

# Advanced Cardiac Life Support (ACLS)

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# 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
- O<sub>2</sub> for metabolic need of brain

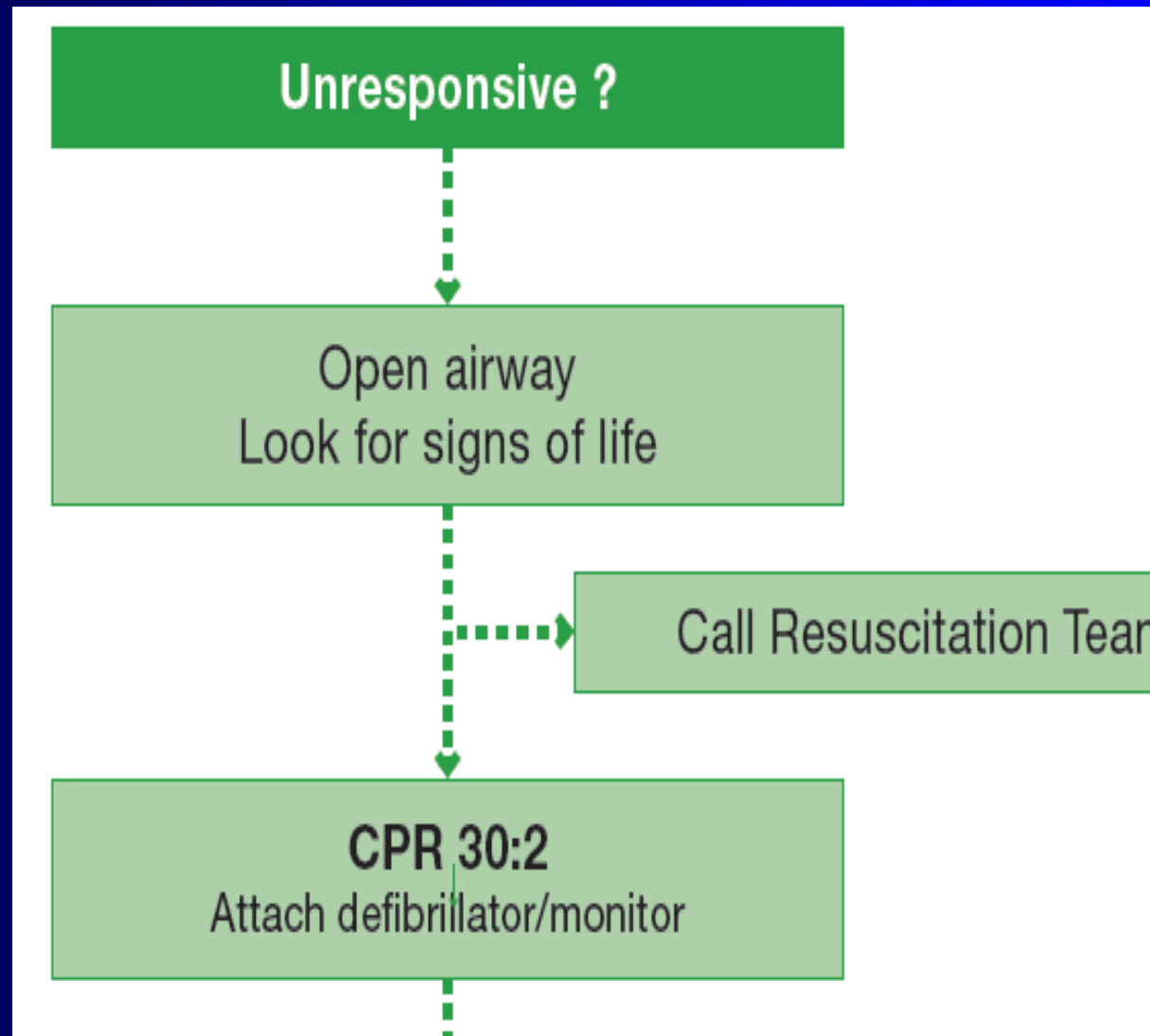
## Evaluation of CPR

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

# Basic Life Support 2005

## DR ABC

- Danger
- Response
- Airway
- 
- Circulation
- Breathing



BLS /basic life support/

A - airway

B - breathing

C - circulation

ACLS /advanced cardiac life support/

D - drugs and fluids

E - ECG

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

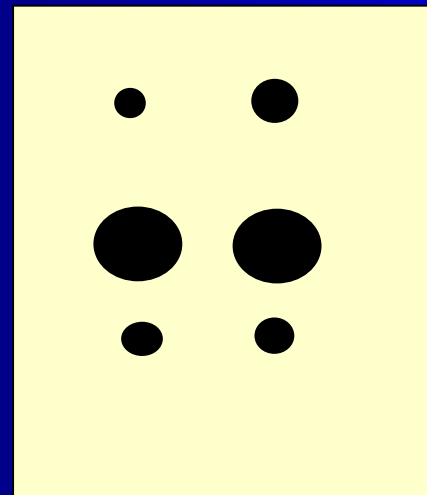


# Response – Evaluation of consciousness

- **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
- **expired gas** - free airway
- frequency

### Skin color:

- pink
- cyanotic

### Signs of airway obstruction

# Breathing

- tidal volume
- inspiration 1s. insp. exp. ratio 1:1
- frequency 10/min.
- $V_t$  600 ml
- ? movement of chest, expiration



