

Advanced Cardiac Life Support (ACLS)

MUDr. L. Dadák
ARK, FN u sv. Anny

Introduction



- The most common cause of death is a heart attack.
- A disturbance in the electrical rhythm of the heart called ventricular fibrillation.
- Because up to 80% of all cardiac arrests occur in the home, you are most likely to perform CPR on a family member or loved one.

Obr: AIM front wall + septum

What is CPR?

Combination of rescue breathing and chest compressions delivered to victims thought to be in cardiac arrest.

- Basic Life Support = Základní neodkladná resuscitace
- Advanced Cardiac Life Support = Rozšířená neodkladná resuscitace

○ <http://circ.ahajournals.org/>

1. Rescuers should phone ER for unresponsive adults before beginning CPR. Exceptions: Provide CPR first for adult victims of submersion, trauma and drug intoxication.
2. Rescuers should provide about one minute of CPR for infants and children up to age 8 before calling ER.
4. Lay rescuers will no longer be taught a pulse check. The signal for lay rescuers to begin chest compressions is the absence of signs of circulation (normal breathing, coughing or movement) in response to the two rescue breaths.
5. The compression rate for adult CPR is increased to about **100** per minute.
6. The compression-to-ventilation ratio for CPR for victims age 1 or older is **30 compressions to 2 breaths** for one or two rescuers.
7. Chest-compression-only CPR is recommended **ONLY** when the rescuer is unwilling or unable to perform mouth-to-mouth rescue breathing.

Effectiveness of ACLS

- 1/3 Cardiac Output
- O₂ for metabolic need of brain

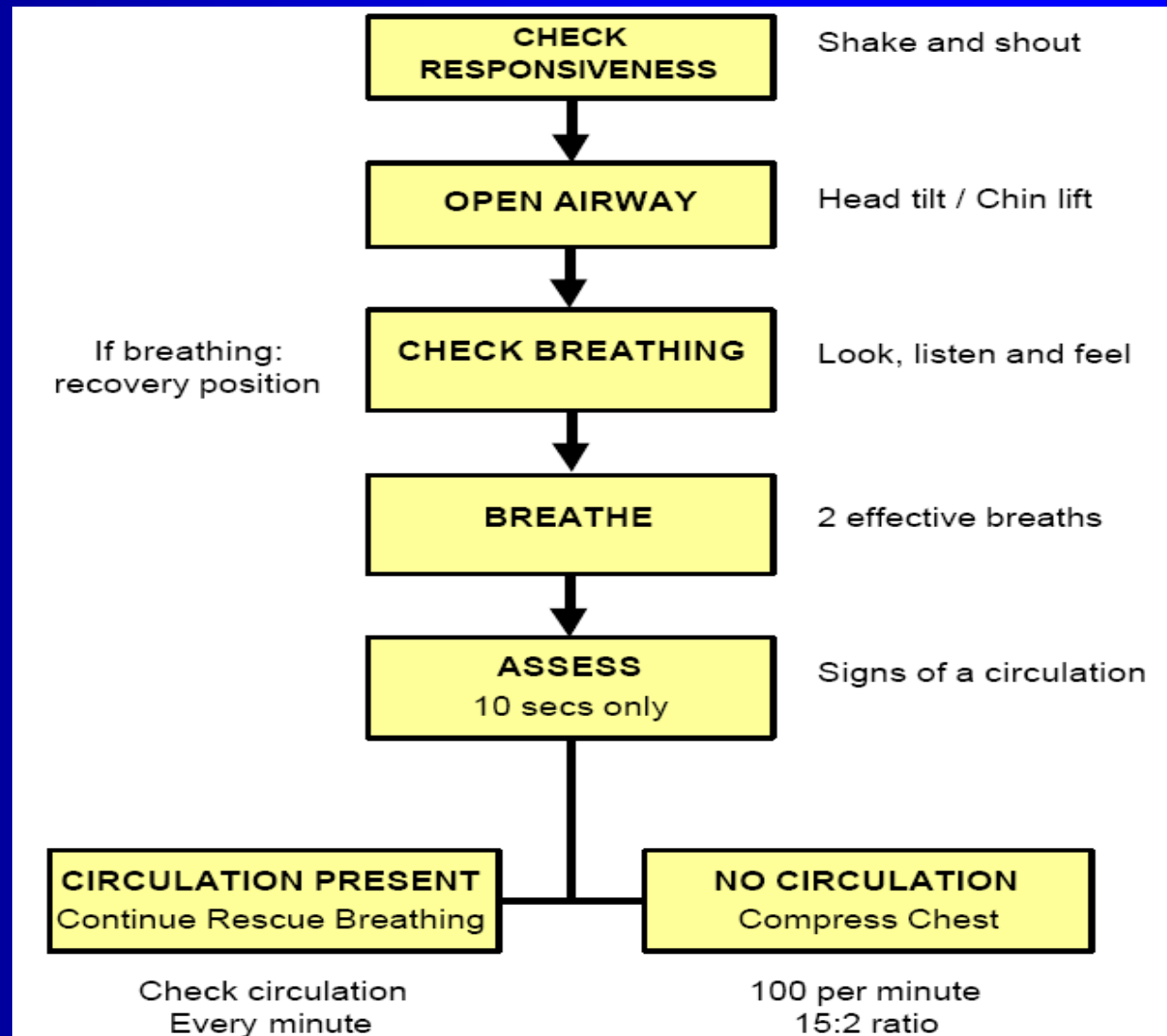
Evaluation of CPR

- **resumption of circulation**
- **Successful CPR - sociologic aspect - return to taxpayer**

Basic Life Support 2000

DR ABC

- Danger
- Response
- Airway
- Breathing
- Circulation



Send or go for help as soon as possible according to guidelines

BLS /basic life support/

A - airway

B - breathing

C - circulation

ACLS /advanced cardiac life support/

D - drugs and fluids

E - EKG

F - fibrillation treatment

Advanced Cardiac Life Support

= BLS +

- A+ B:
 - Oxygen
 - Intubation
 - Positive Pressure Ventilation
- C:
 - Vein access, drugs, fluids
 - Therapy of fibrillation

Danger



Danger

- Location:
car, fire, gas, ...
- Biologic – bld of victim

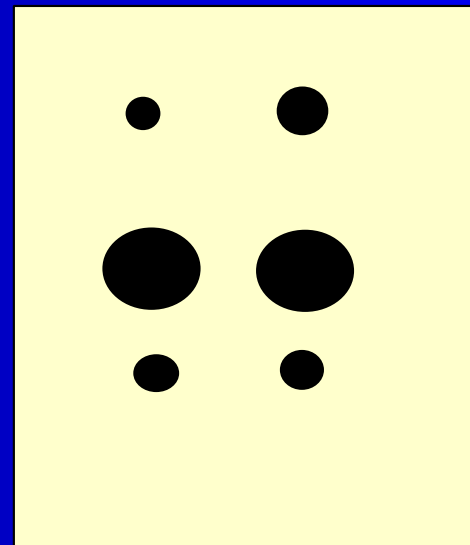


Response – Evaluation of consciousness

- **Shake & Shout**
!! shoulder !!
- unconsciousness = no reaction to word, pain, dilatated pupils

If correct ABC:

- pupils
 - symetrie?
 - mydriasis
 - miosis
- reaction to light
- movements of eyes
- Meningeal symptoms





Evaluation of breathing:

- movement of chest
- **air flow** – opened airway
- frequency

Skin color:

- pink
- cyanotic

Signs of airway obstruction

Breathing

- záklon hlavy,
- nosní dírky, brada
- nádech, obejmě,
- Vdech 2s. Poměr vdech : výdech 1:1.
- Frekvence asi 12/min.
- Objem 800-1000ml
- ? = zvedá se hrudník?, pasivní odchod vzduchu



Most common errors:

- delays in diagnosing respiratory or cardiac arrest
- failure to establish a patent airway
- delays in instituting BLS promptly;
- inadequate ventilation (eg, poor seal around mouth or nose, failure to deliver the initial two full breaths, or inadequate amount of expired-air pressure generated to cause chest movements)

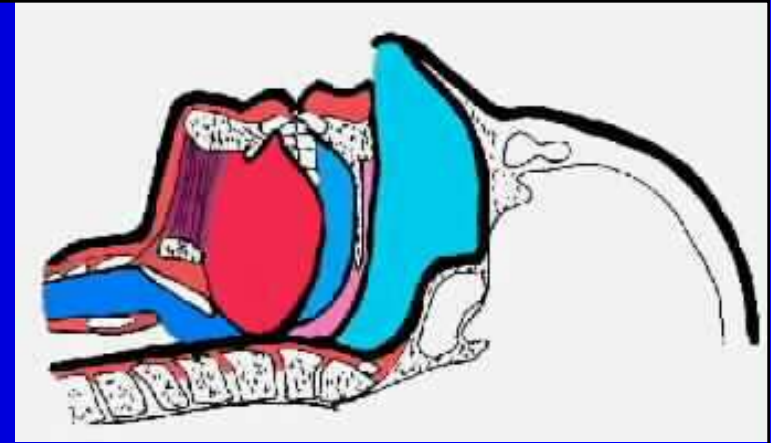
Airway

Problem = obstruction

- relaxed tongue and neck muscles in an unconscious person
- foreign body

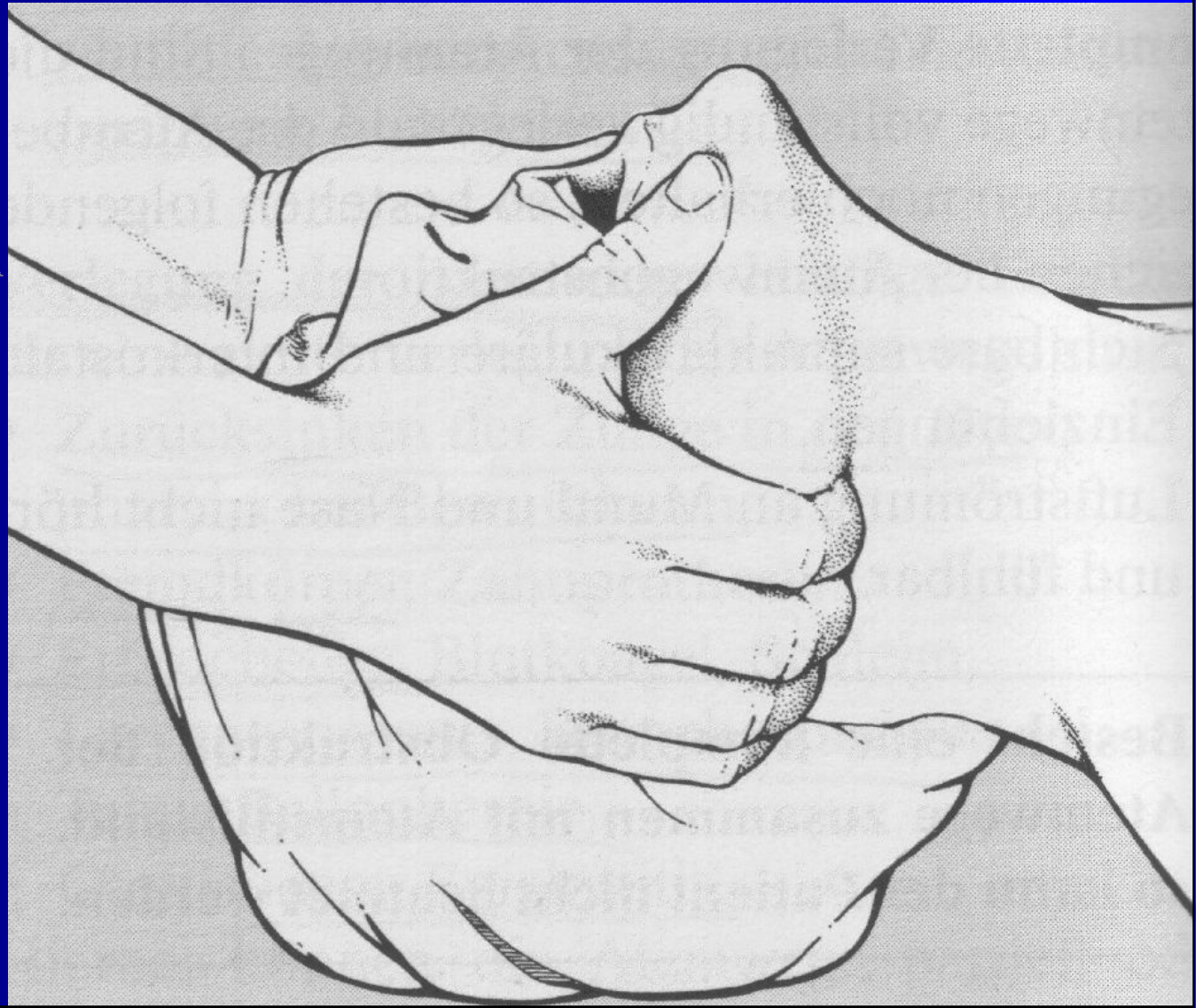
Solution:

- head tilt-chin lift
- airway
- laryngeal mask
- kombitube
- intubation
- coniotomy

