Paediatric emergencies

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CPR

* Cardiopulmonary arrest is = cardiopulmonary support to help for any brain oxygenation and blood perfusion
Epidemiology

age

neonates

infants

Child=Adult

( 8 Years, weight 25 kg, length 25 cm )
The publication of these European Resuscitation Council (ERC) Guidelines for cardiopulmonary resuscitation (CPR) updates those that were published in 2005 and maintains the established 5-yearly cycle of guideline changes.

Like the previous guidelines, these 2010 guidelines are based on the most recent International Consensus on CPR Science with Treatment Recommendations (CoSTR), which incorporated the results of systematic reviews of a wide range of topics relating to CPR.
The sections of the 2010 guidelines are:

1. Executive summary
2. Adult basic life support and use of automated external defibrillators;
3. Electrical therapies: automated external defibrillators, defibrillation, cardioversion and pacing;
4. Adult advanced life support;
5. Initial management of acute coronary syndromes
6. Paediatric life support
7. Resuscitation of babies at birth
8. Cardiac arrest in special circumstances: electrolyte abnormalities, poisoning, drowning, accidental hypothermia, hyperthermia, asthma, anaphylaxis, cardiac surgery, trauma, pregnancy, electrocution;
9. Principles of education in resuscitation
10. The ethics of resuscitation and end-of-life decisions
Chain of survival

- Early recognition and call for help
  - To prevent cardiac arrest

- Early CPR
  - To buy time

- Early Defibrillation
  - To restart the heart

- Post resuscitation care
  - To restore quality of life
Newborn life support algorithm

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Newborn Life Support

1. Dry the baby
   - Remove any wet towels and cover
   - Start the clock or note the time

2. Assess (tone), breathing, and heart rate

3. If gasping or not breathing
   - Open the airway
   - Give 5 inflation breaths
   - Consider SpO2 monitoring

4. Re-assess
   - If no increase in heart rate
   - Look for chest movement

5. If chest not moving
   - Recheck head position
   - Consider two-person airway control or other airway manoeuvres
   - Repeat inflation breaths
   - Consider SpO2 monitoring
   - Look for a response

6. If no increase in heart rate
   - Look for chest movement

7. When the chest is moving
   - If the heart rate is not detectable or slow (< 60)
     - Start chest compressions
     - 3 compressions to each breath

8. Reassess heart rate every 30 seconds
   - If the heart rate is not detectable or slow (< 60)
     - Consider venous access and drugs
Paediatric basic life support algorithm for those with a duty to respond

1. Unresponsive?
   - Shout for help
   - Open airway

2. Not breathing normally?
   - 5 rescue breaths

3. No signs of life?
   - 15 chest compressions
   - 2 rescue breaths
   - 15 compressions

Call cardiac arrest team or Paediatric ALS team
Paediatric advanced life support algorithm
© 2010 ERC
Adult Basic/Advanced life support algorithm

Adult Basic Life Support

UNRESPONSIVE?
- Shout for help
- Open airway

NOT BREATHING NORMALLY?
- Call 112*
- 30 chest compressions
- 2 rescue breaths

30 compressions

*or national emergency number

Advanced Life Support

Unresponsive?
- Not breathing or only occasional gasps

Call Resuscitation Team

CPR 30:2
- Attach defibrillator/monitor
- Minimise interruptions

Shockable (VF/Pulseless VT)

s Shock

Return of Spontaneous Circulation

Immediately resume: CPR for 2 min
- Minimise interruptions

Non-shockable (PEA/Aoystole)

Immediately resume: CPR for 2 min
- Minimise interruptions

Immediate Post Cardiac Arrest Treatment
- Use ABCDE approach
- Controlled oxygenation and ventilation
- Control ICA
- Treat precipitating cause
- Temperature control / Therapeutic hypothermia

During CPR
- Ensure high-quality CPR: rate, depth, recoil
- Plan actions before interrupting CPR
- Give oxygen
- Consider advanced airway and intubation
- Continuous chest compressions when advanced airway is in place
- Vascular access (intravenous, intraosseous)
- Give adrenalin every 7.5 mins
- Correct reversible causes