## 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)



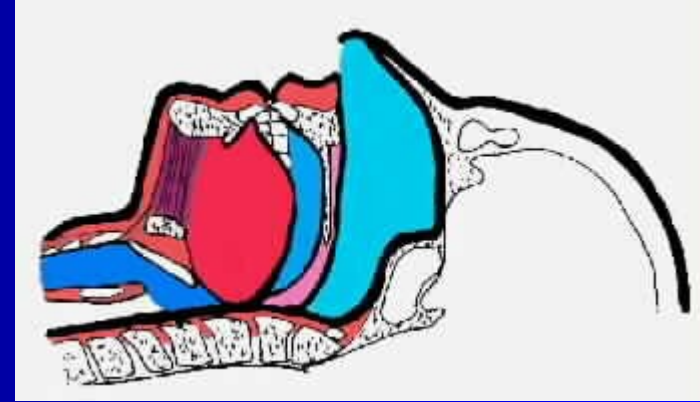
# Airway

Problem = obstruction

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

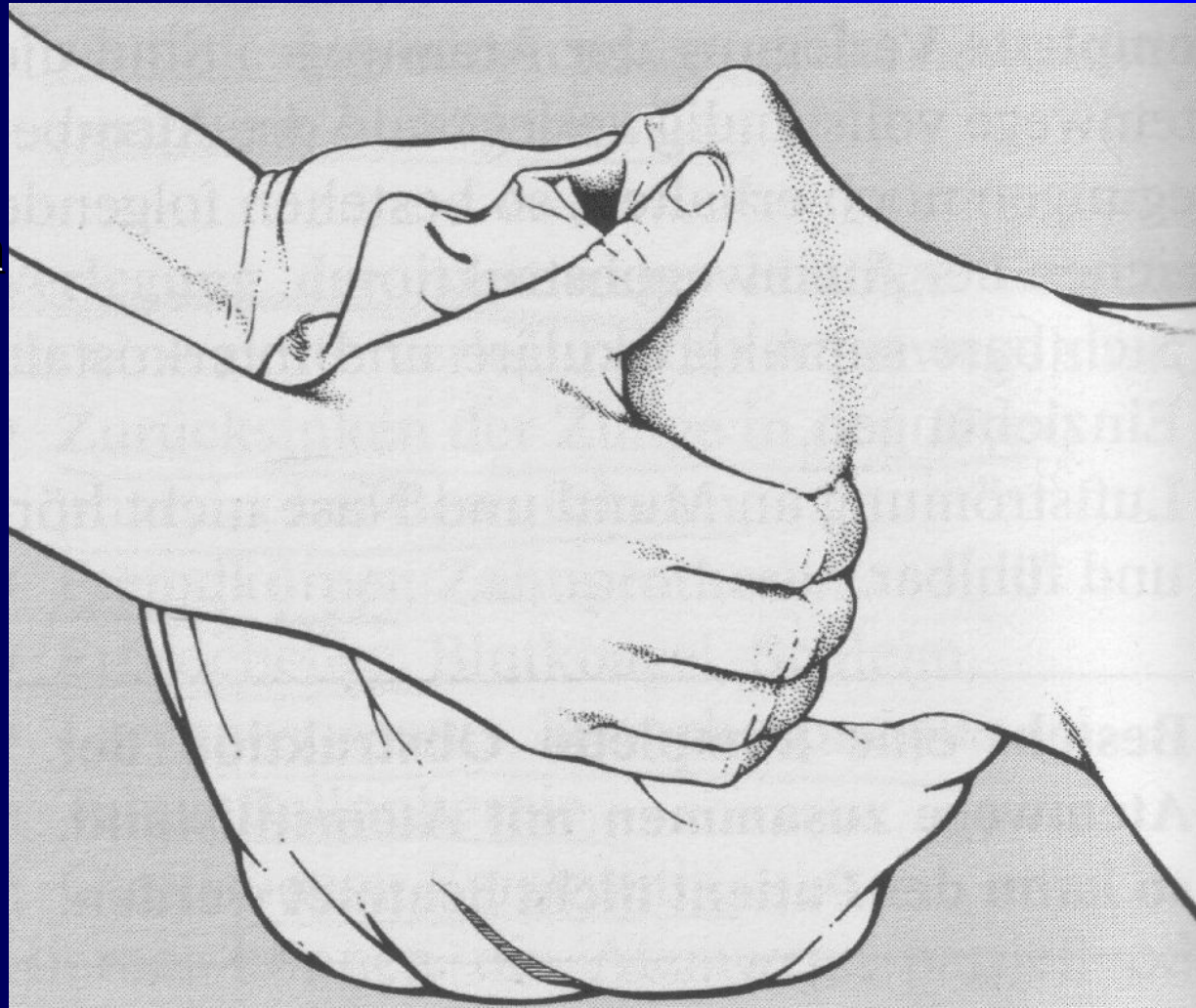
Solution:

- head tilt-chin lift
- airway
- laryngeal mask
- combitube
- intubation
- cricothyrotomy

