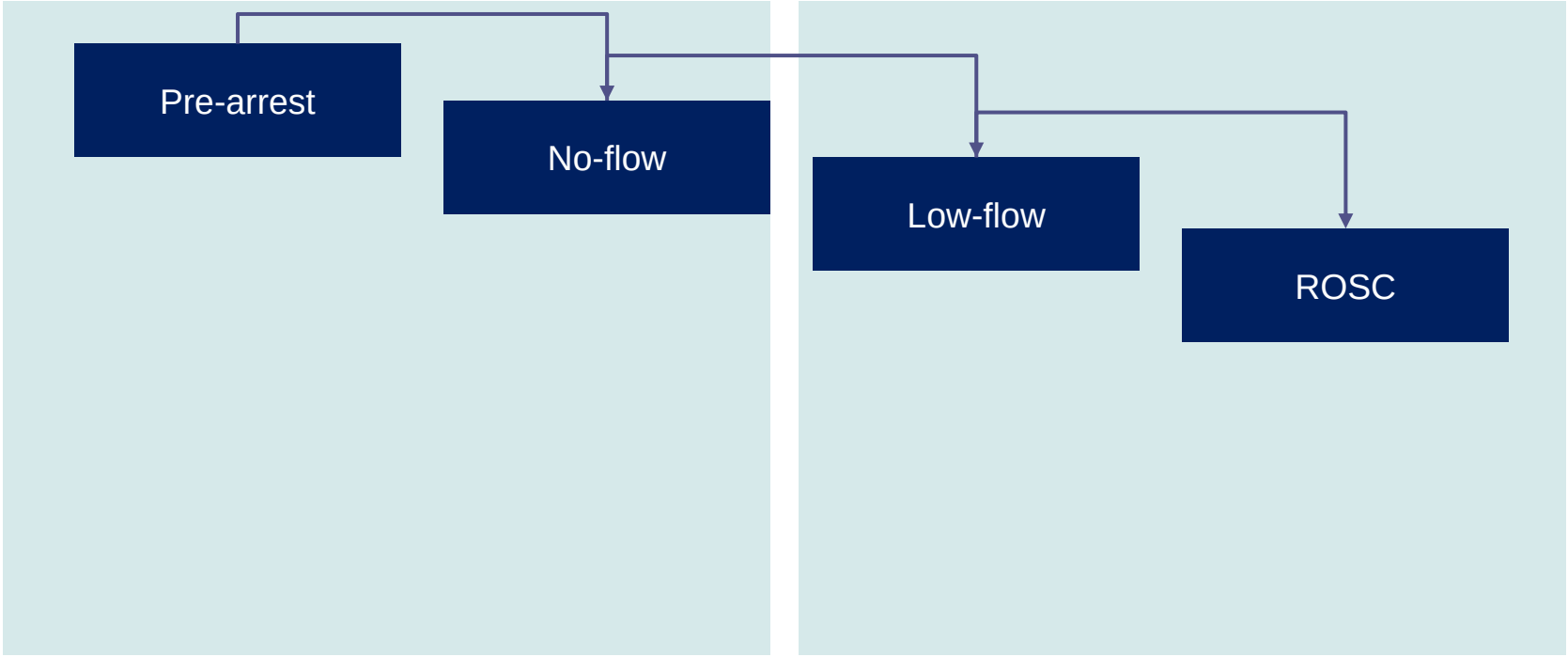
- The low-flow phase begins at the initiation of CPR.
- Chest compressions combined with ventilation provide coronary and cerebral perfusion.