Reversible Causes
- Hypothermia
- Hypothermia
- Hypokalaemia/metabolic
- Hypothermia
- Trench-foot – coronary or pulmonary
- Syncope – cardiac
- Trauma
- Tension pneumothorax
Adult foreign-body airway obstruction (choking) sequence. © 2010 ERC

Adult Foreign Body Airway Obstruction Treatment

Assess severity

Severe airway obstruction (ineffective cough)
- Unconscious
  - Start CPR
- Conscious
  - 5 back blows
  - 5 abdominal thrusts

Mild airway obstruction (effective cough)
- Encourage cough
  - Continue to check for deterioration to ineffective cough or until obstruction relieved
Differentiation between mild and severe foreign body airway obstruction (FBAO):

<table>
<thead>
<tr>
<th>Sign</th>
<th>Mild obstruction</th>
<th>Severe obstruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Are you choking?&quot;</td>
<td>&quot;Yes&quot;</td>
<td>Unable to speak</td>
</tr>
</tbody>
</table>

Other signs

- Can speak, cough, breathing
- Cannot breath/wheezy breathing/silent attempts to cough/unconsciousness
Automated External Defibrillation Algorithm

Unresponsive?

- Call for help
- Open airway
  Not breathing normally

Send or go for AED
  Call 112*

*C or national emergency number

CPR 30:2
Until AED is attached

AED assesses rhythm

Shock advised

- 1 Shock
  Immediately resume: CPR 30:2 for 2 min

No shock advised

- Immediately resume: CPR 30:2 for 2 min

Continue until the victim starts to wake up: to move, open eyes and to breathe normally
Algorithm for the initial management of in-hospital cardiac arrest © 2010 ERC

In Hospital Resuscitation

Collapsed/sick patient

Shout for HELP & assess patient

Signs of life?

No

Call resuscitation team

CPR 30:2 with oxygen and airway adjuncts

Apply pads/monitor Attempt defibrillation if appropriate

Advanced Life Support when resuscitation team arrives

Yes

Assess ABCDE Recognise & treat Oxygen, monitoring, iv access

Call resuscitation team If appropriate

Handover to resuscitation team
ALS cardiac arrest algorithm. © 2010 ERC

**Advanced Life Support**

- Unresponsive? Not breathing or only occasional gasps
  - Call Resuscitation Team
  - CPR 30:2 Attach defibrillator/monitor Minimise interruptions
  - Assess rhythm
  - Shockable (VF/Pulseless VT)
    - 1 Shock
    - Immediately resume: CPR for 2 min Minimise interruptions
  - Non-shockable (PEA/Asystole)
    - Return Of Spontaneous Circulation
    - Immediately resume: CPR for 2 min Minimise interruptions

**Immediate Post Cardiac Arrest Treatment**
- Use ABCDE approach
- Controlled oxygenation and ventilation
- 12-lead ECG
- Treat precipitating cause
- Temperature control / Therapeutic hypothermia

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

**Reversible causes**
- Hypoxia
- Hypovolaemia
- Hypo-/hyperkalaemia/metabolic
- Hypothermia
- Thrombosis - coronary or pulmonary
- Tamponade - cardiac
- Toxins
- Tension pneumothorax
Tachycardia Algorithm © 2010 ERC

**Synchronised DC Shock**
Up to 3 attempts

- Amiodarone 300 mg IV over 60-90 min and repeat shock, followed by:
- Amiodarone 900 mg over 24 h

**Unstable**

- Assess for evidence of adverse signs:
  1. Shock
  2. Syncope
  3. Myocardial ischaemia
  4. Heart failure

**Stable**

- Is QRS narrow (≤ 0.12 sec)?
  - Yes
    - Narrow
      - Regular
        - Use vagal manoeuvres
        - Adenosine 6 mg rapid IV bolus; if unsuccessful give 12 mg; if unsuccessful give further 12 mg; Monitor ECG continuously