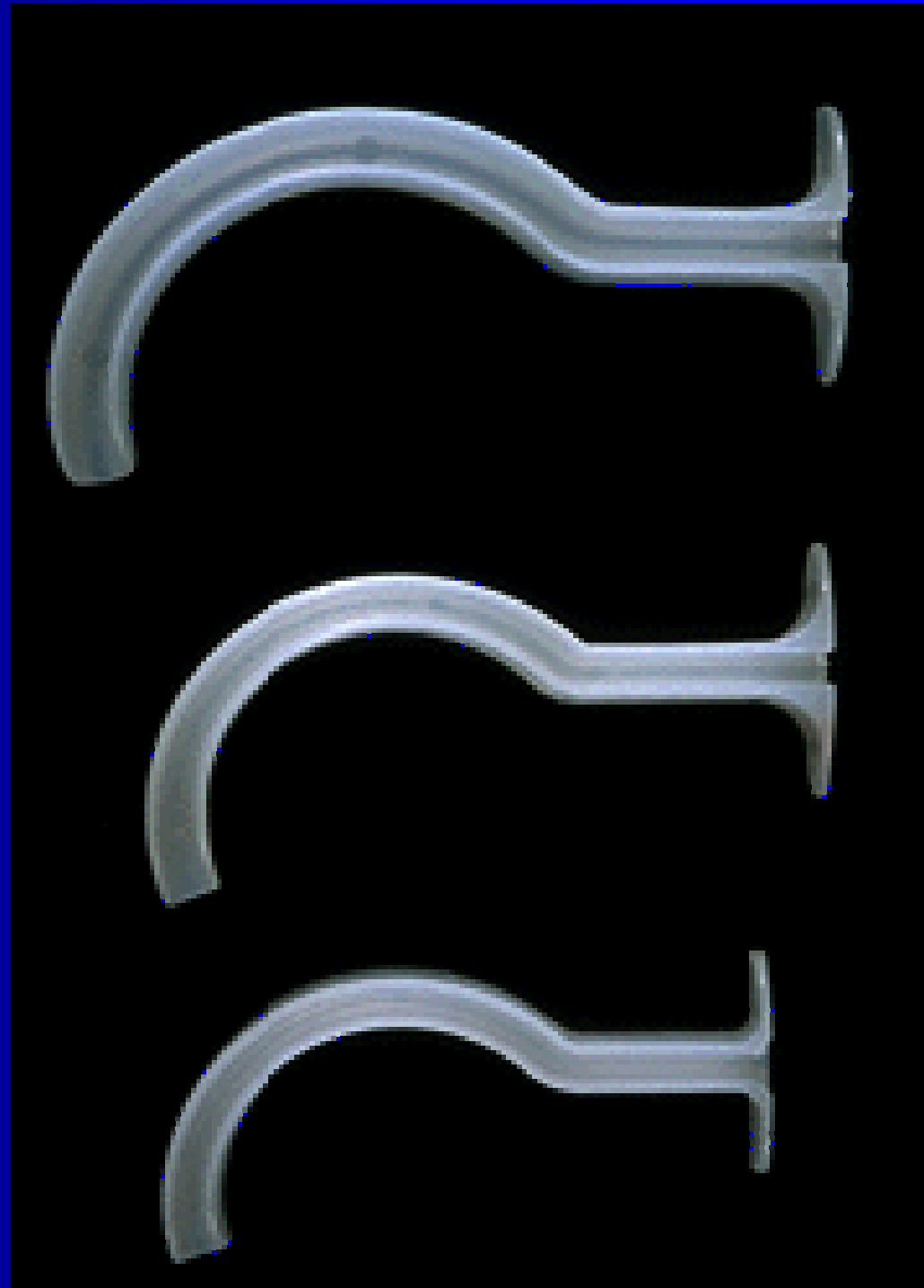


Esmarch:

- **Head tilt**
- **Chin lift**
- **Mouth open**



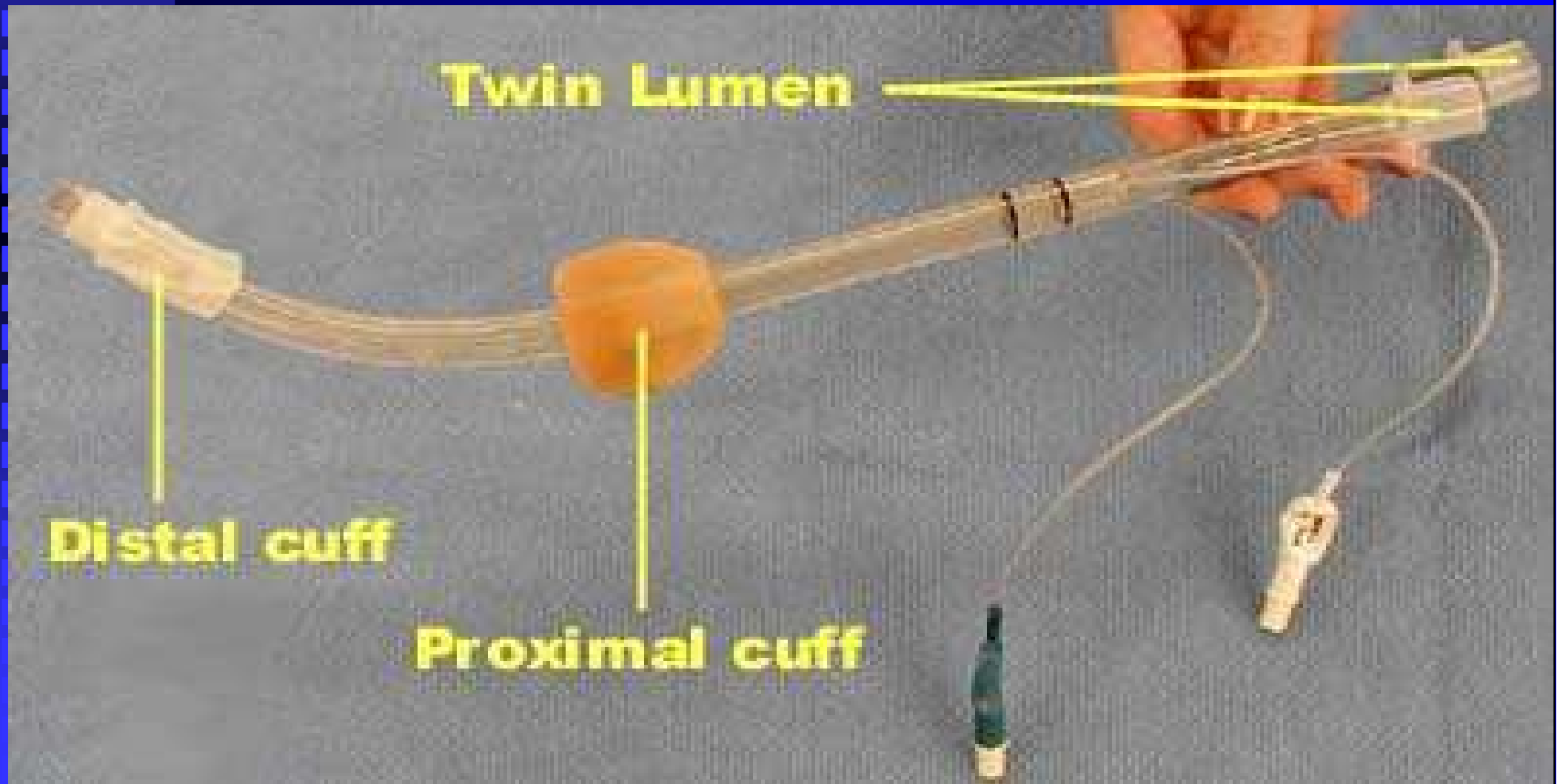
Airway



LM



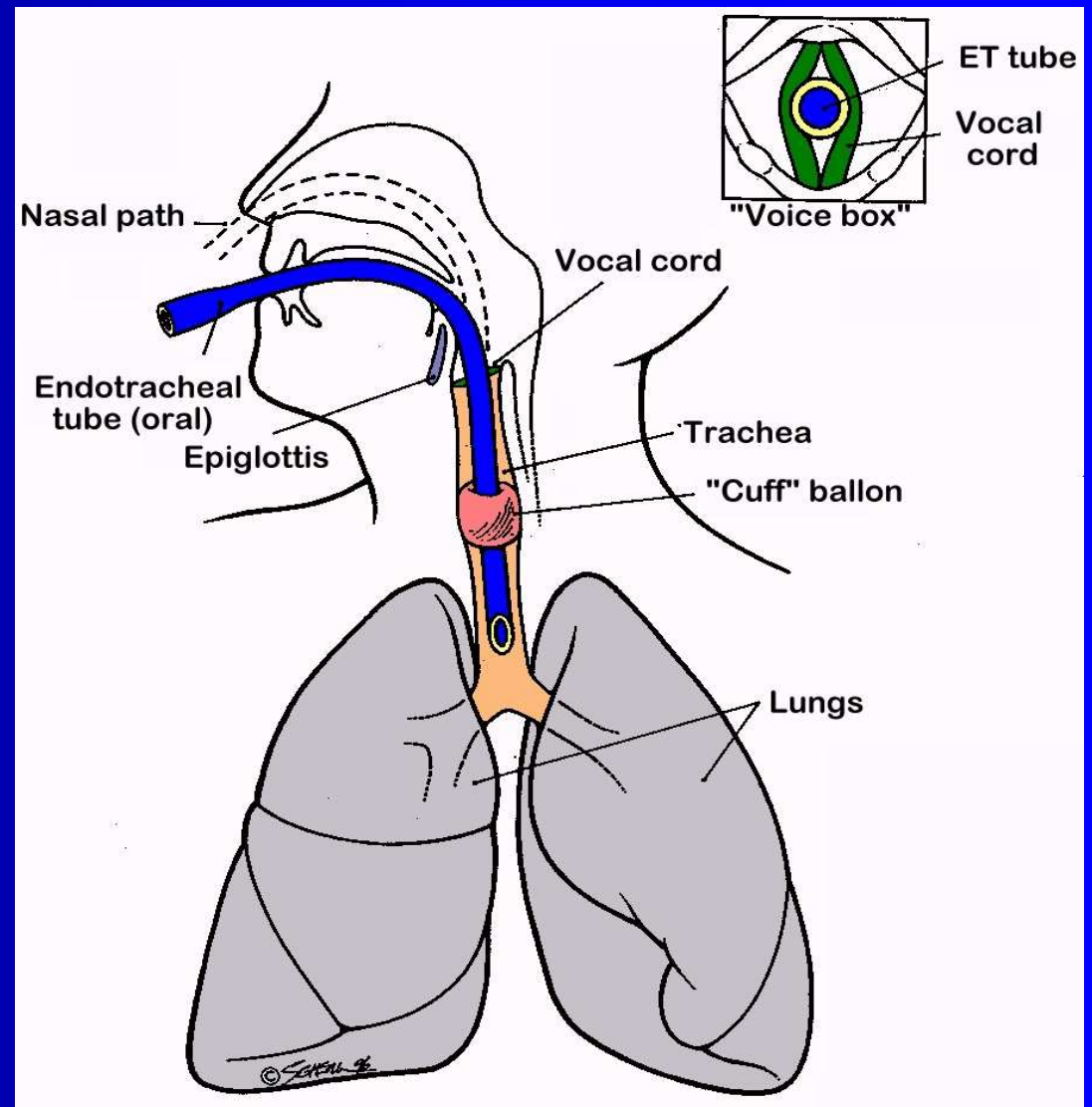
Combitube



Intubation

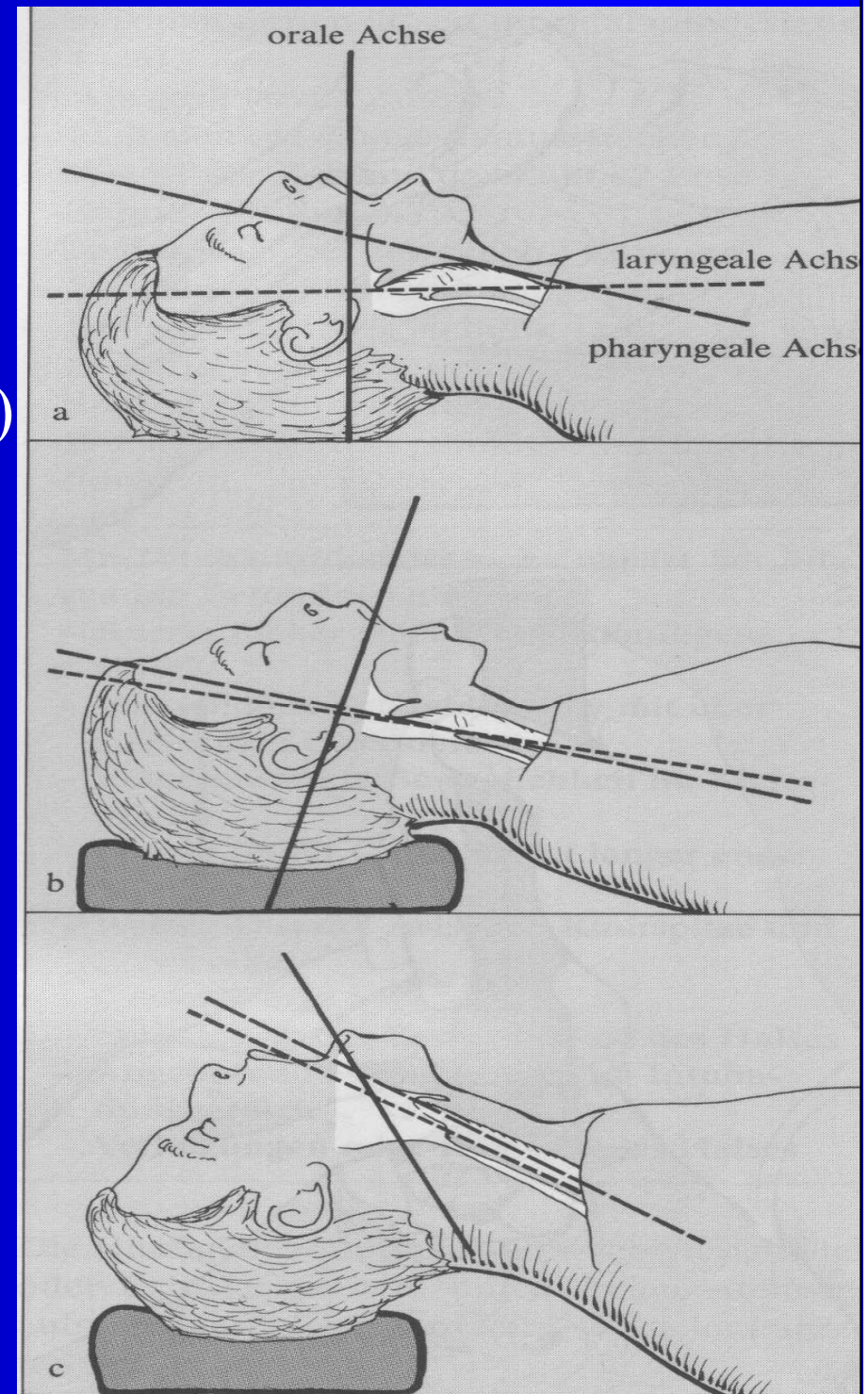
- Laryngoskope
- Magill pincers
- tracheal tubes
- Introducer
- syringe