4 phases of cardiac arrest

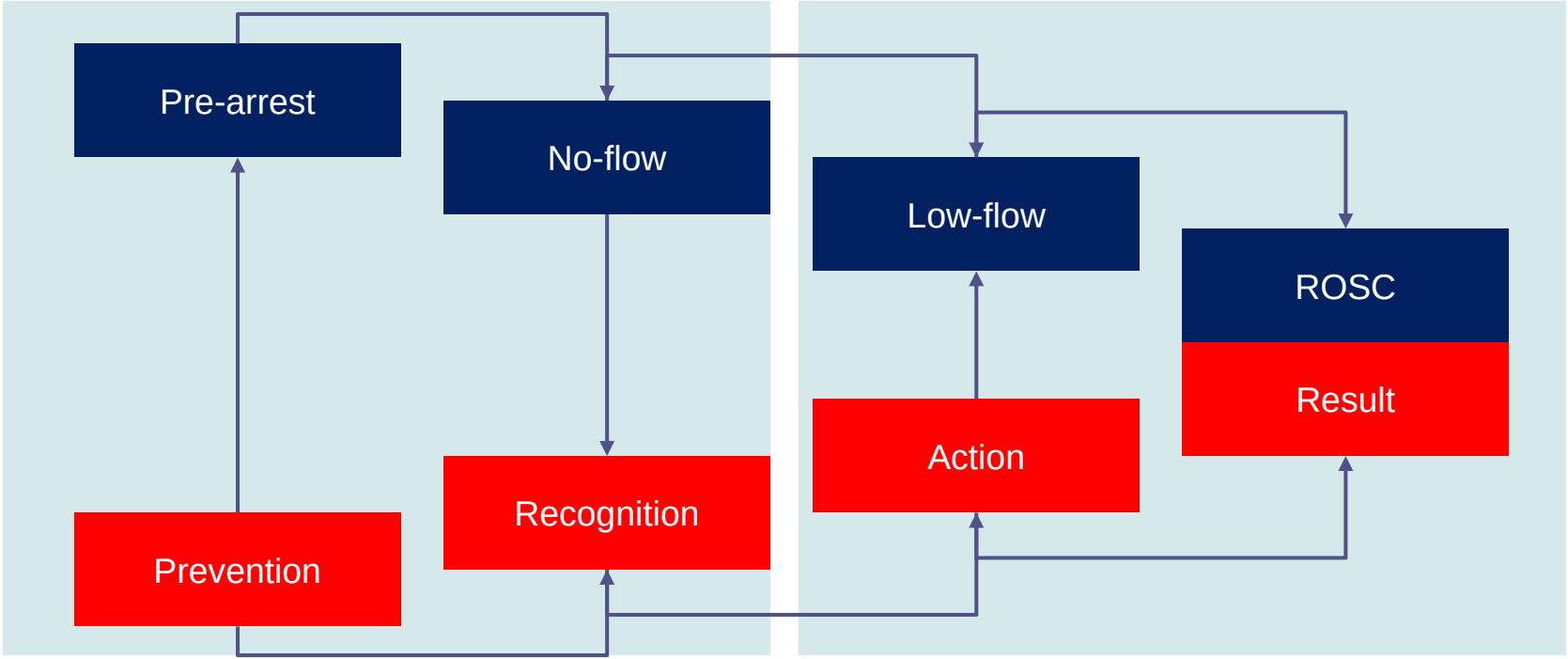
4. Post-resuscitation phase

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

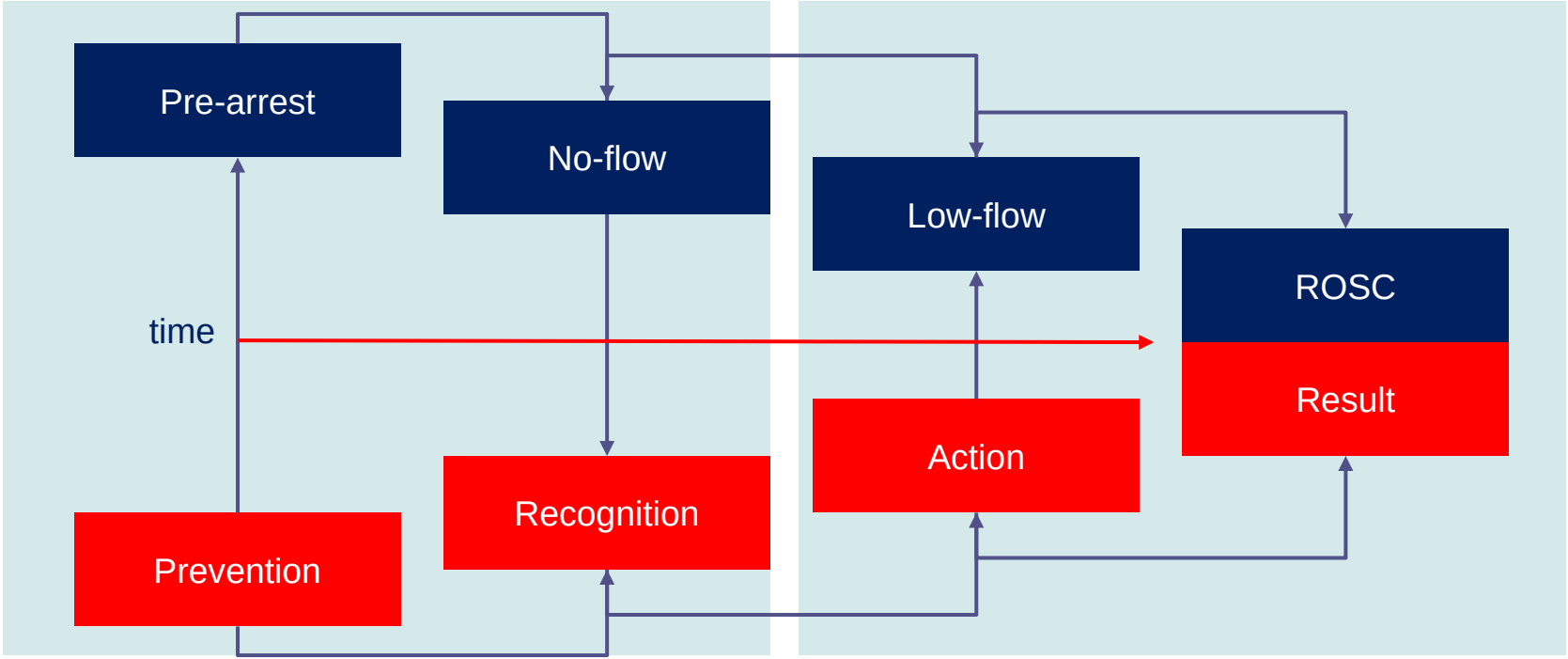
4 phases of cardiac arrest



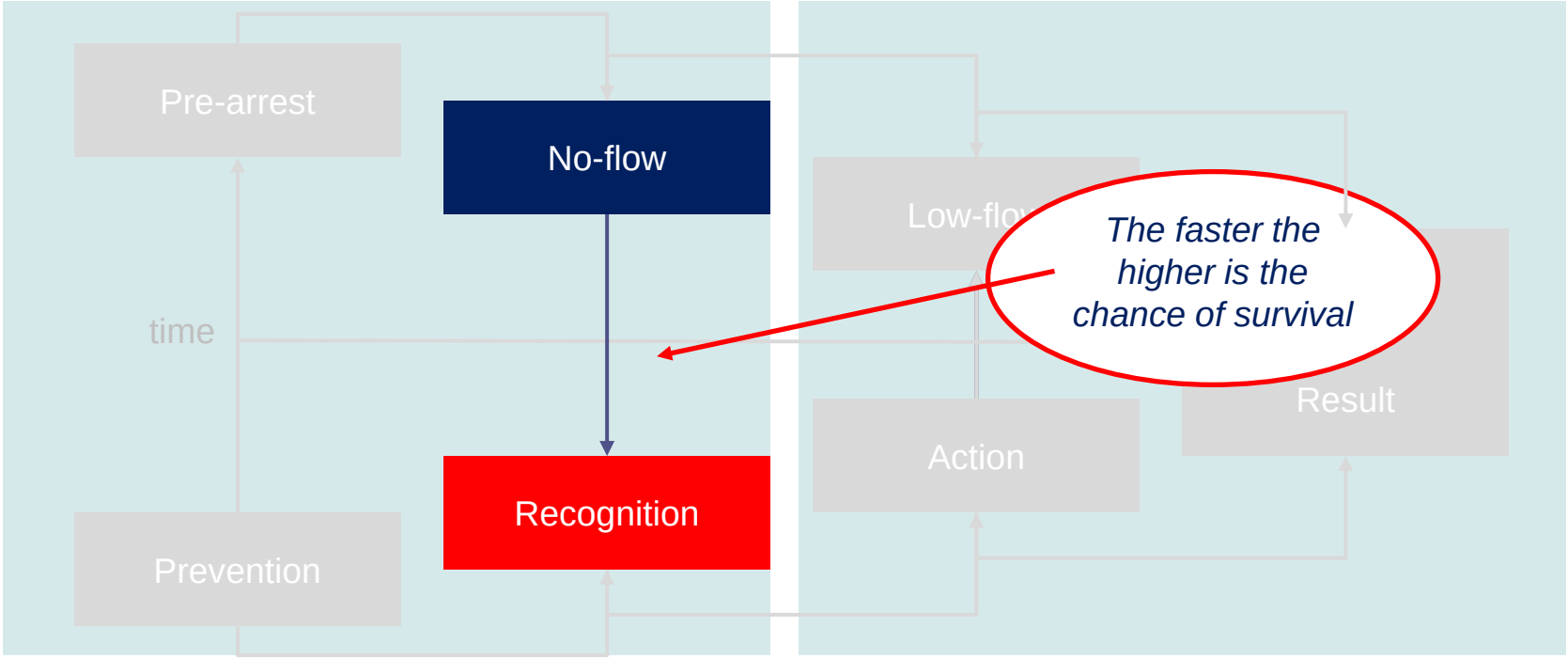
4 phases of cardiac arrest



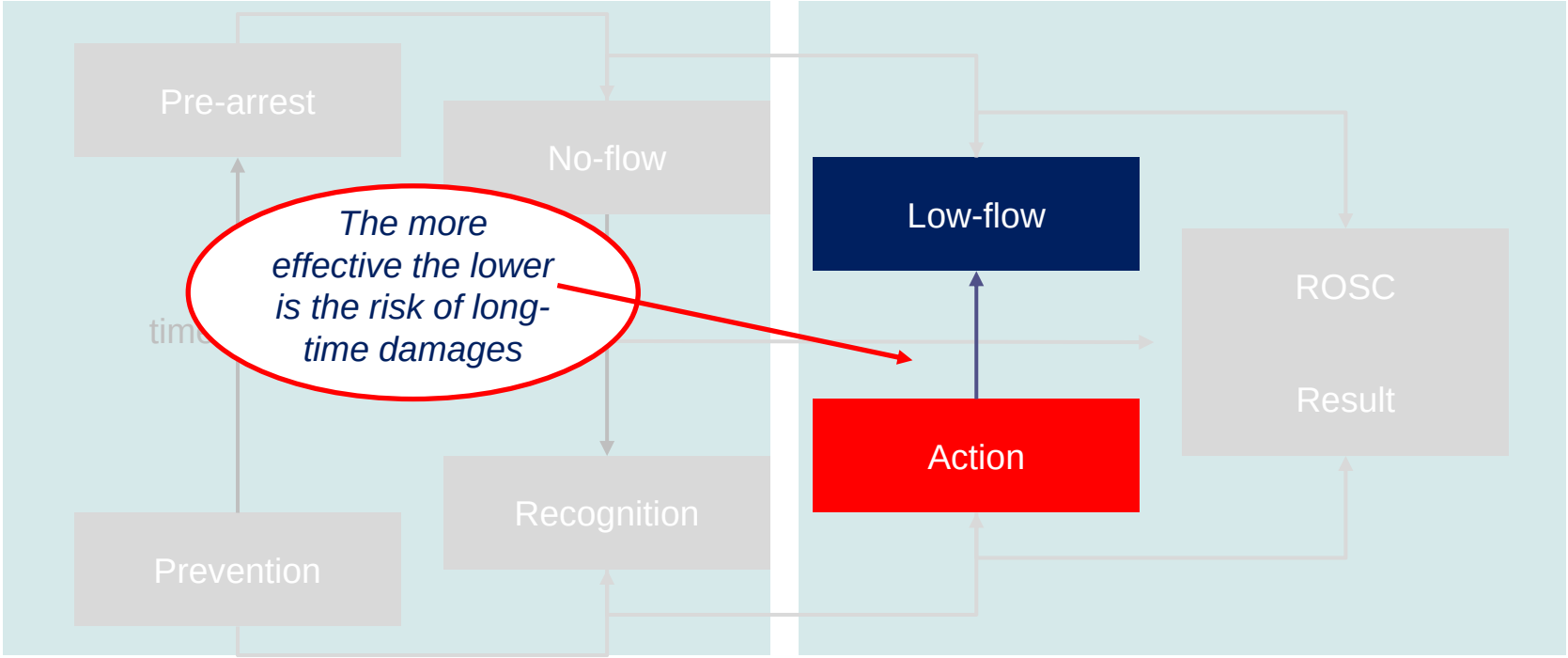
4 phases of cardiac arrest



4 phases of cardiac arrest



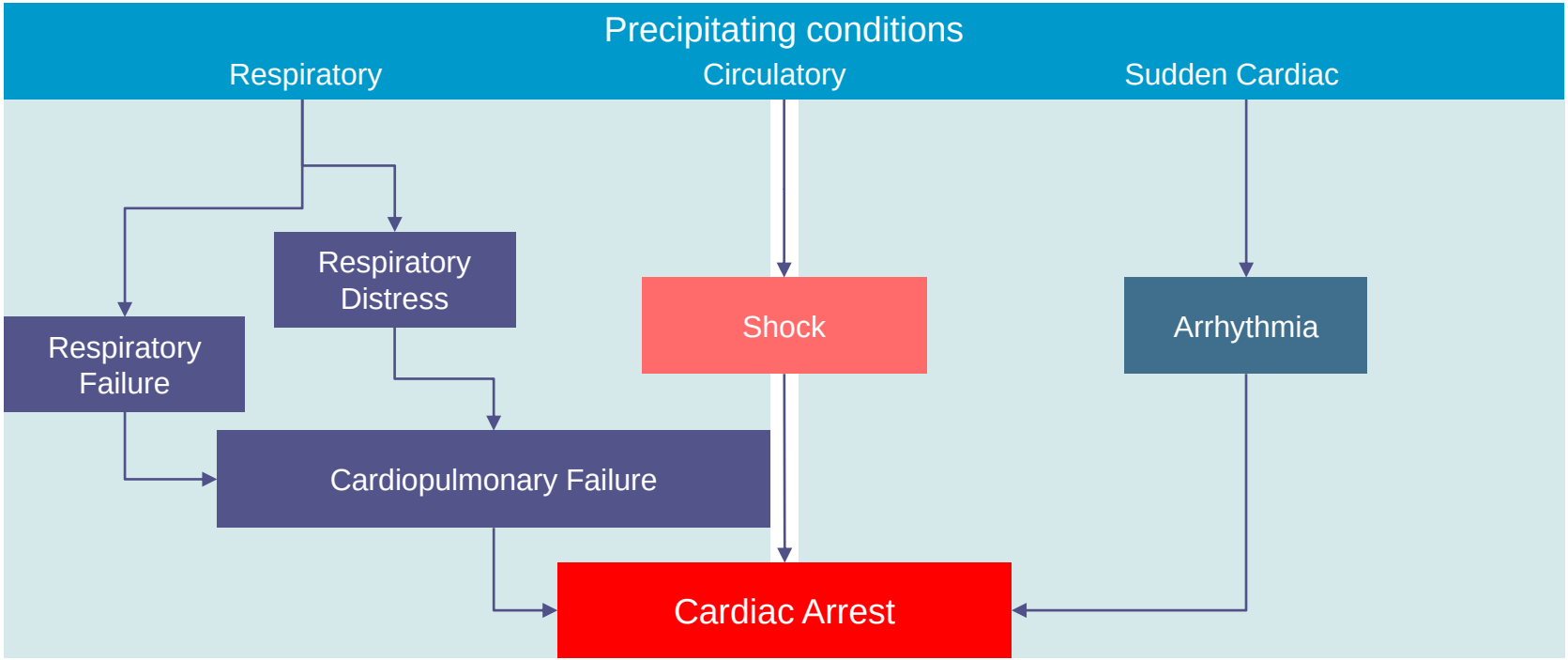
4 phases of cardiac arrest



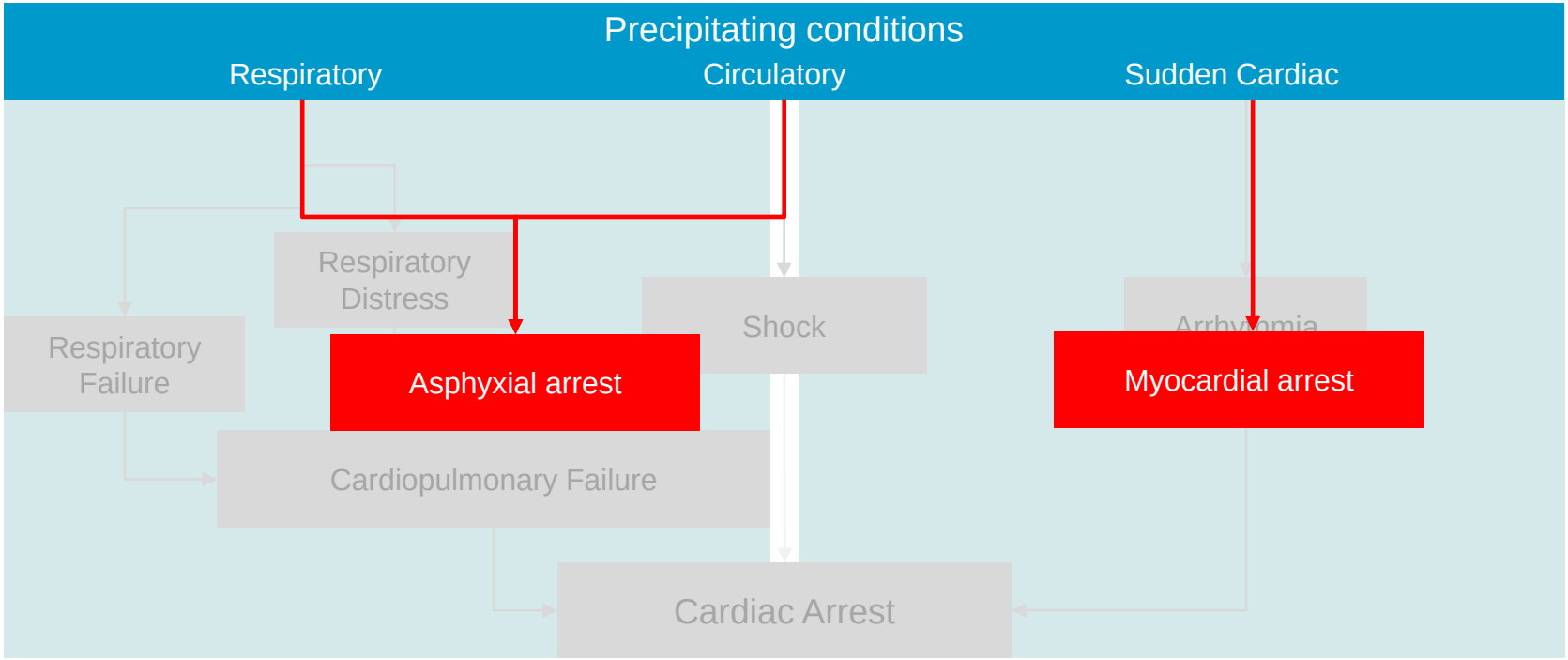
Cause of cardiac arrest

- 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**.