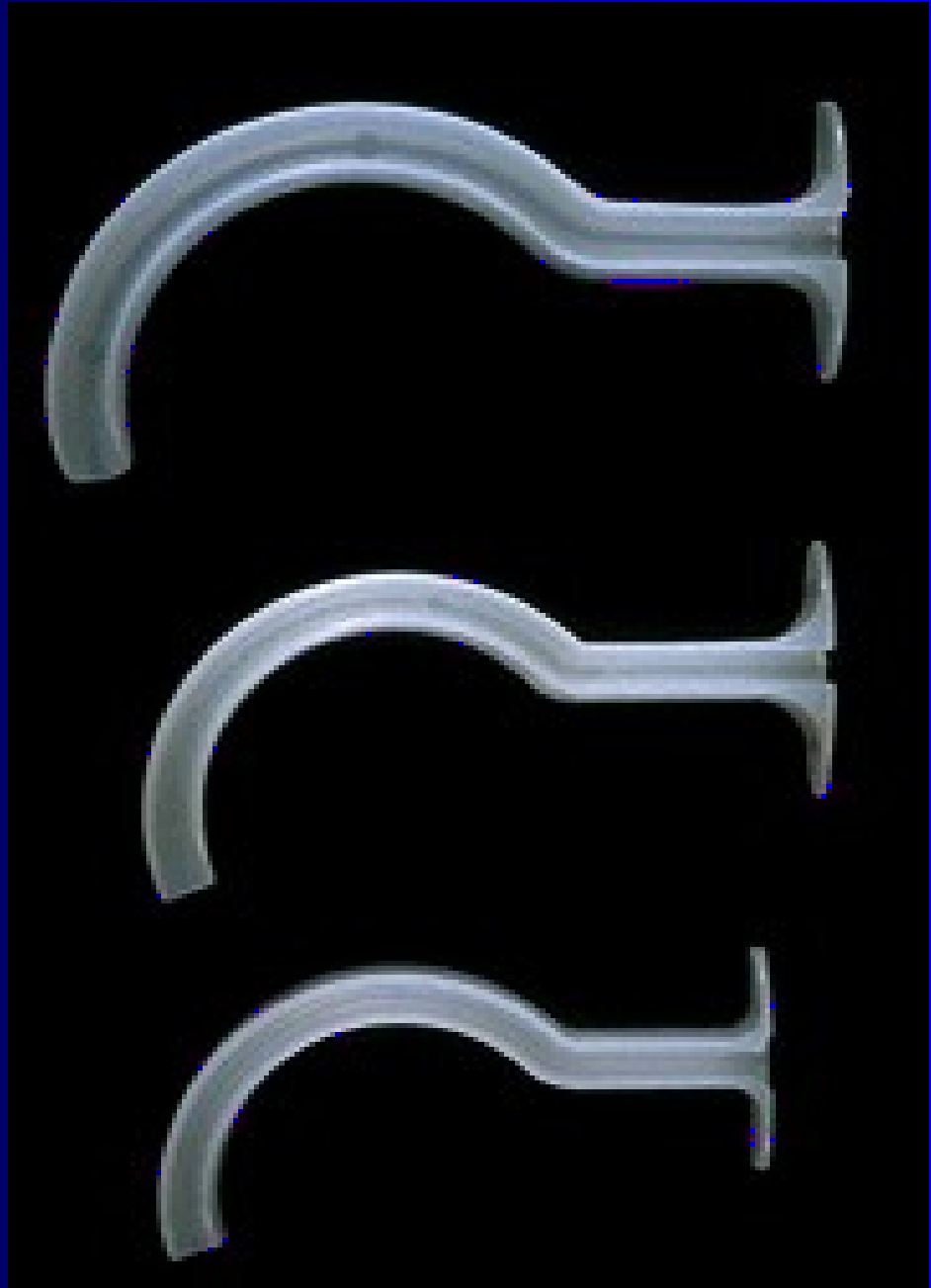


## Esmarch:

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