- broncho-fibroskops

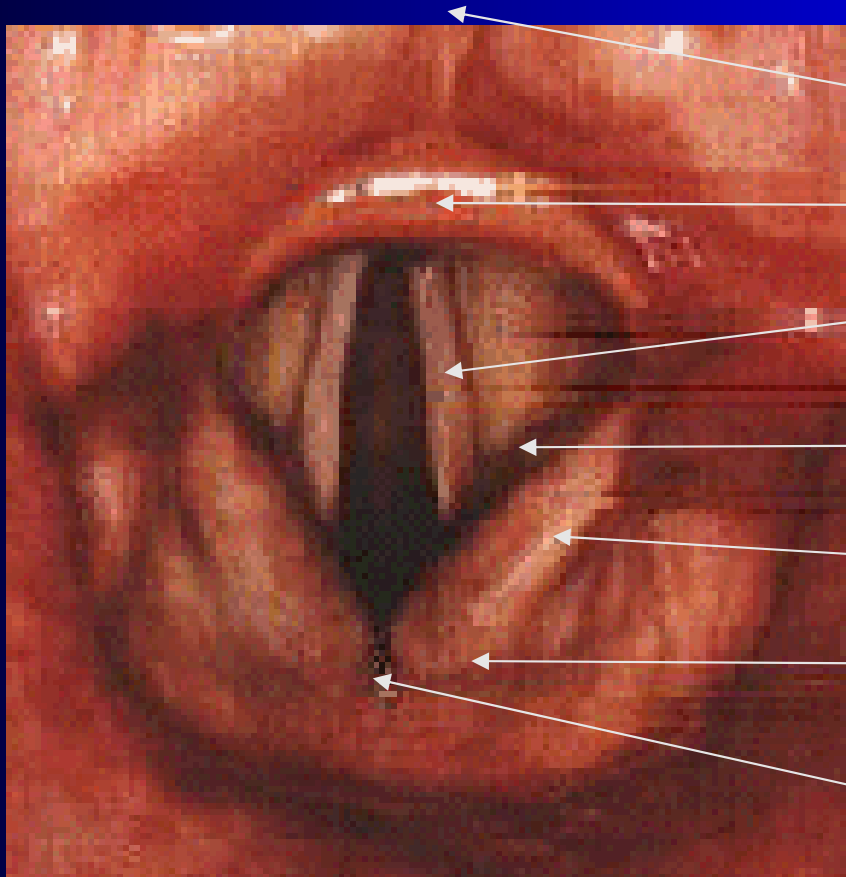


Intubation:

- prepare instruments (ventilate)
- position of patient
- (anestezie / unconsciousness)
- direct laryngoscopy
- introduce Tr tube
- fill balloon
- check position
- fix tube



direct laryngoscopy - view:



tonque

epiglottis

vocal cords

recessus piriformis

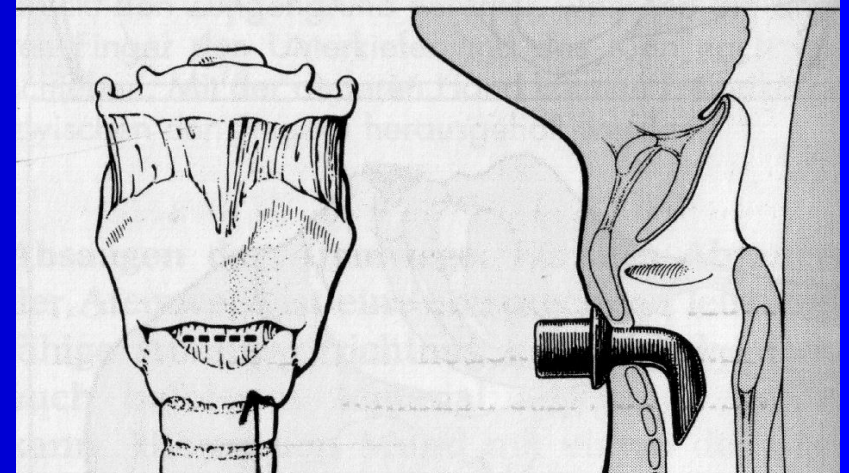
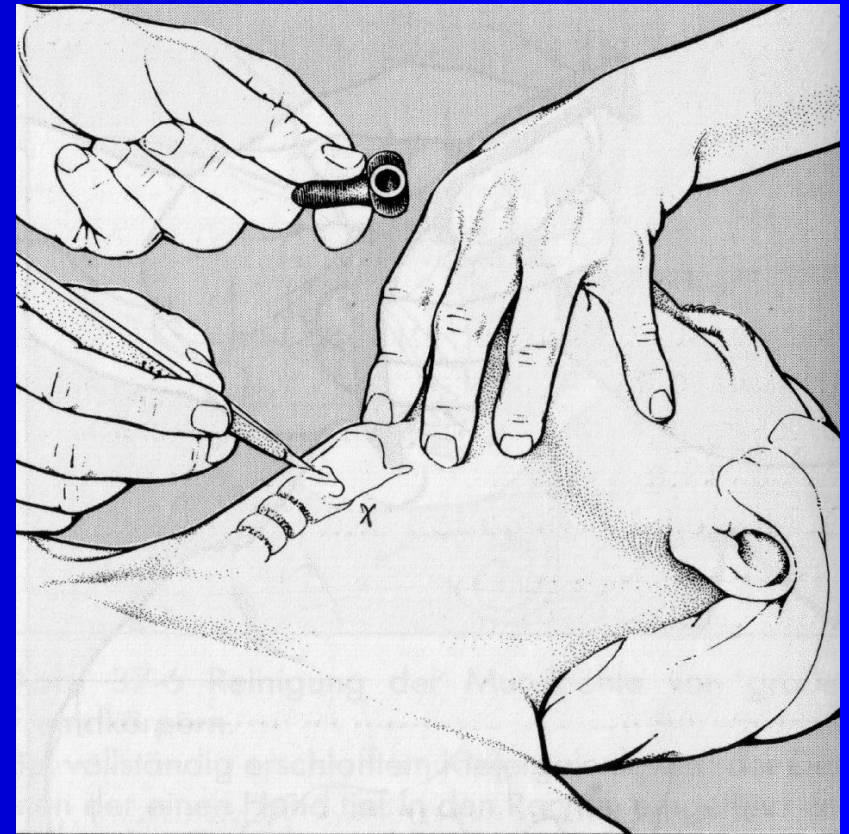
plica aryepigottica

tuberculum corniculatum

zadní komisura

Coniotomy

- urgent preservation of airways
- lig. cricothyreoideum (lig. conicum)



B – breathing

ACLS

positive pressure ventilation

- bug („ambu“), holding mask by 1 or 2 hands
- (ventilator – Volume Control Ventilation)
- 6 ml/kg; 12/min, f_iO₂ 100%
- ACLS 2 breaths in the beginning
- ratio – 2 : 30 - ventilated by mask
 - no ratio = 10 : 100 – advanced airway
- inspiration 1s

Oxygen

- as high FiO_2 as possible
- Hypoxia a acidosis contra efectivness of elektrik and farmakologic therapy

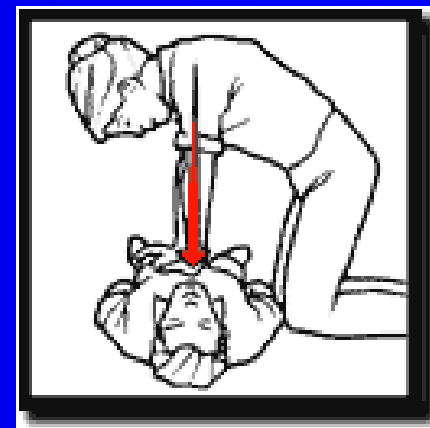
Top-less CPR

- opening of airway and chest compressions without breathing to casualty
- risk of infection

Circulation

- pulsations on central arteries
(a.carotis; a.femoralis)
- NEVER - periferal – wrist art.
- NEVER – (heart rate)
- NEVER – blood pressure
- NEVER - (capillary refill)

Chest compressions



- Rescuer should stand or kneel next to victim's side.
- Find the tip of the breastbone = xyphoid process
- 2 fingers up to danger spot
- Place heel of 1 hand on lower sternum and other hand on top of hand
- Apply pressure only with heel of hand straight down on sternum with arms straight and elbows locked into position so entire weight of upper body is used to apply force.
- During relaxation all pressure is removed but hands should not lose contact with chest wall.
- Sternum must be depressed 5 cm in average adult (palpable pulse when SBP >50 mm Hg)
- Duration of compression should equal that of relaxation.
- Compression rate should be 100/min.

Adequacy of chest compressions

- is judged by palpation of carotid or femoral pulse (palpable pulse primarily reflects Systolic Blood Pressure).