Cause of cardiac arrest

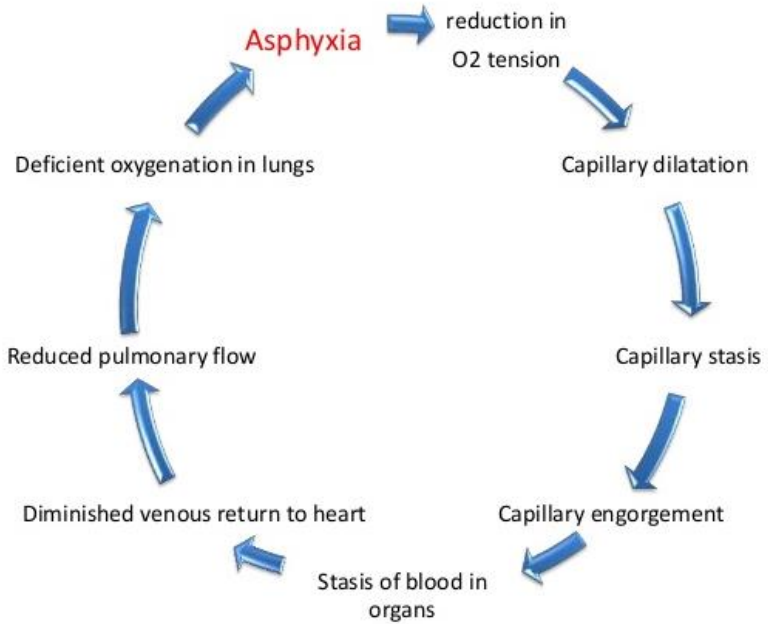


Cause of cardiac arrest



Asphyxia

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

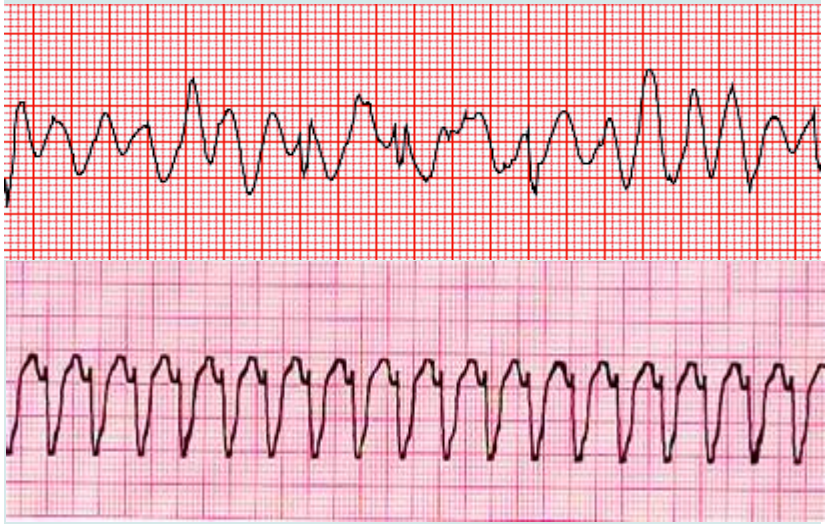


Non-cardiac causes

- Foreign body aspiration
- Seizures
- Poisoning
- Bronchospasm
- Burns
- Drowning
- Gastroenteritis (vomiting / diarrhea)
- Sepsis

Cardiac causes

- Ventricular fibrillation (VF) or pulseless ventricular tachycardia (VT), is the initial cardiac rhythm in approximately **5 to 15%** of paediatric 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.

Maron BJ (2003): Sudden Death in Young Athletes. N Engl J Med 349:1064-1075

Maron BJ et al.(2009): Sudden Deaths in Young Competitive Athletes. Analysis of 1866 Deaths in the United States, 1980–2006. Circulation 119: 1085-1092

Out-of-hospital cardiac arrest

- The incidence of out-of-hospital cardiac arrest is between **7.5 to 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).

Kämäräinen A (2010): Out-of-hospital cardiac arrests in children. J Emerg Trauma 3 (3); 273 - 276.
Topjian A, Berg RA (2012): Pediatric Out-of-Hospital Cardiac Arrest. Circulation 25: 2374-2378

Out-of-hospital cardiac arrest

- The **outcome is generally poor**, as only 2 to 9% of patients survive to hospital discharge.
- The neurologic outcome of survivors is good only in 24 to 31% of patients.

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

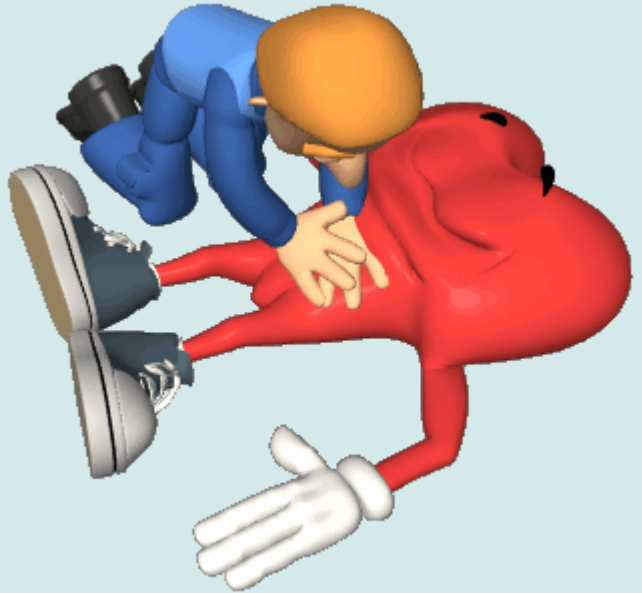
In-hospital cardiac arrest

- In-hospital cardiac arrest occurs in **2 to 6%** of the patients admitted to a paediatric intensive care unit.
- As expected, a majority (71 - 88%) of the children 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. (2009): In-hospital versus out-of-hospital pediatric cardiac arrest: A multicenter cohort study. Crit Care Med 37: 2259 - 2267

In-hospital cardiac arrest

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



In-hospital cardiac arrest

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

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 from a model evaluating calendar year as a categorical variable. Rates are adjusted for age groups, sex, race, initial cardiac arrest rhythm, heart failure this admission, heart failure before admission, hypotension/hypoperfusion, respiratory insufficiency, baseline depression in central nervous system function, acute central nervous system nonstroke event, pneumonia, assisted/mechanical ventilation, use of vasoactive agents, use of extracorporeal membrane oxygenation during resuscitation, hospital location, use of a hospitalwide response, and years of participation in the registry.

†Acute resuscitation survival was determined by the number of patients with return of spontaneous circulation for at least 20 minutes divided by the number of patients with a cardiac arrest.

- *Girotra et al. (2013): Trends in Pediatric In-hospital Cardiac Arrests. Circ Cardiovasc Qual Outcomes.*

In-hospital cardiac arrest

- 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. (2013): Trends in Pediatric In-hospital Cardiac Arrests. Circ Cardiovasc Qual Outcomes*

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.

- *Girotra et al. (2013): Trends in Pediatric In-hospital Cardiac Arrests. Circ Cardiovasc Qual Outcomes*

EUROPEAN RESUSCITATION COUNCIL

- Founded in 1990
- First guidelines published in 1992
- Revisions made in:
  - 1998
  - 2000
  - 2005
  - 2010
  - **October 2015**

www.erc.edu

Stichting RobinAid
Chaine de l'Espoir Europe

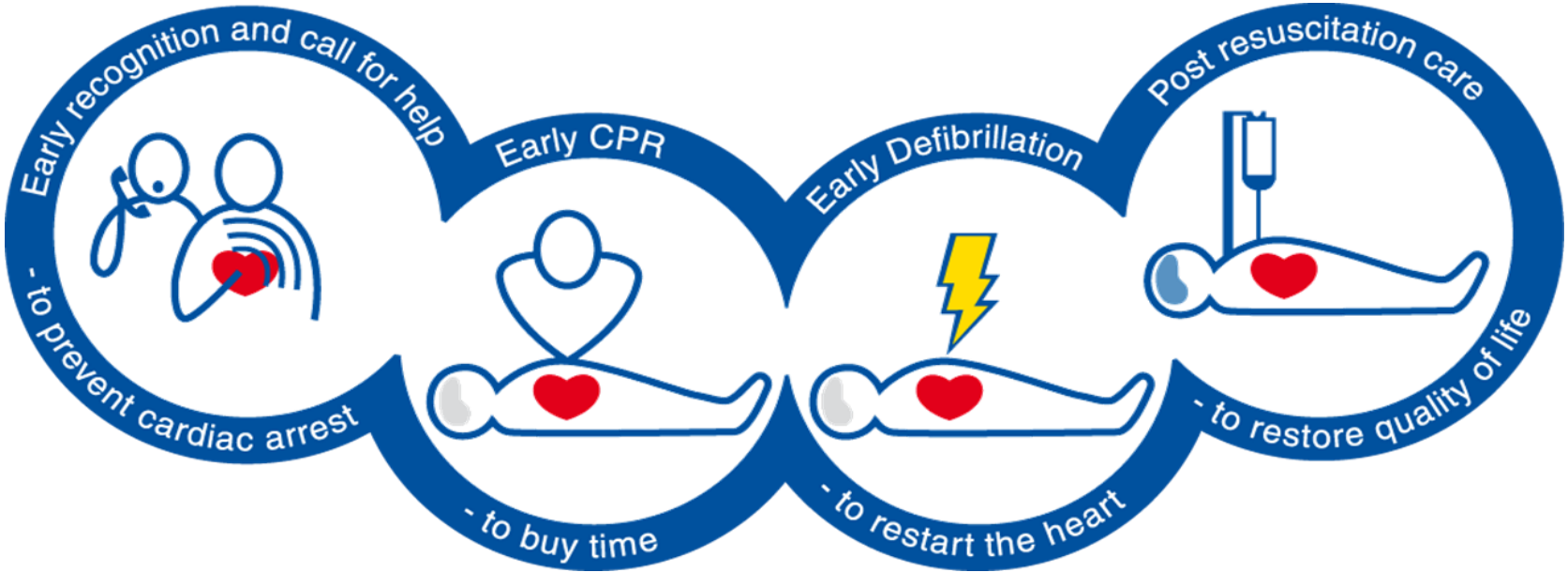
EUROPEAN RESUSCITATION COUNCIL

- Since 2000 the guidelines are based on the **International Consensus** on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations of the International Liaison Committee on Resuscitation (ILCOR).