# Airway



LM

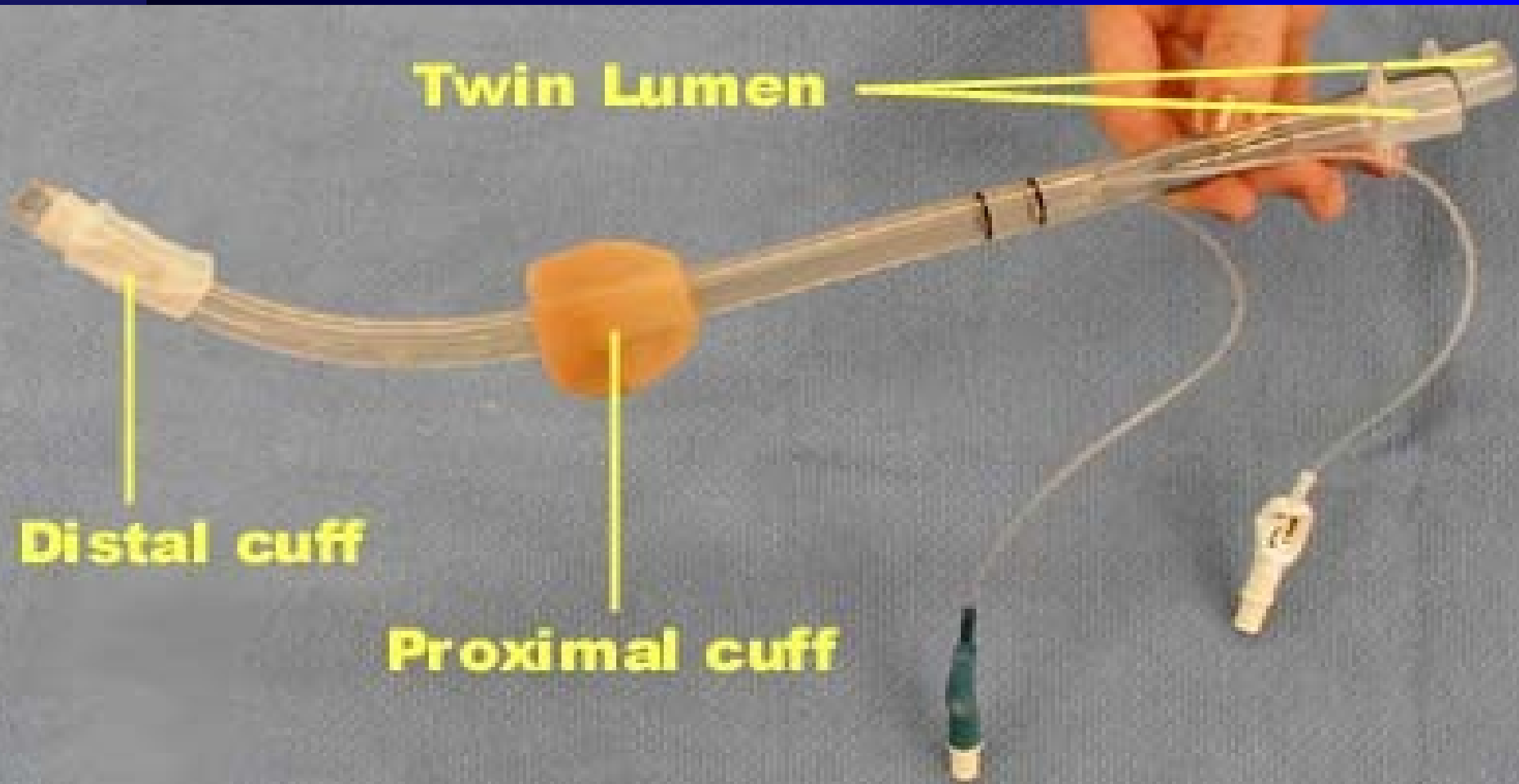


# Combitube

**Twin Lumen**