C – circulation

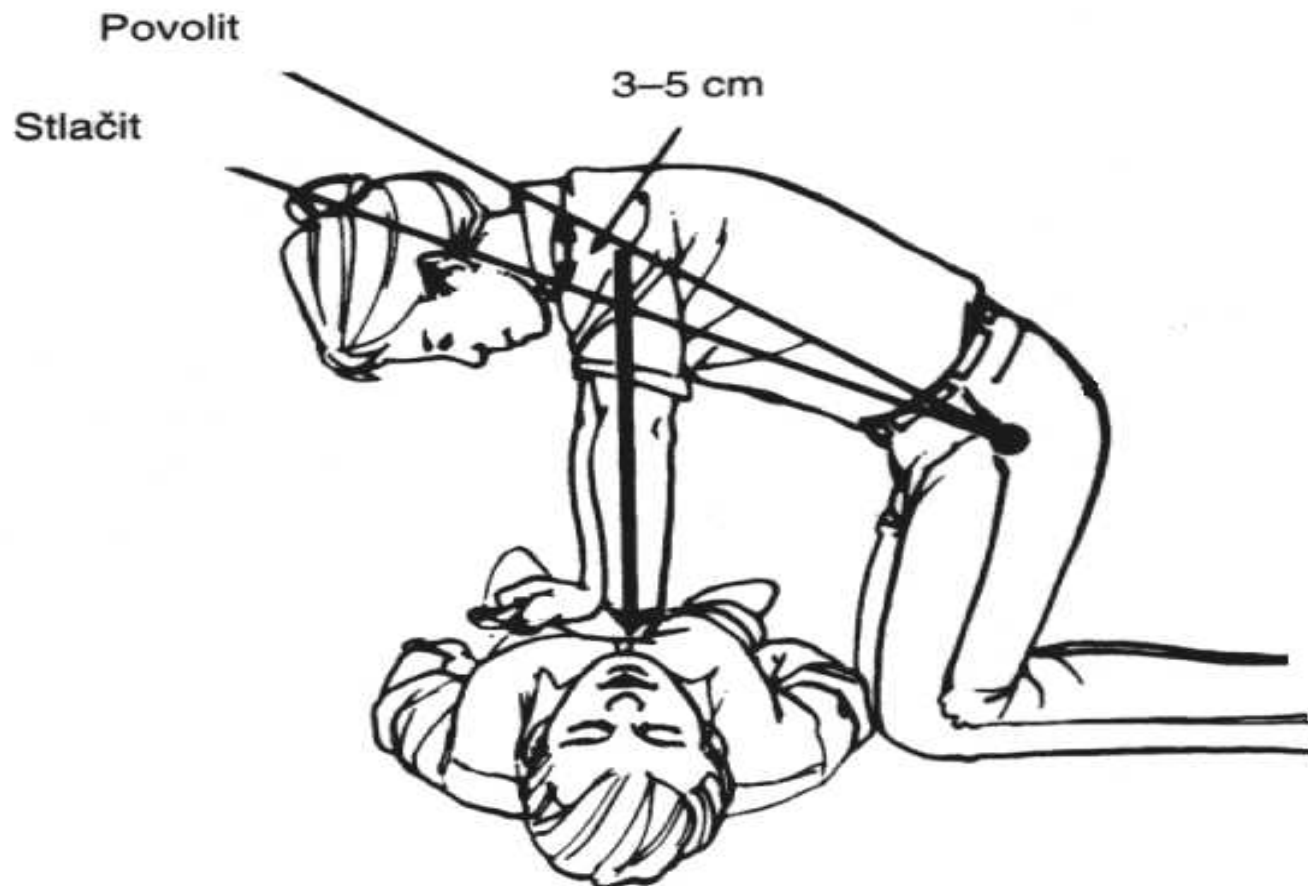
Signs of circulation = pulsations

- a. carotis communis
- a. femoralis

children

- a. brachialis

Theory of heard pump x Theory of thoracic pump



Ratio 2005

compressions : breaths

- adult nonintubated 30 : 2
- adult intubated 100:10
- child + medical pers. 15:2
- newborn 3:1

Drugs - administration

Intravenously – periferal cath. - v. jugul. externa

- v. femoralis

- central v. cath. - v. subclavia

- v. jugul. interna

- Add 20ml i.v of fluids to move the drug.
- Effect in 1 min

Drugs administration

2. Endotracheally – ONLY 4:

- adrenalin
- atropin
- naloxon
- lidokain
- **2 – 2,5 x higher dose than i.v.**
- **Volume (10 ml FR)**

3. (Intraosseal access - children)

Epinephrine = Adrenalin

Alfa effect = **raise diastolic pressure**

- raise brain, heart perfusion pressure

Beta effect - raise contractility

- change of type of fibrillation

D: **1 mg i.v. a 3 min**

2 mg E.T. a 3 min

Vasopressin

Vasoconstriction, direct stimulation of V1 receptor
smooth muscle = elevation of TK

without β activity – no effect on consumption of O₂
in heart

„long“ halftime - 20 min.

I: alternative to Adrenalin (VF, PEA, asystolia)

D: 40 i.u. (1x)

„D“ Atropin

- **I:**
 - **sinus bradycardia**
 - **a-v block**
 - **asystolia**
- **D: to 4 mg i.v.**

Amiodarone (CORDARONE)

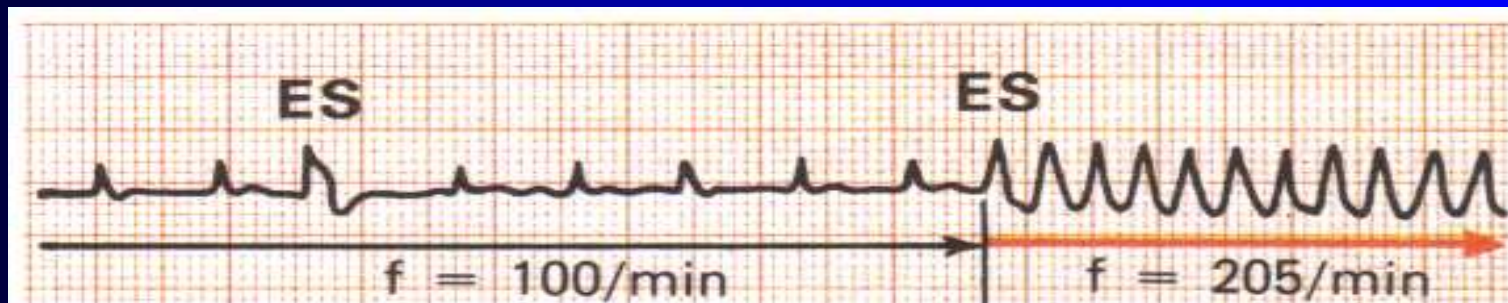
- antiarytmic drug

I:

- recurent VF

D:

- 5mg/kg (150mg iv.)