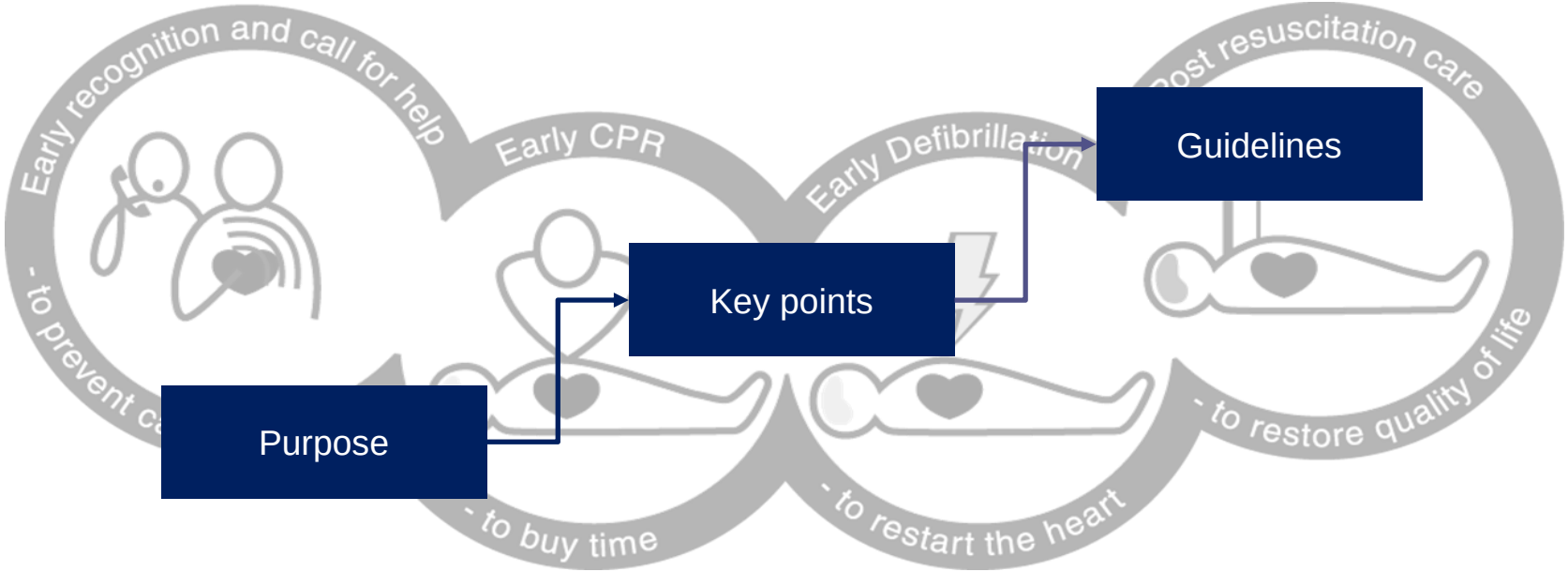
American Heart Association. Learn and Live
EUROPEAN RESUSCITATION COUNCIL
HEART & STROKE FOUNDATION Finding answers. For life.
Australian Resuscitation Council
NEW ZEALAND Resuscitation Council
RESUSCITATION COUNCIL OF SOUTHERN AFRICA
InterAmerican Heart Foundation
Resuscitation Council of Asia

www.ilcor.org

Chain of survival



Chain of survival



Purpose

- Acquire the ability to **recognize** an adult, adolescent, child, infant or newborn 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.

Guidelines

- Basic Life Support and Automated External Defibrillation (BLS)
- Advanced Life Support (ALS)
- Paediatric Basic Life Support (PBLS)
- Paediatric Advanced Life Support (PALS)
- Newborn Life Support (NLS)
- Anaphylaxis
- Avalanche Accident
- Drowning
- Hyperkalaemia
- Traumatic Cardiac Arrest

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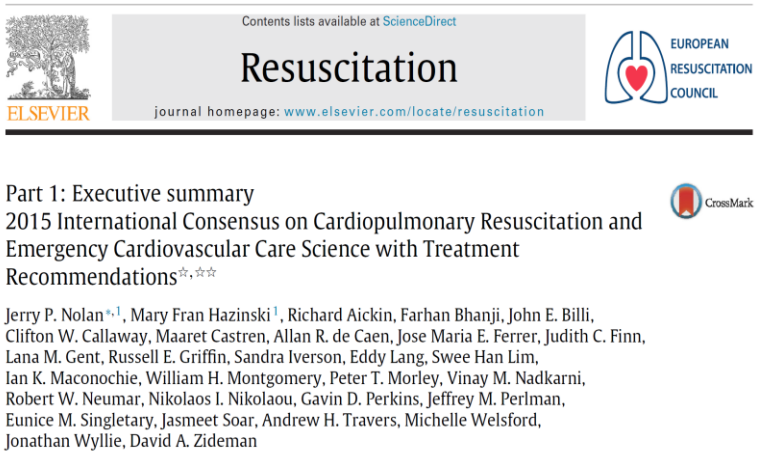

Contents lists available at ScienceDirect

Resuscitation

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

Part 1: Executive summary
2015 International Consensus on Cardiopulmonary Resuscitation and Emergency Cardiovascular Care Science with Treatment Recommendations☆,☆☆

Jerry P. Nolan*,[1], Mary Fran Hazinski[1], Richard Aickin, Farhan Bhanji, John E. Billi, Clifton W. Callaway, Maaret Castren, Allan R. de Caen, Jose Maria E. Ferrer, Judith C. Finn, Lana M. Gent, Russell E. Griffin, Sandra Iverson, Eddy Lang, Swee Han Lim, Ian K. Maconochie, William H. Montgomery, Peter T. Morley, Vinay M. Nadkarni, Robert W. Neumar, Nikolaos I. Nikolaou, Gavin D. Perkins, Jeffrey M. Perlman, Eunice M. Singletary, Jasmeet Soar, Andrew H. Travers, Michelle Welsford, Jonathan Wyllie, David A. Zideman

Guidelines

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- Valid for neonates, infants, and children up to the adolescence

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Paediatric emergencies

- **Paediatric Life Support (2015):**

- Severe paediatric emergencies are **rare**.
- They are usually **preventable**.
- Timely intervention in seriously ill or injured children is the **key** to preventing progression toward cardiac arrest and to saving lives.
- The prognosis can be improved substantially by using **algorithms** and regularly training of the rescuers.

Paediatric Life Support

- **Paediatric Life Support (2015):**

Contents lists available at ScienceDirect

Resuscitation

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

European Resuscitation Council Guidelines for Resuscitation 2015
Section 6. Paediatric life support

Ian K. Maconochie[a,*], Robert Bingham[b], Christoph Eich[c], Jesús López-Herce[d], Antonio Rodríguez-Núñez[e], Thomas Rajka[f], Patrick Van de Voorde[g], David A. Zideman[h], Dominique Biarent[i], on behalf of the Paediatric life support section Collaborators[i]

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[b] Department of Paediatric Anaesthesia, Great Ormond Street Hospital for Children, London, UK
[c] Department of Anaesthesia, Paediatric Intensive Care and Emergency Medicine, Auf der Bult Children's Hospital, Hannover, Germany
[d] Paediatric Intensive Care Department, Hospital General Universitario Gregorio Marañón, Medical School, Complutense University of Madrid, Madrid, Spain
[e] Paediatric Emergency and Critical Care Division, Paediatric Area Hospital Clínico Universitario de Santiago de Compostela, Santiago de Compostela, Spain
[f] Paediatric Intensive Care Department, Womens and Childrens Division, Oslo University Hospital, Ulleval, Oslo, Norway
[g] Paediatric Intensive Care and Emergency Medicine Departments, University Hospital Ghent and Ghent University, EMS Dispatch 112 Eastern Flanders, Federal Department Health Belgium, Ghent, Belgium
[h] Anaesthesia Department, Imperial College Healthcare NHS Trust, London, UK
[i] Paediatric Intensive Care and Emergency Medicine Departments, Universite Libre de Bruxelles, Hôpital Universitaire des Enfants, Brussels, Belgium

- The section of the **ERC GL 2015** includes:
  - basic life support;
  - management of foreign bodies in the airway;
  - prevention of cardiopulmonary arrest;
  - advanced life support during cardio-pulmonary arrest;
  - post resuscitation care.

News in 2015

- **Paediatric Life Support (2015):**

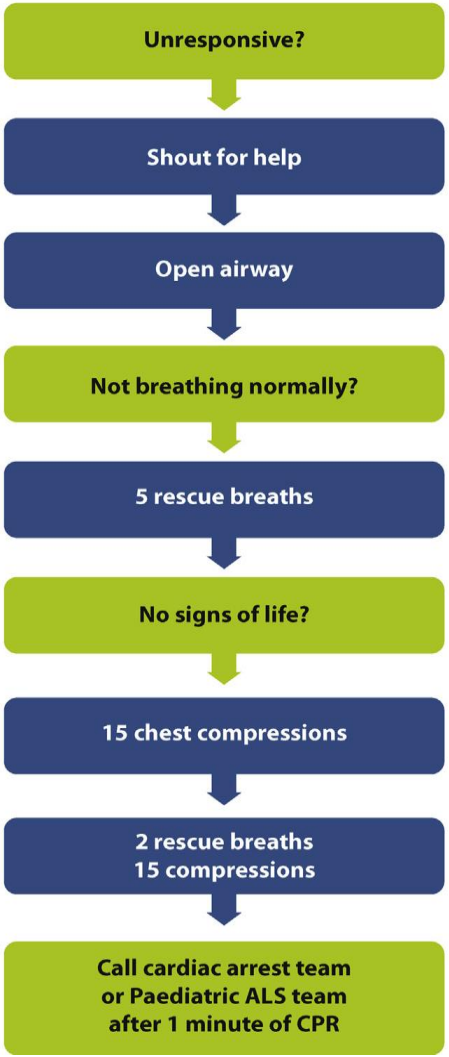
- The well-known statements were **confirmed** essentially.
- **Volume substitution** should be handled more **restrictive**.
- Normothermia or mild hypothermia after ROSC, **never allow fever**.
- For **cardioversion** of a supraventricular tachycardia (SVT), the initial dose has been revised to **1 J / kg**.

News in 2015

- **Paediatric Life Support (2015):**

- Inspiration time for one breath: **1 sec.**
- Compression depth: **4 cm** in infants, **5 cm** for the child.
- Treatment of **newborns** in the delivery room has its own algorithm.
- With start of **puberty** the guidelines for adults are valid.

- **Paediatric Basic Life Support (2015):**
  - these guidelines aim to provide **clear advice** to healthcare professionals and members of the general public about the delivery of **basic** life support to children.



Essentials

- **Paediatric Basic Life Support (2015):**

- Any child who does not respond and without breathing normally, has a circulatory arrest and requires **immediately** cardio pulmonary resuscitation.

Essentials in detail

- **Paediatric Basic Life Support (2015):**

- Shout for help.
- Turn the child carefully on his back.
- **Open** the child's **airway** by tilting the head and lifting the chin.
- Place your hand on his forehead and gently tilt his head back.

Essentials in detail

- **Paediatric Basic Life Support (2015):**

- At the same time, with your fingertip(s) under the point of the child’s chin, lift the chin.
- Do **not** push on the soft tissues under the chin as this may obstruct the airway, this is especially important in infants.
- If you still have difficulty in opening the airway, try a **jaw thrust**: place the first two fingers of each hand behind each side of the child’s mandible and push the jaw forward.

Essentials in detail

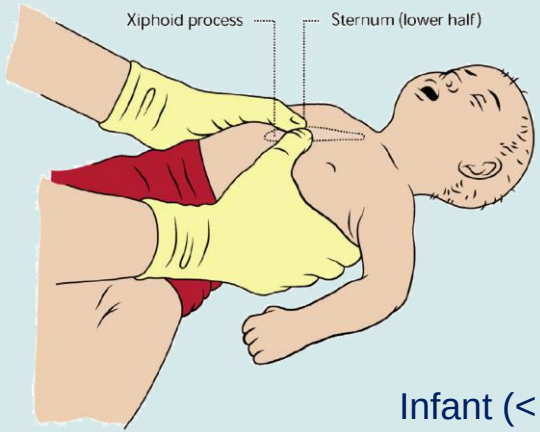
- **Paediatric Basic Life Support (2015):**

Infant (< 1 year) Child (> 1 year)

- If breathing is not normal or absent:
  - carefully **remove** any obvious airway obstruction
  - give **five** initial **rescue breaths**
  - while performing the rescue breaths note any gag or cough response to your action

Essentials in detail

- **Paediatric Basic Life Support (2015):**



Infant (< 1 year)

- If there are no signs of life:
  - follow with high-quality chest compressions
  - ratio between compressions and breaths is **15 : 2**;
  - frequency of the compressions must be **100 to 120 min^{-1}**.