      - Irregular
        - Irregular Narrow Complex Tachycardia
          - Probable atrial fibrillation
          - Control rate with:
            - β-Blocker or diltiazem
            - Consider digoxin or amiodarone if evidence of heart failure
          - Anticoagulate if duration > 48 h

        - Probable re-entry PSVT:
          - Record 12-lead ECG in sinus rhythm
          - If recurs, give adenosine again & consider choice of anti-arrhythmic prophylaxis

    - No
        - Seek expert help

  - Regular
    - Narrow QRS is rhythm regular?
      - Yes
        - Normal sinus rhythm restored?
          - Yes
            - Seek expert help
          - No
            - Probable atrial flutter
              - Control rate (e.g., β-Blocker)

      - Irregular
        - Irregular Narrow Complex Tachycardia
          - Probable atrial fibrillation
          - Control rate with:
            - β-Blocker or diltiazem
            - Consider digoxin or amiodarone if evidence of heart failure
          - Anticoagulate if duration > 48 h

**Broad QRS**

- Broad QRS is QRS regular?
  - Yes
    - Seek expert help
  - No
    - Seek expert help

**Regular**

- Narrow QRS is rhythm regular?
  - Yes
    - Normal sinus rhythm restored?
      - Yes
        - Seek expert help
      - No
        - Probable atrial flutter
          - Control rate (e.g., β-Blocker)

- Irregular
  - Irregular Narrow Complex Tachycardia
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**Irregular**

- Irregular Narrow Complex Tachycardia
  - Probable atrial fibrillation
  - Control rate with:
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    - Consider digoxin or amiodarone if evidence of heart failure
  - Anticoagulate if duration > 48 h

**Possibilities include:**
- AF with bundle branch block
- Pre-excited AF
- Consider amiodarone
- Polymorphic VT (e.g., torsades de points - give magnesium 2 g over 10 min)

- If ventricular tachycardia (or uncertain rhythm):
  - Amiodarone 300 mg IV over 20-60 min; then 900 mg over 24 h
  - If previously confirmed SVT with bundle branch block:
  - Give adenosine as for regular narrow complex tachycardia

**Attempted electrical cardioversion is always undertaken under sedation or general anaesthesia**
Bradycardia algorithm. © 2010 ERC
General signs of FBAO

- Witnessed episode
- Coughing/choking
- Sudden onset
- Recent history of playing with/eating small objects

**Ineffective cough**
- Unable to vocalise
- Quiet or silent cough
- Unable to breathe
- Cyanosis
- Decreasing level of consciousness

**Effective cough**
- Crying or verbal response to questions
- Loud cough
- Able to take a breath before coughing
- Fully responsive
Epidemiology

neonates

• Perinatal asphyxia - term (20%), preterm

• ≥ 1 M
  * SIDS

≥ 1 Y
  * Airway obstruction

≥ 8 Y
  * trauma – CNS, thermic, drowning
  * sepsis syndrome
Pathogenesis

Childhood

* Respiratory arrest ... hypoxia ... hypercarbia ... acidosis ... asystole
  * 5 - 10 % primary etiology (VF)

adult

* 85 % primary etiology (VF, ICHS)
CPR assessment - WHEN CPR?

Children with any following features:
- airway obstruction
- tachypnoea, hypopnoea,
- bradycardia,
- tachycardia
- hypotension
- altered mental state or convulsion
- Low oximetry values (SpO2 ≤92%)
Anaphylaxis

- **Airway**
- **Breathing\ bronchospasm, swelling**
- **Circulation**
- **Drugs:** adrenaline sol (1:1000), stridor, bronchospasm 3-5 ml sol nebulized or 1:10000:10 ug/kg iv., hydrokortison 50 mg iv. (100 mg iv adults)
CPR - WHEN stopp?