„D“ Lidokain

- local anaesthetic
- I:
 - VES
 - VT
 - reccurent VF after defibrillation

D: bolus 1mg/kg

max. 3 mg/kg

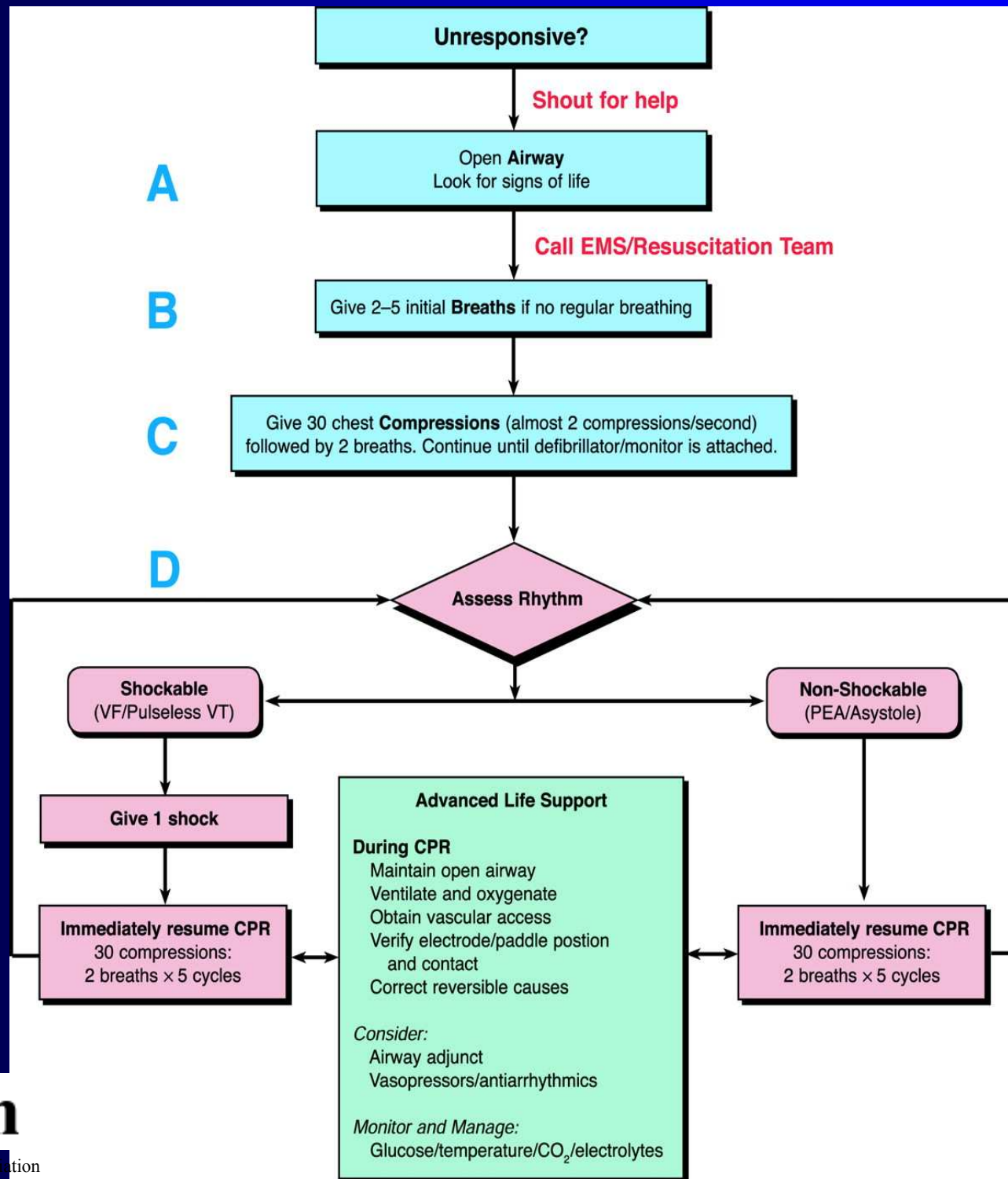
Fluids

- Bolus of 20ml after each dose = movement of drug
- Acute bleeding – rubt. AAA, EUG;

Types:

- Crystalloids – Ringer, Hartman, physiol. sol.
- Coloids – Gelatina, HAES = stark
- Glc – do NOT use – wrong neurology result

ILCOR Universal Cardiac Arrest Algorithm



Asystolia

The worst situation

- **Diagnosis on ECG monitor – flat line**
- **2 breaths, chest compressions, ...**
- **Intubation, i.v.**
- **Adrenalin 1 mg i.v. á 3 min.**
children 10 µg/kg
- **Atropin up to 4 mg i.v. (0,04 mg/kg)**
- **check for electrical activity and pulsations**

Asystole Check me in another lead,
then let's have a cup of TEA."

- (T = Transcutaneous Pacing)
- E = Epinephrine
- A = Atropine

Pulseless Electrical Activity

reasons:

- **Hypovolemia**
- **Hypoxia**
- **H⁺ acidosis**
- **Hyper/hypocalcemia**
- **Hypothermia**

PEA - reasons:

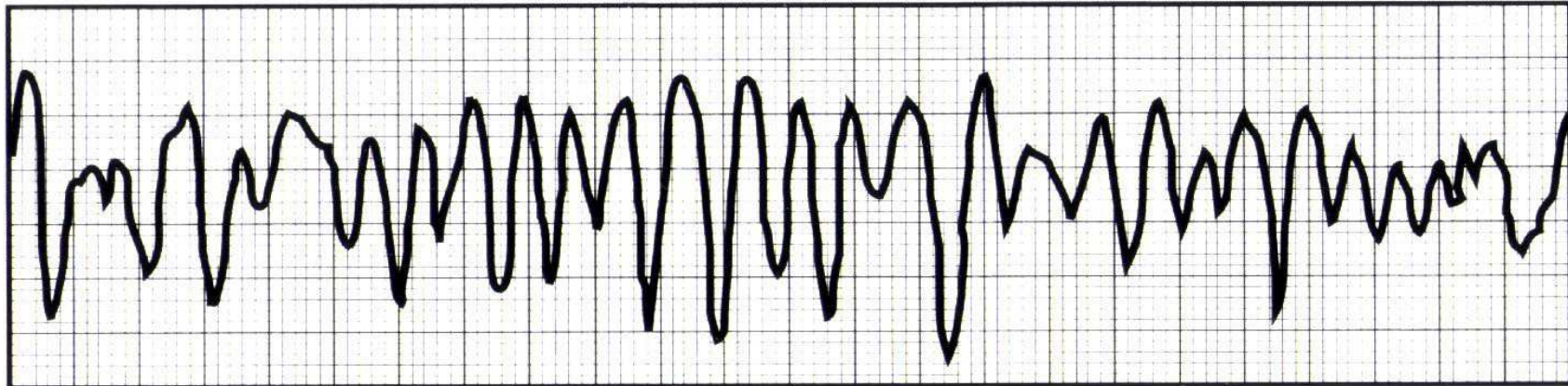
- „**Tablets**“ (overdose)
- **Cardiac Tamponade**
- **Tension pneumothorax**
- **Trombosis of C.a.**
- **Trombosis of a.pulm.**

Pulseless electrical activity are guided by the letters P-E-A

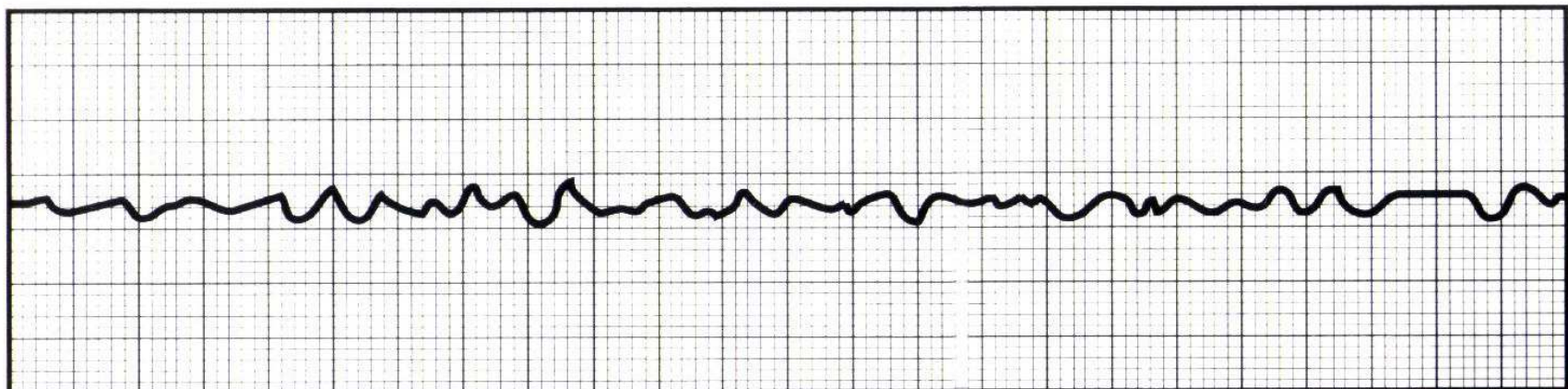
- Problem (H, T)
- Epinephrine
- Atropine