Essentials in detail

- **Paediatric Basic Life Support (2015):**

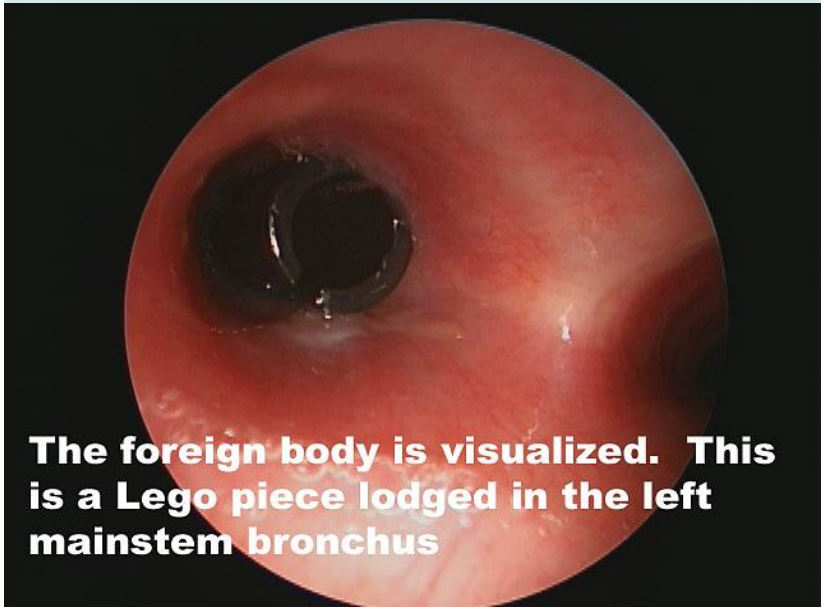
Child (> 1 year)

- Do **not** interrupt resuscitation until:
  - the child shows **signs of life** (starts to wake; up, to move, opens eyes and to breathe normally);
  - **more** healthcare workers arrive and can either assist or take over;
  - you become exhausted.

Foreign-body airway obstruction (FBAO)

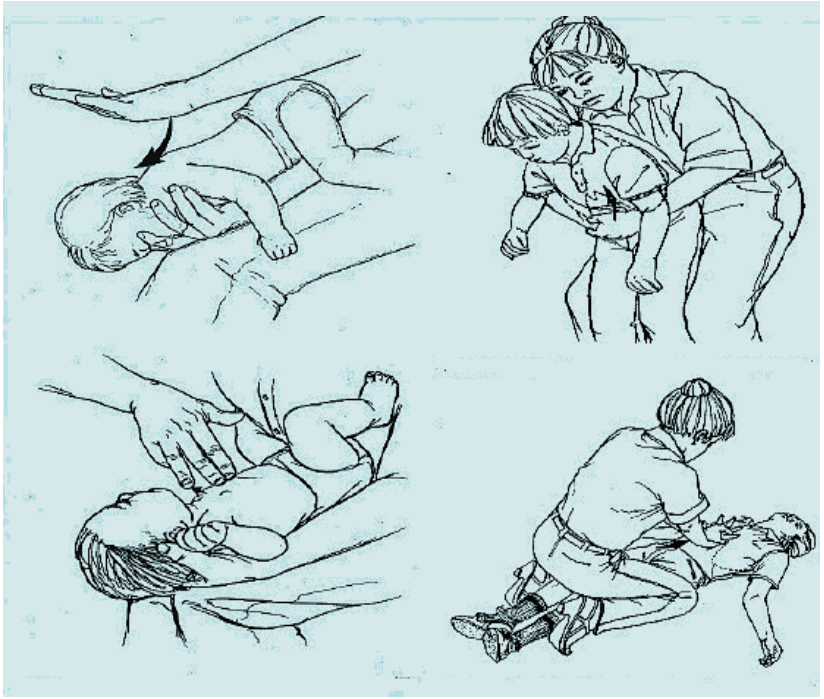
- 90% of childhood deaths from foreign body aspiration occur in children **< 5 years** of age; 65% are infants.
- Balloons, small objects, foods (hot dogs, round candies, nuts and grapes) are the most common causes of foreign-body airway obstruction.

Foreign-body airway obstruction (FBAO)



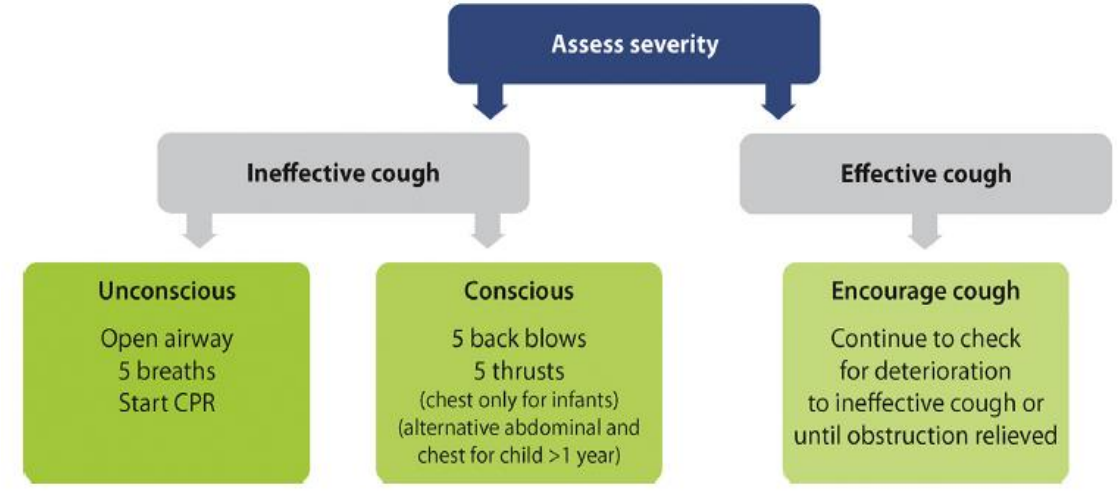
- If FBAO is mild, do not interfere.
- Allow the victim to clear the airway by **coughing**.
- If the FBAO is severe (victim unable to make a sound) you must act to **relieve** the obstruction.

Foreign-body airway obstruction (FBAO)



- Back blows, chest thrusts and abdominal thrusts all increase intra-thoracic pressure and can expel foreign bodies from the air-way.
- Abdominal thrusts should **not** be used for infants.
- Although abdominal thrusts have caused injuries in all age groups, the risk is particularly **high** in infants and very young children.

Foreign-body airway obstruction (FBAO)



Prevention of cardiopulmonary arrest

- As the outcome from cardiopulmonary arrest in children is **poor**, identifying the preceding stages of circulatory or respiratory failure is a priority as **effective** early intervention in these stages maybe life saving.

Prevention of cardiopulmonary arrest

- The order of assessment and intervention for any seriously ill child follows the **ABCDE** principles.
- Interventions are made at each step of the assessment as abnormalities are identified.
- The next step of the assessment is **not** started until the preceding abnormality has been managed and corrected if possible.

Prevention of cardiopulmonary arrest

- Assessment of a potentially critically ill child starts with the assessment of **airway** (A) and **breathing** (B).
- Respiratory failure can be defined as the body's inability to maintain adequate blood levels of oxygen and carbon dioxide.
- Physiological compensatory mechanisms may be seen, such as an increase in respiratory rate and heart rate, and **increased** work of breathing.

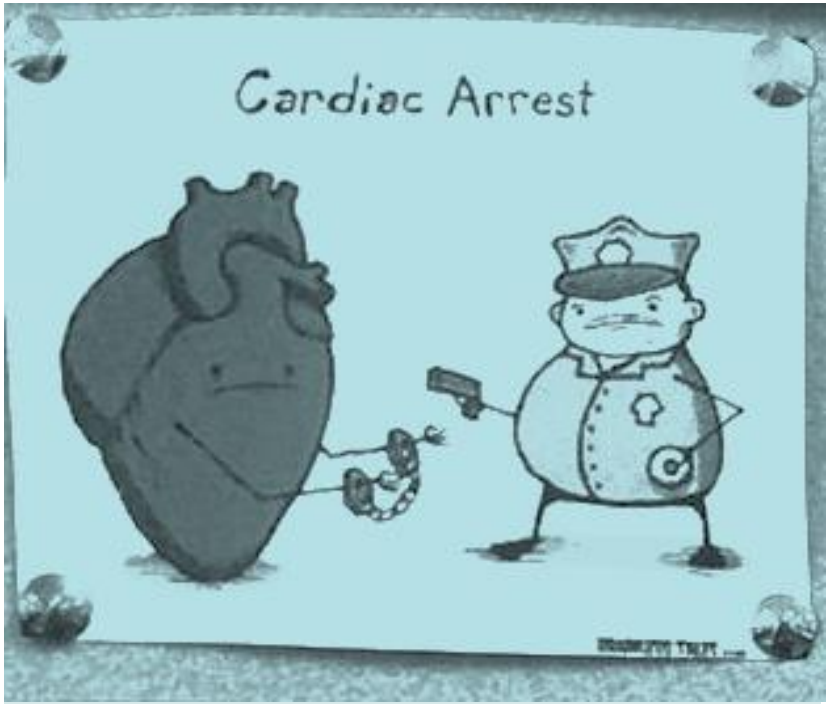
Prevention of cardiopulmonary arrest

- Circulatory failure is characterised by a **mismatch** between the metabolic demand by the tissues, and the delivery of oxygen and nutrients by the circulation.
- Physiological compensatory mechanisms lead to **changes** in heart rate, in the systemic vascular resistance, and in tissue and organ perfusion.

Prevention of cardiopulmonary arrest

- The topics of D (i.e. neurological status) and E (any subsequent conditions that may be found) are **beyond** the remit of these guidelines but are taught in paediatric life support courses.

Diagnosting of cardiopulmonary arrest



- Signs of cardiopulmonary arrest include:
  - **unresponsiveness** to pain (coma);
  - apnoea or gasping respiratory pattern;
  - **absent** circulation;
  - pallor or deep cyanosis;
  - if personnel skilled in echocardiography are available, this investigation may help to detect cardiac activity and potentially treatable causes for the arrest but **don't** waste time by use.

Airway management

- **Paediatric Advanced Life Support (2015):**

- The use of laryngeal mask airways and endotracheal intubation **must** be practiced.
- Cuffed tubes can have benefits.
- Control of the end-tidal CO_2.
- The oxygen supply is **titrated** by SO_2.
- Under resuscitation the respiratory rate must be at **10 min^{-1}**.

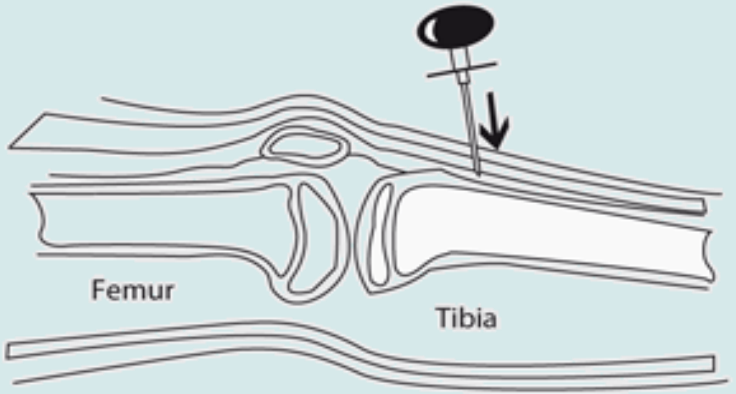
Circulation

- **Paediatric Advanced Life Support (2015):**

- Expand hemodynamic monitoring **rapidly**.
- Echocardiography is helpful.
- When a child shows signs of circulatory failure caused by hypovolaemia, **controlled** volume administration is indicated.
- Primary volume: isotonic crystalloid solution.
- Intraosseous access when IV access is not available during **60 sec**.

