MUNI
MED

ALS – non shockable rhythms

4H´s / 4T´s

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Learning outcomes

- Student will learn about non-shockable rhythms associated with cardiac arrest and their potentially reversible causes

Advanced Life Support (ALS)

= advanced interventions that follow basic life support (BLS)

ECG rhythms in cardiac arrest

Shockable

- ventricular fibrillation (VF)
- pulseless ventricular tachycardia (pVT)

defibrillation as soon as possible

Non - Shockable

- asystole
- pulseless electrical activity (PEA)

defibrillation not indicated

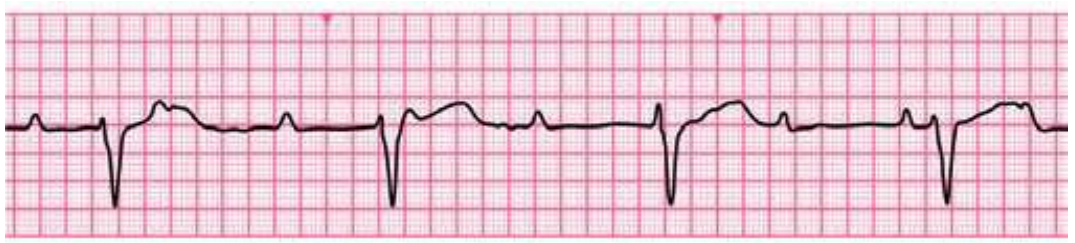
Non-Shockable rhythms

Asystole

- total cessation of electrical activity
- no myocardial contraction
- no blood flow

Pulseless electrical activity

- presence of electrical activity that would normally be associated with palpable pulse
- myocardial contraction too weak to produce a detectable blood pressure



Non-Shockable rhythms recognized

- CPR 30:2 immediately & re-check the rhythm every 2 minutes

↓

- palpate the pulse in the presence of an organized rhythm and/or signs of life:

→ no pulse palpable → continue CPR

→ pulse palpable → post resuscitation care

- **always continue quality CPR in case of any doubt !**

Non-Shockable rhythms recognized

- establish intravenous (IV) access as soon as possible
- peripheral venous cannulation is quick, safe and easy to perform in most cases
- consider the itraosseous (IO) route if IV is difficult or impossible

- give adrenaline 1mg once IV/IO access is obtained
- repeat adrenaline 1mg IV/IO every 3-5min. whilst CPR continues

- **adrenaline is the one and only agent of choice**

Adrenaline – mechanism of action

- α-1 stimulation
- ↓
- vasoconstriction
- ↓
- ↑ coronary perfusion pressure = ↑ myocardial blood flow
- ↓
- ↑ chance of ROSC

Pulseless electrical activity

- PEA is often caused by reversible conditions
- PEA may be effectively reversed upon appropriate treatment

- two groups of reversible causes (based upon initial letter):

Reversible causes of cardiac arrest

4 H´s

- hypoxia
- hypovolemia
- hypo-/hyperkalemia
- hypo-/hyperthermia

4 T´s

- thrombosis (coronary, pulmonary)
- tension pneumothorax
- tamponade
- toxins

Hypoxia / asphyxia

- **common conditions associated with cardiac arrest**

- **top priorities**

→ placement of an advanced airway
→ effective ventilation
→ highest possible inspired oxygen

Hypovolemia

- **causes of hypovolemia**

→ severe hemorrhage
→ anaphylaxis
→ sepsis / septic schock

- **top priorities**

→ fluid replacement (crystalloids, blood products)
→ urgent intervention to stop the bleeding

Hypo- / hyperkalemia

+ other electrolyte and metabolic disorders

- **easy detection by Point-of-Care testing**
  → electrolytes *(K, Na, Ca, Cl)*
  → metabolites *(Glu, Lac, Crea, Urea)*
  → blood gases*(pH, pO2, pCO2)*

Dyskalemia

Hyperkalemia

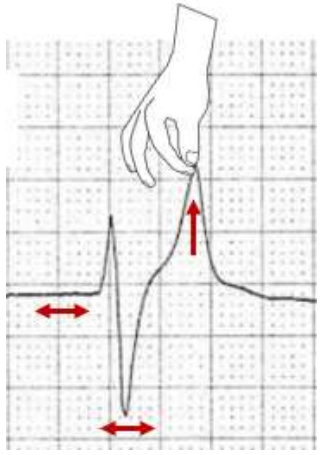
- mild 5.5 – 5.9 mmol/L
- moderate 6.0 – 6.4 mmol/L
- severe ≥ 6.5 mmol/L

Hypokalemia

- mild < 3.5 mmol/L
- severe < 2.5 mmol/L

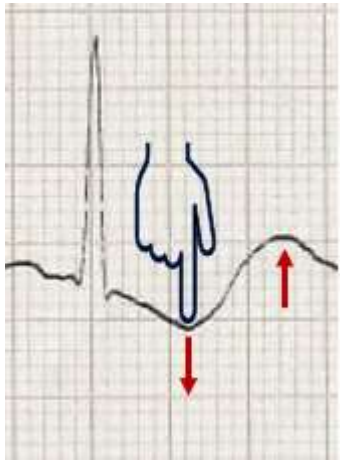
ECG changes

- flat / absent P waves
- broad QRS
- tall / peaked T waves



ECG changes

- U waves
- T waves flattening
- ST segment changes



Dyskalemia

Hyperkalemia treatment

- **shift potassium into cells**

→ *insulin-glucose i.v., bicarbonate i.v. salbutamol inh.*

- **remove potassium from the body**

→ *loop diuretics, potassium binder, cation exchgange rasin, dialysis*

- **cardiac protection**

→ *calcium chloride/gluconate i.v.*

Hypokalemia treatment

- **restore potassium levels**
- **check for exacerbating factors** *(hypomagnesemia, digoxin toxicity,...)*

Hypotermia

- **risk factors for imminent cardiac arrest**
  → core temperature < 30°C
  → ventricular arrythmia
  → systolic blood pressure < 90mmHg

- **adrenaline should be withhold if the core temperature is < 30°C**

- **rewarming in hypotermic cardiac arrest should be performed with extra-corporeal membrane oxygenation (ECMO)**

Thrombosis

Pulmonary embolism

- **dignosis**

→ bedside echocardiography

- **therapy**

→ anticoagulation therapy

→ thrombolytic therapy

→ surgical embolectomy as alternative to thrombolysis

Coronary thrombosis

- **diagnosis**

→ clinical signs (chest pain prior to arrest)

→ ECG (STEMI, NON-STEMI)

- **therapy**

→ coronary angiography + percutaneous coronary intervention after / before ROSC

Cardiac tamponade

- **diagnosis is very difficult in the absence of point-of-care echocardiography**

- **treatment is based on immediate decompression of the pericardium:**
  → ultrasound guided pericardiocentesis
  → resuscitative thoracotomy

Tension pneumothorax

- **diagnosis is based on clinical examination or point-of-care ultrasound**

- **chest decompression is effective treatment:**
  → needle thoracocentesis
  → chest tube insertion
  → open thoracostomy

Intoxication

- **priority is to secure the personal safety**

- **toxic agents can (in)directly cause electrolyte abnormalities, hypoxia and hypo- or hyperthermia**

- **specific treatment modalities:**
  → antidotes
  → decontamination
  → enhanced elimination

Take home message

- The ALS algorithm distinguishes between shockable and non-shockable rhythms
- For adult patients in cardiac arrest with a non-shockable rhythm adrenaline should be given as soon as possible
- During cardiac arrest must be considered potentially reversible causes for which exist specific treatment

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