VENTRICULAR Fibrillation

Hrubovlnná komorová fibrilace



Jemnovlnná komorová fibrilace



Ventricular fibrillation

- electrical instability of heart muscle (ischemia, hypothermia)

signs:

- pulselessness

Th: defibrillation,
adrenalin, vasopressin
amiodarone

Please Shock-Shock-Shock, EVerybody Shock, And Let's Make Patients Better

- (Please = precordial thrump)
- Shock 200J bifasic / 360J mono
- EVerybody = Epinephrine / Vasopressin

- And = Amiodarone
- Let's = Lidocaine
- Make = Magnesium
- Patients = Procainamide
- Better = Bicarbonate

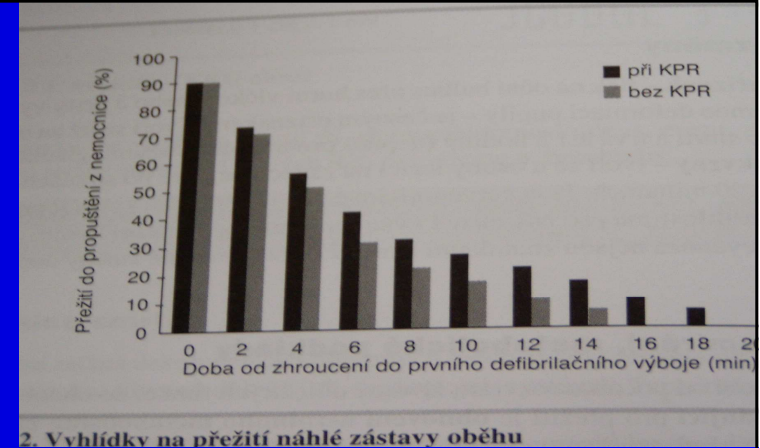
VF

- **Adrenalin 1 mg i.v. á 1 min.**
children 10 µg/kg

(Vazopresin 40 j (1x))

- **Antiarrhythmics: Lidokain 1,5 mg/kg**
 - **Amiodaron 5 mg/kg**
300 mg slowly i.v.

Defibrillation



- Defibrillation sends a high energy DC electric shock through the heart, stopping it momentarily. The sinoatrial node should then take over and a coordinated rhythm restart. However, ventricular fibrillation often recurs so multiple shocks are used routinely.

Position of electrodes:

Energy:

Joule (Watt × sec.)

heard - ONLY 4%/

monophasic shock

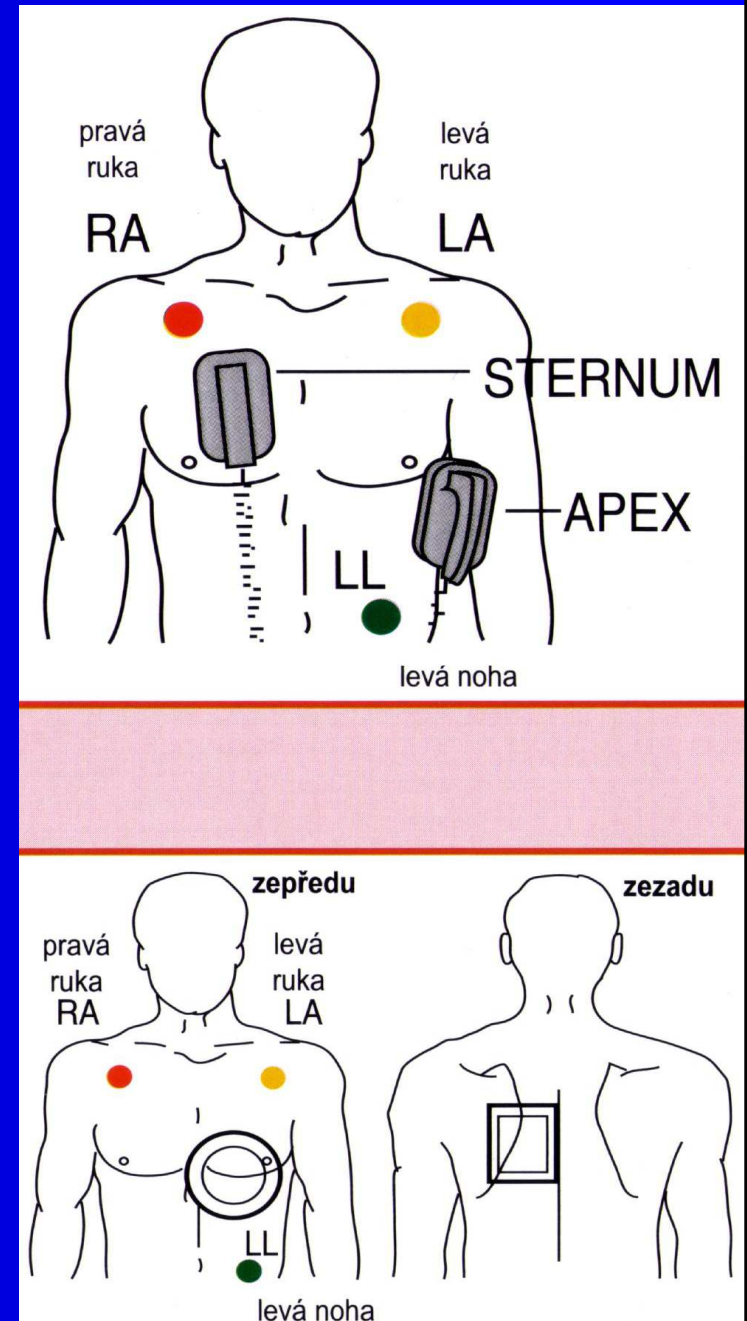
360 J

biphasic shock

200 J

internal shock

25 - 35 J



Biphasic versus monophasic

- Monophasic defibrillation delivers a charge in only one direction.
- Biphasic defibrillation delivers a charge in one direction for half of the shock and in the electrically opposite direction for the second half.

Defibrillation

Voltage 1,5 – 3 kV

Current 30 – 40 A

Time 1 ms

Impedance of Th 70 – 80 ohms

- Skin burns,
- "stand clear" order

After recovery of circulation

- Stabilisation of vital functions (circulation, ventilation, AB)
- Diagnosis and treatment of reason of cardiac arrest
- Hypothermia 32 – 34 °C for 12 – 24 h
(better neurological outcome)

When

to start?

Not to start?

- end stage disease, no prognosis
- trauma with no hope for life (decapitation)
- signs (indication) of death (patch, Tonelli sign)
- time factor (15 – 30 minutes from stop of circulation to your arrival), temperature, age.

When stop CPR:

- restored vital functions
- doctor takes care of victim
- no power to continue with CPR