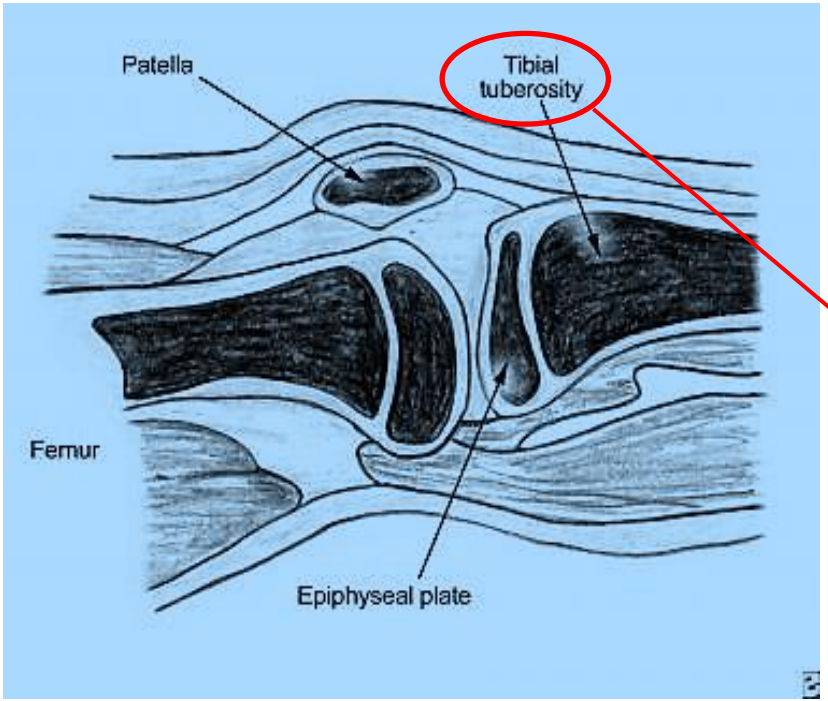
Vascular access

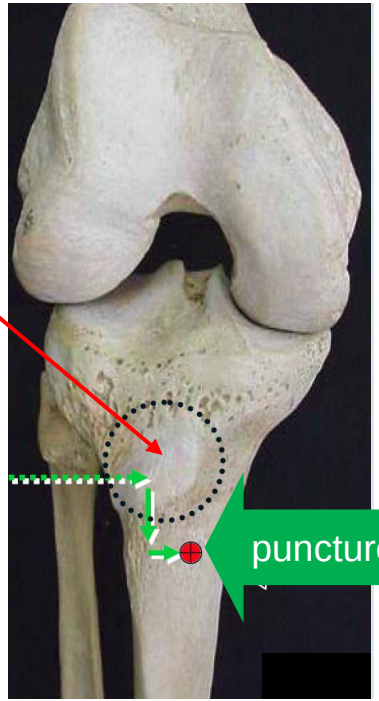
- **Paediatric Advanced Life Support (2015):**



- Intraosseous vascular access should be placed in the **proximal tibia**.
- Bone marrow samples **can be used** to cross match for blood type or group for chemical analysis and for blood gas measurement (the values may be comparable to central venous blood gases if no drug has been injected in the cavity.

Intraosseous vascular access

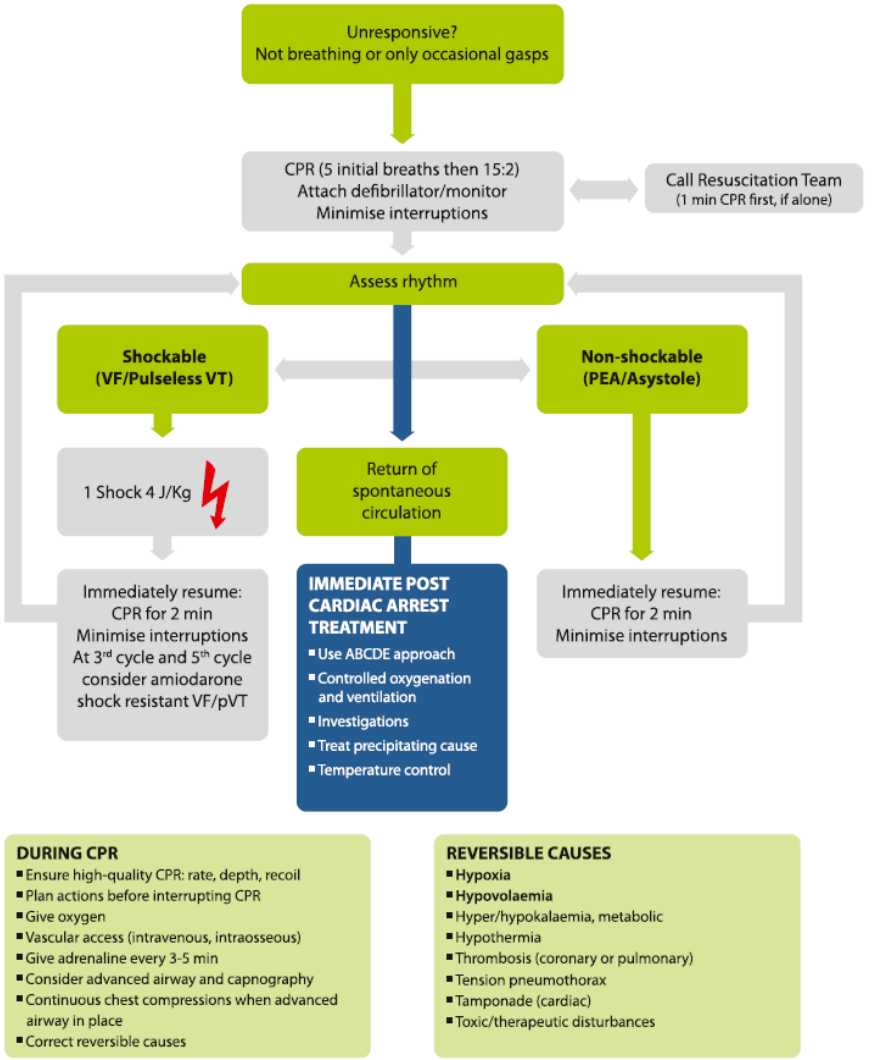




the proximal flat-broad tibial plateau, 1 to 2 finger breadths (1 to 2 cm) below the tibial tubercle on the anteromedial surface

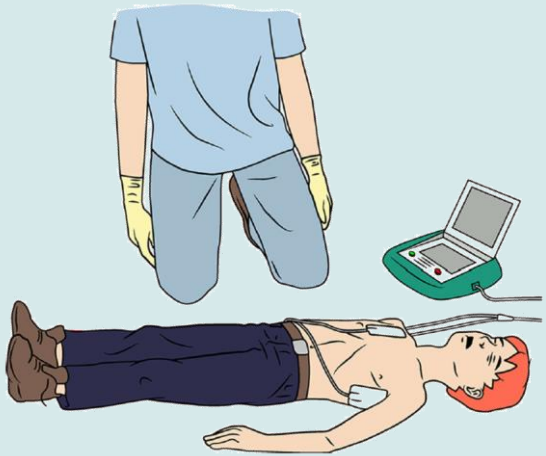
Intraosseous vascular access

- **Paediatric Advanced Life Support (2015):**
  - is designed to give healthcare professionals the ability to assess and **quickly respond** to paediatric emergencies including respiratory arrest and cardiac arrest **adequately**.



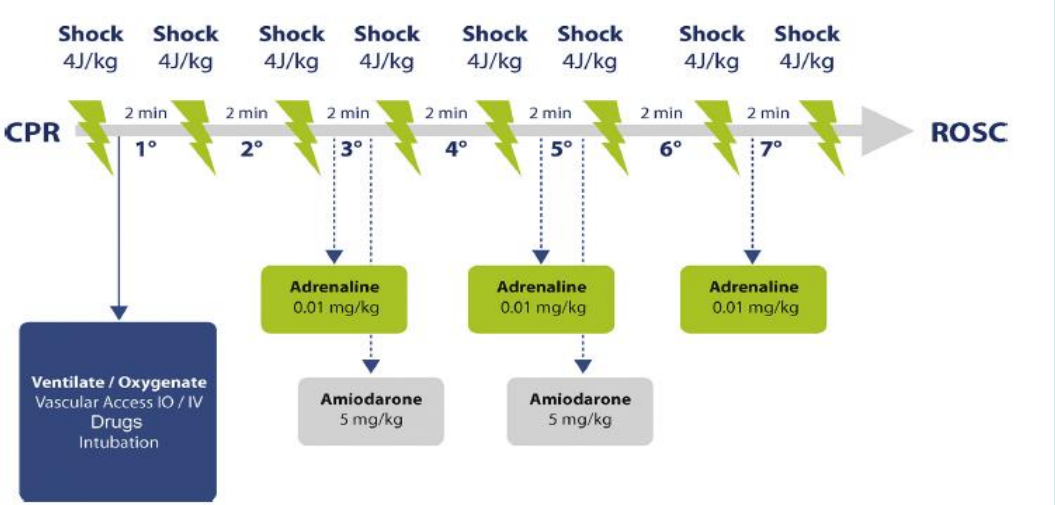
Cardiac arrest - shockable rhythms

- **Paediatric Advanced Life Support (2015):**



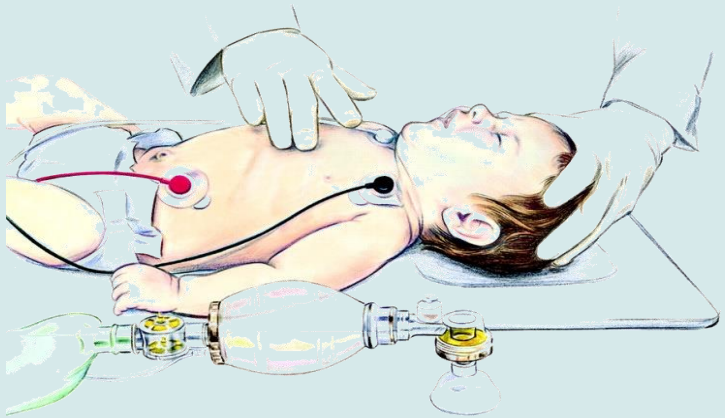
- Children with sudden witnessed collapse (eg, a child collapsing during an athletic event) are likely to VF or pulseless VT and need immediate CPR and **rapid defibrillation**.
- The recommended energy dose for defibrillation is **4 J kg^{-1}**.