- CPR ≥30 min
- asystole, apnoe, arreflexy, mydriasis, no ECG activity
  (cave - hypothermia ≥40 min)

* Exhausted physicians
A B C D  

A airway  -  assess airway
B breathing  -  assess efficacy
C circulation  -  assess circulation
D drugs  -  drugs
defibrillation  -  defibrillation

CPR-BLS
CPR – no start

* Signs of exitus

* trauma

* Signs of brain death

* GA < 23. weeks, BW < 400 g
A - airway

„ to be opened and cleared“
correct position of a head
A - airway

Head position

in neonate  = neutral
small child  = sniffing
bigger child = garling
Breathing (BLS) and ventilation
Oxygenation

* O2-box

(flow of min. 3 l/min, FiO2 až 1,0)
B – breathing (ALS)
ligamentum conicum

(5 - 7 mm)
* Oxygenation

$\text{FiO}_2 \text{ max. } 0,3 - 0,5$

flow $15 \text{ l O}_2 = \text{FiO}_2 0,9$
C - circulation

- HF (10 sec) **pulsation**
  
  * children  a. carotis
  * infants  a. femoralis, a. brachialis
  * neonates  apex of heart

- skin color
C - circulation

* altered level of consciousness, stage of perif. perfusion
C - circulation

- 33 % CO
- 50 % coronary output
- 50 – 90 % brain perfusion
- 5 % splanchnical perfusion
C - circulation

In neonates and children:

* HR 60 / min start thorax compr
Combinate CPR

neonates

1 : 3

HR 120/min

Infants and children ≤8Y

2 : 30 (1)

2 : 15 (2)

HR 100/min

Children ≥8Y

2 : 30

HR 100/min
D - drugs

* ↑ HR
* ↑ Perfusion and oxygenation of organs (brain)
* ↑ Correct MAC
D - drugs

* iv.
* it.
* io.

!!! cave – NO i.m., p.o., s.c., p.r. !!!
Adrenaline (epinephrine) - bradycardia/asystole

- neonates
  
  0,01 - 0,03 mg/kg i.v.

- child i.v.
  
  0,01 mg/kg

- orig. 1 ml = 1 mg = 1 : 1000
- i.v. Apl. 1 : 10 000 (sol. 1 ml do 10 ml FR) = 0,1 ml/kg
D - drugs

atropine

dose 0,01 - 0,02 mg/kg i.v.

-max. dose
children 0,5 mg iv.
adults 1 mg iv.

a 5 min

Cave: no routine!
Amiodaron PULS-less

*TD, fibrilation, VF/VT, presistant after 3 schock*

*Cordarone  5 mg/kg i.v.*
D - drugs

Bicarbonate sodium: NaHCO₃ 4,2% (8,4%)

* Ind: suspected or proven MAC (pH < 7,1)

* cave - no routine!
**D - drugs**

**Bicarbonate - sodium**

**dose 1 mmol/kg i.v.**

- 8.4% sol NaHCO₃ 1 ml = 1 mmol/L
- 4.2% sol NaHCO₃ 1 ml = 0.5 mmol/L
D - drugs

calcium

* Ind: - hypocalcemia, hyperkalemia, hypermagnesemia

dosis

Calcium gluconicum 10 % 0,2 ml / kg

(5 - 7 mg Ca/kg)

- No routinely
D - drugs

magnesium

* Ind: - hypomagnesemia
status asthma
cus

dose

Magnesium sulphuricum 10 % 0,5 ml/kg
D - drugs

**Naloxone**

Naloxone hydrochloride 0,1 mg/kg

(1-4 h)
D - drugs

volumexpanders

dose 10 - 20 ml / kg / 5 - 10 min

* crystaloides - sol. Ringer l/l, FR l/l
* coloids - Biseko, albumin 5-20%, mražená plazma

- cave – isotonic solutions
D - drugs

* Glucose intake

Dextrose 10% 5 - 10 ml/kg

(0.5 - 1 g/kg)

Ind: hypoglycemia protection
D - defibrilation

non synchronize

NO-QRS complex

( fibrillation, flutter )

4 J / kg
D - defibrilation

synchronize

tachydysrytmia with QRS complex

(SVT)

0.5 - 1.0 J / kg
How to stabilize to hospital transport
Recovery - thank You!