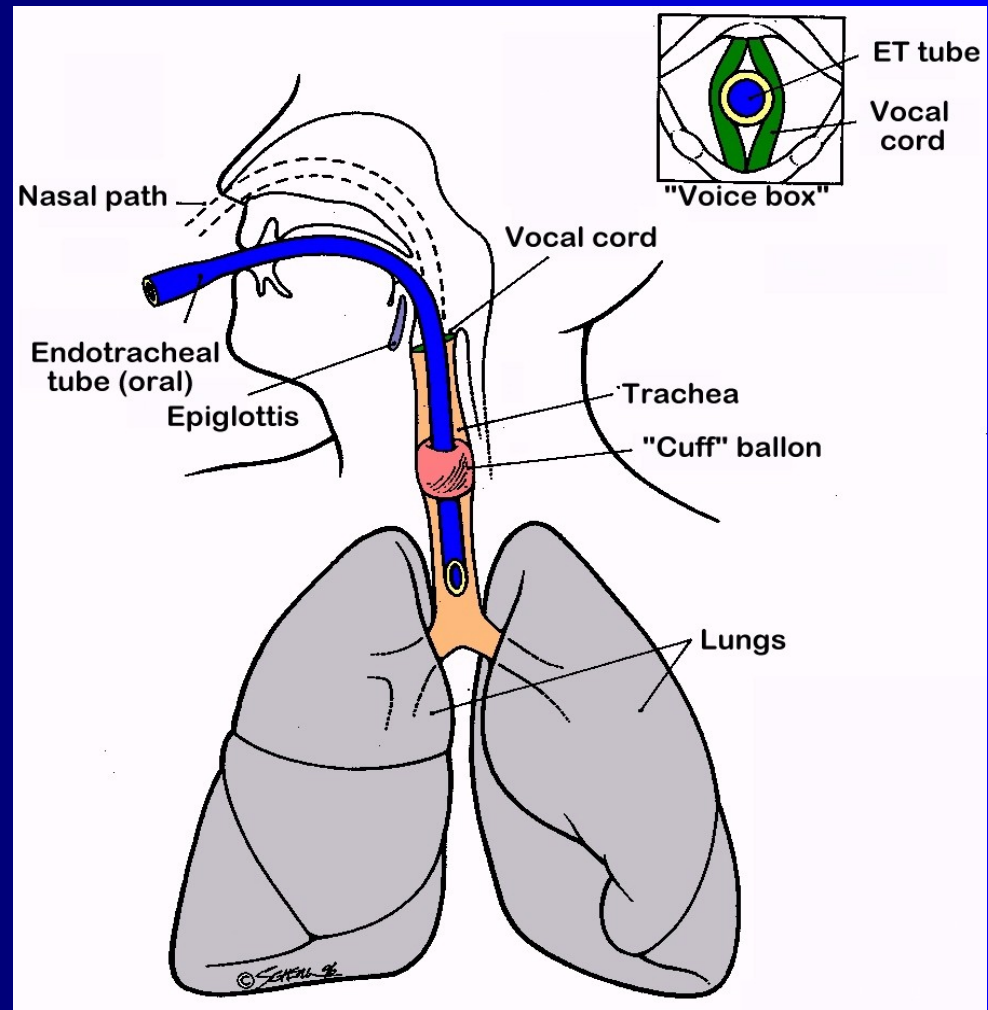
**Distal cuff**

**Proximal cuff**



# Intubation