Cardiac arrest - shockable rhythms



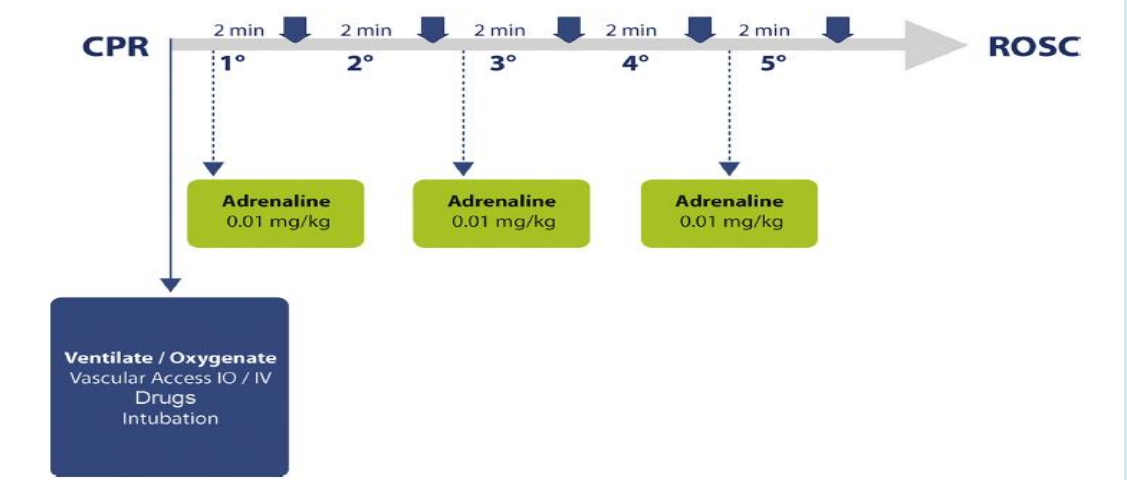
Cardiac arrest - Non shockable rhythms

- **Paediatric Advanced Life Support (2015):**



- The most common ECG patterns in infants, children and adolescents with cardiopulmonary arrest are **asystole** and pulseless electrical activity (PEA).
- It commonly follows a period of hypoxia or myocardial ischaemia, but occasionally can have a **reversible** cause that led to a sudden impairment of cardiac output.

Cardiac arrest - Non shockable rhythms



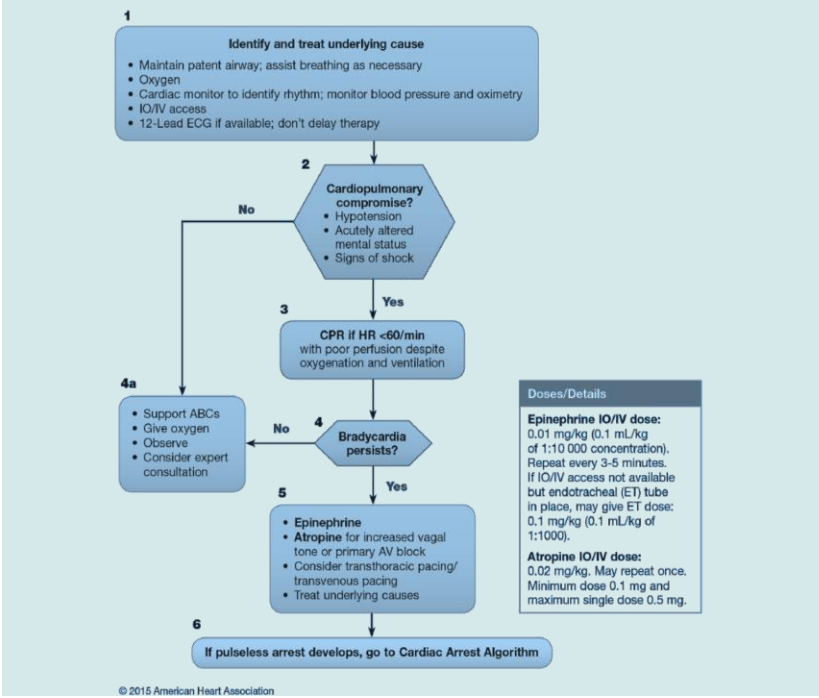
Bradycardia

- **Paediatric Advanced Life Support (2015):**

- The most common dysrhythmia in the paediatric population.
- Etiology is usually **hypoxemia**.
- **Initial** management: ventilation and oxygenation.
- If this does not work IV or IO Adrenaline (Epinephrine) **0.01 mg kg^{-1}** (1:10,000).
- Search for and treat possible contributing factors.

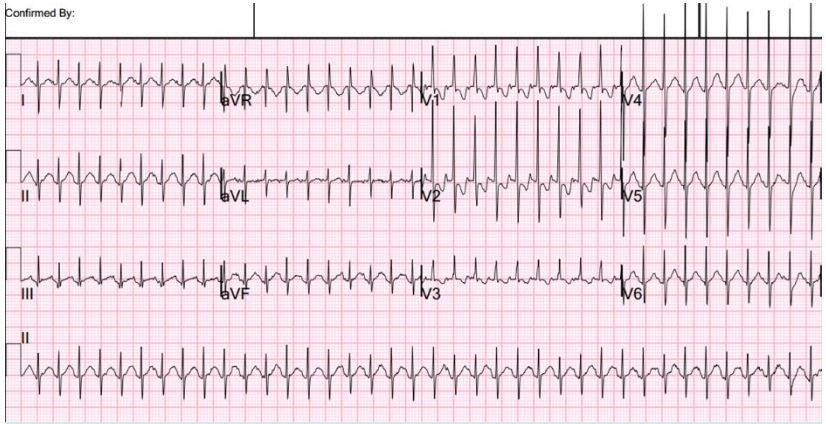
Bradycardia

- **Paediatric Advanced Life Support (2015):**



Tachycardia with pulse

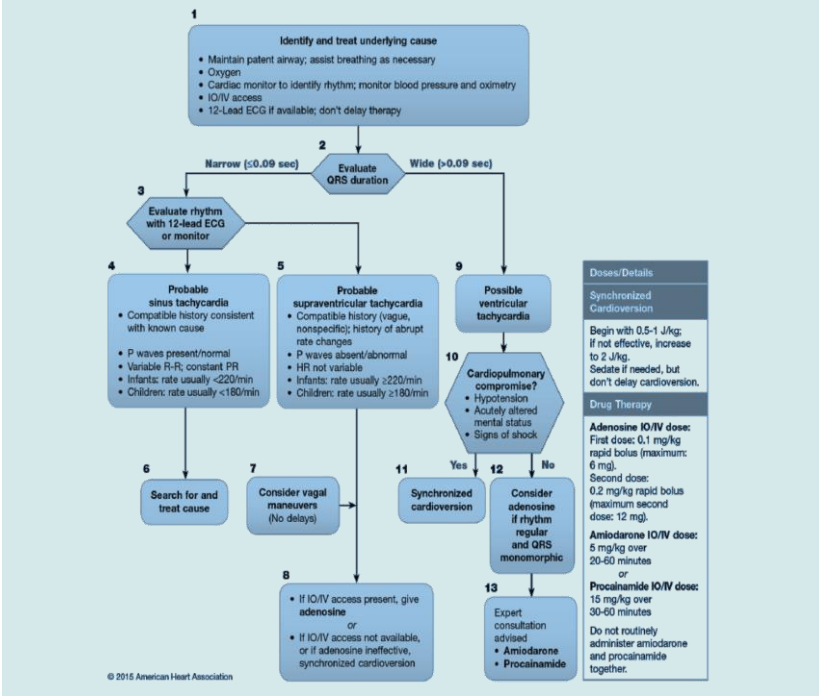
- **Paediatric Advanced Life Support (2015):**



- Mostly **supraventricular** tachycardia.
- History: vague, non-specific, history of abrupt rate change.
- P waves absent or normal.
- HR not variable with activity.
- Infants: rate > 220 min^{-1}
- Children: rate > 180 min^{-1}
- **Adenosine or Amiodarone** recommended as first choice of therapy.

Tachycardia with pulse

- **Paediatric Advanced Life Support (2015):**



Drugs on a glance

- **Paediatric Advanced Life Support (2015):**

- **Adenosine:**
  - recommended for the treatment of supraventricular tachycardia (SVT).
- **Adrenaline:**
  - recommended IV/IO dose for the first and for subsequent doses is 10 mcg kg^{-1}.
- **Amiodarone:**
  - recommended in shock-resistant VF/ pulse-less VT and in narrow complex tachycardia like junctional ectopic tachycardia (JET).

Drugs on a glance

- **Paediatric Advanced Life Support (2015):**

- **Atropine:**
  - recommended only for bradycardia caused by increased vagal tone or cholinergic drug toxicity.
- **Calcium:**
  - the routine use of calcium does not improve the outcome from cardiopulmonary arrest;
  - is only indicated in the presence of hypo-calcaemia, hypermagnesaemia and hyperkalaemia.

Drugs on a glance

- **Paediatric Advanced Life Support (2015):**

- **Glucose:**
  - data from neonates, children and adults indicate that both hyper- and hypo-glycaemia are associated with poor outcome after cardiopulmonary arrest.
- **Magnesium:**
  - there is no evidence for giving magnesium routinely during cardiopulmonary arrest.

Drugs on a glance

- **Paediatric Advanced Life Support (2015):**

- **Sodium bicarbonate:**
  - there is no clear evidence for giving sodium bicarbonate routinely during cardiopulmonary arrest;
  - it may be considered for the child with prolonged cardiopulmonary arrest and/or severe metabolic acidosis;
  - also it may be considered in case of haemodynamic instability and co-existing hyperkalaemia.

Special circumstances

- **Paediatric Advanced Life Support (2015):**

- Cardiac arrest from major (blunt or penetrating) **trauma** is associated with a very **high mortality**.
- For infants and children with a cardiac diagnosis and an in-hospital arrest ECMO should be considered as a **useful** rescue strategy if sufficient expertise and resources are available.

Post-resuscitation care

- **Paediatric Advanced Life Support (2015):**

- Post-cardiac arrest care must be a **multidisciplinary** activity and include all the treatments needed for complete neurological recovery.
- After ROSC, a strict **control** of the temperature must be maintained to avoid hyperthermia (> 37.5°C) and severe hypothermia (< 32°C).
- It is appropriate to monitor blood glucose and to **avoid** hypoglycaemia and hyperglycaemia.

Newborn Life Support

- **Newborn Life Support (2015):**

Contents lists available at ScienceDirect

Resuscitation

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

EUROPEAN RESUSCITATION COUNCIL

ELSEVIER

European Resuscitation Council Guidelines for Resuscitation 2015
Section 7. Resuscitation and support of transition of babies at birth

CrossMark

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- Emergencies in newborns are **rare**.
- An adequate and successful management needs **well-trained teams**.
- Training programs are **not** established all-encompassing.

News in 2015

- **Newborn Life Support (2015):**

- **Support of transition**:
  - recognizing the unique situation of the baby at birth, who rarely requires ‘resuscitation’ but sometimes needs medical help during the process of postnatal transition;
  - the term ‘support of transition’ has been introduced to better distinguish between interventions that are needed to restore vital organ functions (resuscitation) or to support transition.

News in 2015

- **Newborn Life Support (2015):**

- **Cord clamping:**
  - for uncompromised babies, a delay in cord clamping of at least 1 min from the complete delivery of the infant, is now recommended for term and preterm babies;
  - as yet there is insufficient evidence to recommend an appropriate time for clamping the cord in babies who require resuscitation at birth.

News in 2015

- **Newborn Life Support (2015):**

- **Temperature:**
  - the temperature of newly born non-asphyxiated infants should be maintained between 36.5 °C to 37.5 °C after birth;
  - the importance of achieving this has been highlighted and reinforced because of the strong association with mortality and morbidity.

News in 2015

- **Newborn Life Support (2015):**

- **Maintenance of temperature:**
  - at < 32 weeks gestation, a combination of interventions may be required to maintain the temperature between 36.5°C to 37.5°C after delivery through admission and stabilization;
  - these may include warmed humidified respiratory gases, increased room temperature plus plastic wrapping of body and head, plus thermal mattress.

News in 2015

- **Newborn Life Support (2015):**

- **Optimal assessment of heart rate:**
  - it is suggested in babies requiring resuscitation that the ECG can be used to provide a rapid and accurate estimation of heart rate;
  - heart rate is he most important parameter of the APGAR score.

News in 2015

- **Newborn Life Support (2015):**

- **Meconium:**
  - tracheal intubation should **not** be routine in the presence of meconium and should only be performed for suspected tracheal obstruction;
  - the emphasis should be on initiating ventilation within the first minute of life in non-breathing or ineffectively breathing infants and this should not be delayed.

News in 2015

- **Newborn Life Support (2015):**

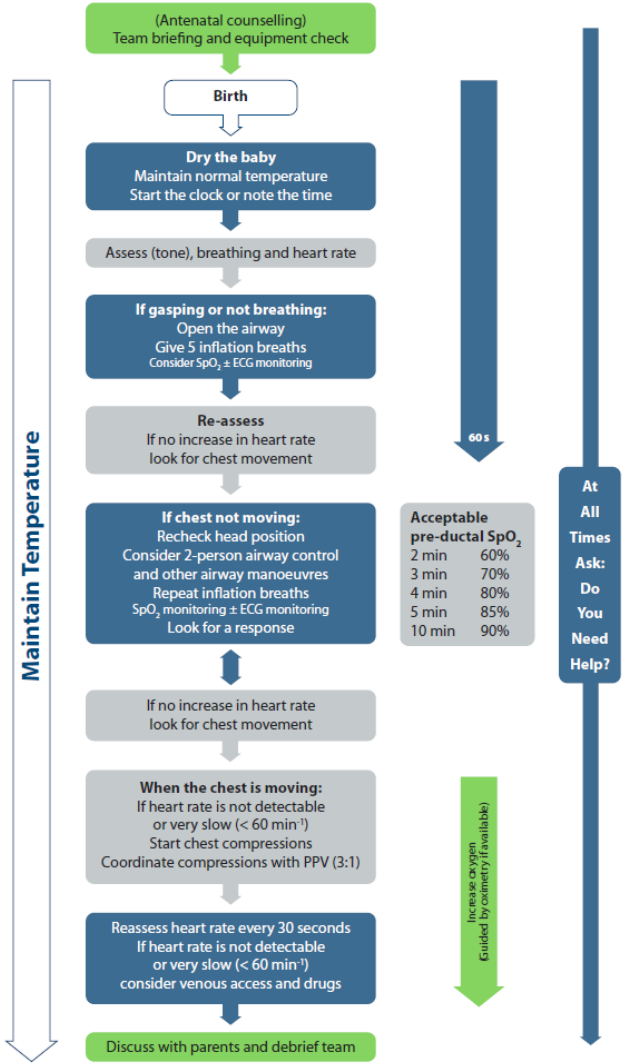
- **Air / Oxygen:**
  - ventilatory support of term infants should start with air (FiO_2 0.21);
  - for preterm infants, either air or a low concentration of oxygen (up to FiO_2 0.3) should be used initially;
  - if, despite effective ventilation, oxygenation (ideally guided by oximetry) remains unacceptable, use of a higher concentration of oxygen should be considered.

News in 2015

- **Newborn Life Support (2015):**

- **Continuous Positive Airways Pressure (CPAP):**
  - initial respiratory support of spontaneously breathing preterm infants with respiratory distress may be provided by CPAP rather than intubation.

- **Newborn Life Support (2015):**



Essentials

- **Newborn Life Support (2015):**

- Commence newborn life support if initial assessment shows that the baby has failed to establish adequate regular normal breathing, or has a heart rate of less than **100 min^{-1}**.
- **Opening the airway** and aerating the lungs is usually all that is necessary.
- Furthermore, more complex interventions will be **senseless** unless these two first steps have been successfully completed.

Airway

- **Newborn Life Support (2015):**

- Place the baby on his or her back with the head in a **neutral** position.
- A 2 cm thickness of a towel placed under the baby's shoulder may be helpful in maintaining proper head position.
- The application of jaw thrust or the use of an appropriately sized oropharyngeal airway may be essential in **opening** the airway.
- Suction is needed **only** if the airway is obstructed.

Initial breaths and assisted ventilation

- **Newborn Life Support (2015):**

- After initial steps at birth, if breathing efforts are absent or inadequate, lung aeration is the **priority** and must not be delayed.
- The respiratory support should start with **air**.
- The primary measure of adequate initial lung inflation is a **prompt** improvement in heart rate.
- If the heart rate is not improving assess the chest wall movement.

Positive end expiratory pressure

- **Newborn Life Support (2015):**

- All term and preterm babies who remain apneic despite initial steps **must** receive positive pressure ventilation after initial lung inflation.
- It is suggested that positive end expiratory pressure (PEEP) of **5 cm H_2O** should be administered.
- The laryngeal mask airway **can** be used in resuscitation of the newborn, particularly if facemask ventilation is unsuccessful or tracheal intubation is unsuccessful or not feasible.

CPAP

- **Newborn Life Support (2015):**

- Initial respiratory support of all spontaneously breathing preterm infants with respiratory distress may be provided by **CPAP**, rather than intubation.

Circulatory support

- **Newborn Life Support (2015):**

- Circulatory support with chest compressions is effective **only** if the lungs have first been successfully inflated.
- Give chest compressions if the heart rate is less than **60 beats min^{-1}** despite adequate ventilation.

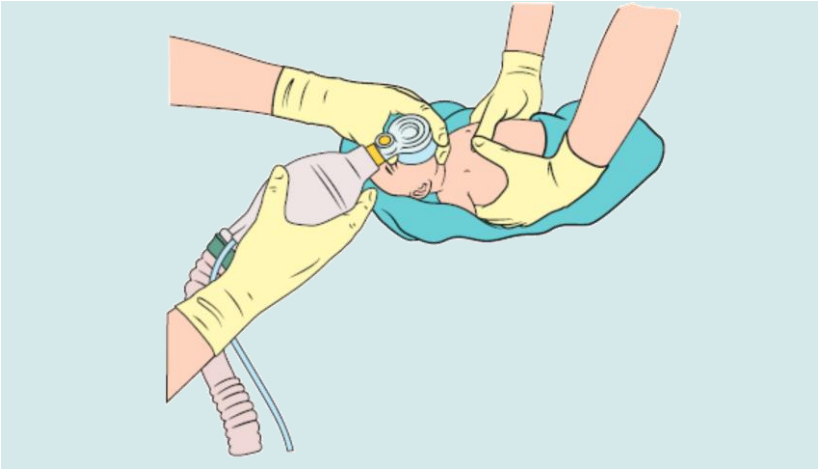
Circulatory support

- **Newborn Life Support (2015):**

- As ventilation is the **most** important intervention in newborn resuscitation, and may be compromised by compressions, it is vital to ensure that effective ventilation is occurring **before** commencing chest compressions.

Circulatory support

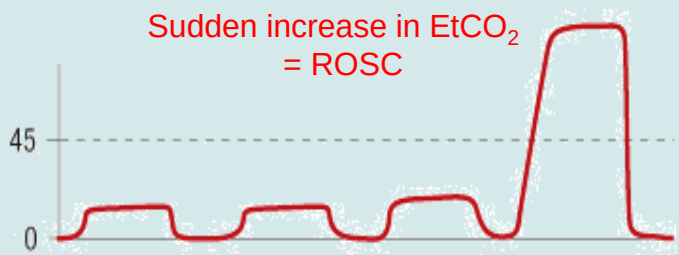
- **Newborn Life Support (2015):**



- The most effective technique for providing chest compressions is with **two thumbs** over the lower third of the sternum with the fin-gers encircling the torso and supporting the back.
- This technique generates **higher** blood pressures and coronary artery perfusion with less fatigue than the previously used two-finger technique.

Circulatory support

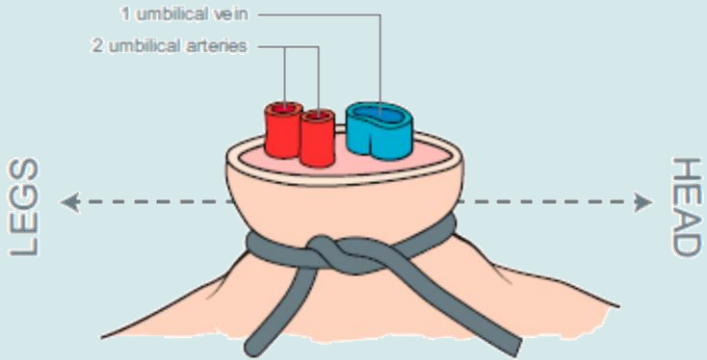
- **Newborn Life Support (2015):**



- Check the heart rate after about 30 sec and periodically there after.
- Discontinue chest compressions when the spontaneous heart rate is faster than 60 beats min^{-1}.
- Exhaled carbon dioxide monitoring and pulse oximetry have been reported to be **useful** in determining the return of spontaneous circulation.

Drugs

- **Newborn Life Support (2015):**



- Drugs are **rarely** indicated in resuscitation of the newly born infant.
- However, if the heart rate remains less than 60 beats min^{-1} despite **adequate** ventilation and chest compressions, it is reasonable to consider the use of drugs.
- These are best given via a centrally positioned umbilical venous catheter

Adrenaline

- **Newborn Life Support (2015):**

- Despite the lack of human data it is reasonable to use adrenaline when adequate ventilation and chest compressions have **failed** to increase the heart rate above 60 beats min^{-1}.
- Adrenaline is used in an initial dose 10 micrograms kg^{-1}(0.1 ml kg^{-1} of 1:10,000 adrenaline) IV or IO.
- The tracheal route is **not** recommended.

Sodium bicarbonate

- **Newborn Life Support (2015):**

- There are **insufficient** data to recommend routine use of bicarbonate in resuscitation of the newly born.
- The hyperosmolarity and carbon dioxide-generating properties of sodium bicarbonate may **impair** myocardial and cerebral function.

Sodium bicarbonate

- **Newborn Life Support (2015):**

- If it is used during prolonged arrests unresponsive to other therapy, it should be given **only** after adequate ventilation and circulation is established with CPR.
- A dose of **1 to 2 mmol kg^{-1}** may be given by slow intravenous injection **after** adequate ventilation and perfusion have been established.

Fluids

- **Newborn Life Support (2015):**

- If there has been suspected blood loss or the infant appears to be in shock (pale, poor perfusion, weak pulse) and has not responded adequately to other resuscitative measures then **consider** giving fluid.
- In the absence of suitable blood (i.e. irradiated and leucocyte-depleted group O Rh-negative blood), **isotonic crystalloid** rather than albumin is the solution of choice.

Fluids

- **Newborn Life Support (2015):**

- Give a bolus of **10 ml kg^{-1}** initially.
- If successful it may need to be repeated to maintain an improvement.
- When resuscitating preterm infants volume is **rarely** needed and has been associated with intraventricular and pulmonary haemorrhages when large volumes are infused rapidly.

Communication with parents

- **Newborn Life Support (2015):**

- It is important that the team caring for the newborn baby **informs the parents** of the baby's progress.
- European guidelines are supportive of family presence during cardiopulmonary resuscitation.
- In recent years healthcare professionals are increasingly offering family members the opportunity to **remain present** during CPR.

Post-resuscitation care

- **Newborn Life Support (2015):**

- **Induced hypothermia:**
  - Whole body cooling and selective head cooling are both **appropriate** strategies.
  - Treatment should be consistent with the protocols used in the randomized clinical trials:
  - commence within **6 h** of birth, continue for **72 h** of birth and re-warm over at least **4 h**.

Thank you for your attention!

Glory to God in the highest,
and on Earth peace,
goodwill towards men.
LUKE 2:14

All the best!