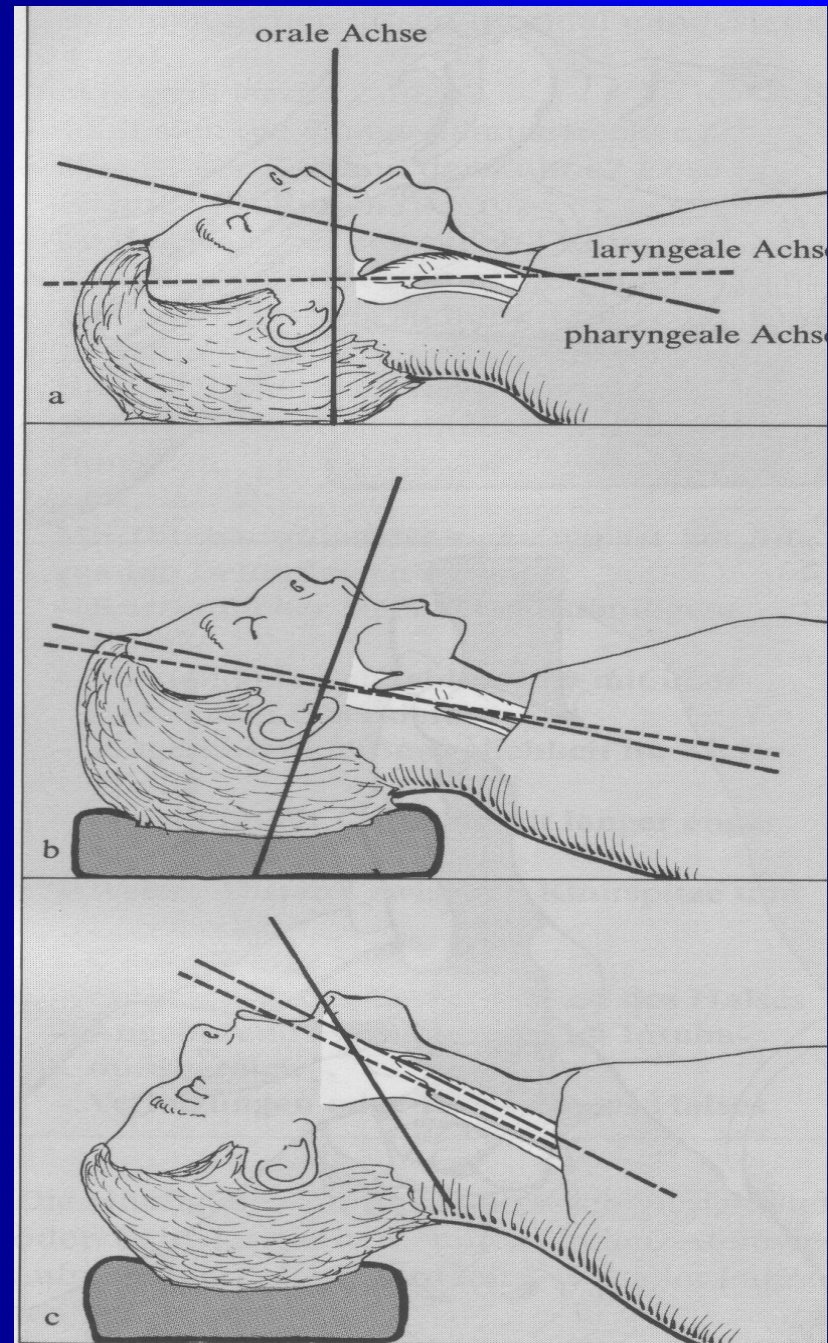
- Laryngoskope
- Magill pincers
- tracheal tubes
- Introducer
- syringe
  
- broncho-  
fibroskopscope



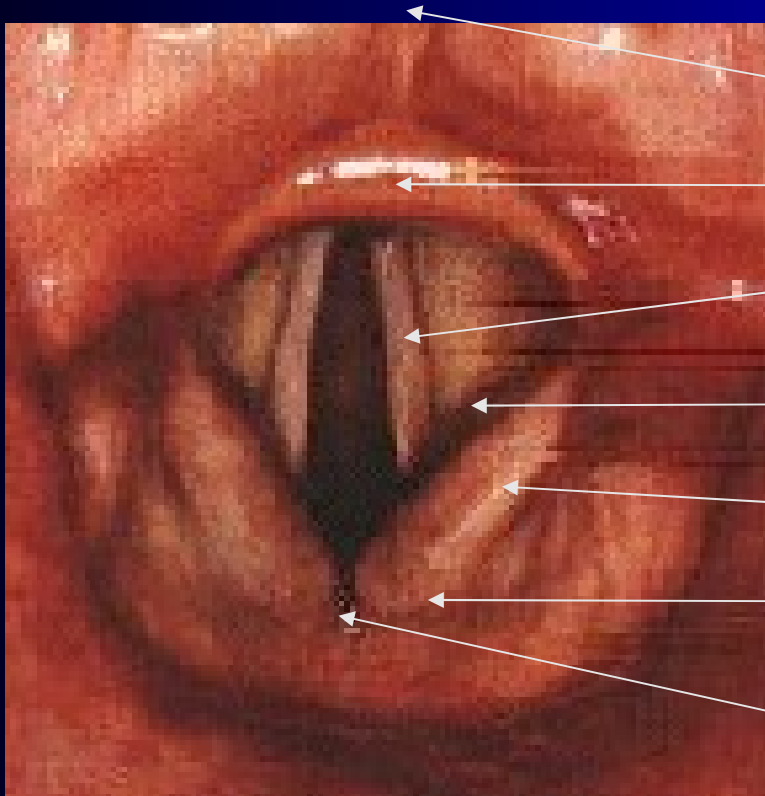


# Intubation:

- 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

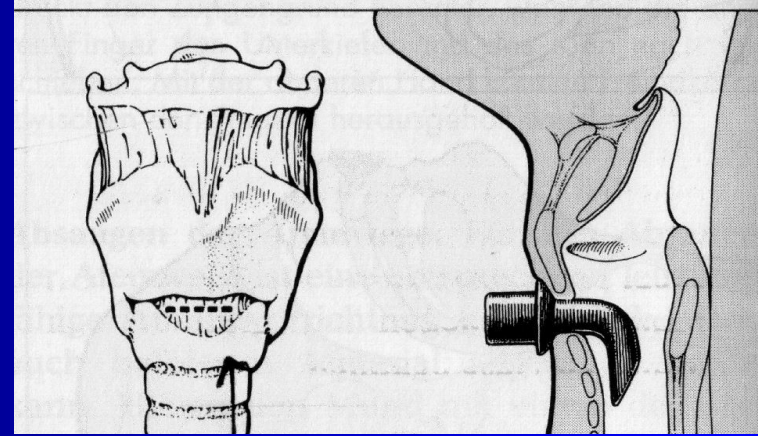
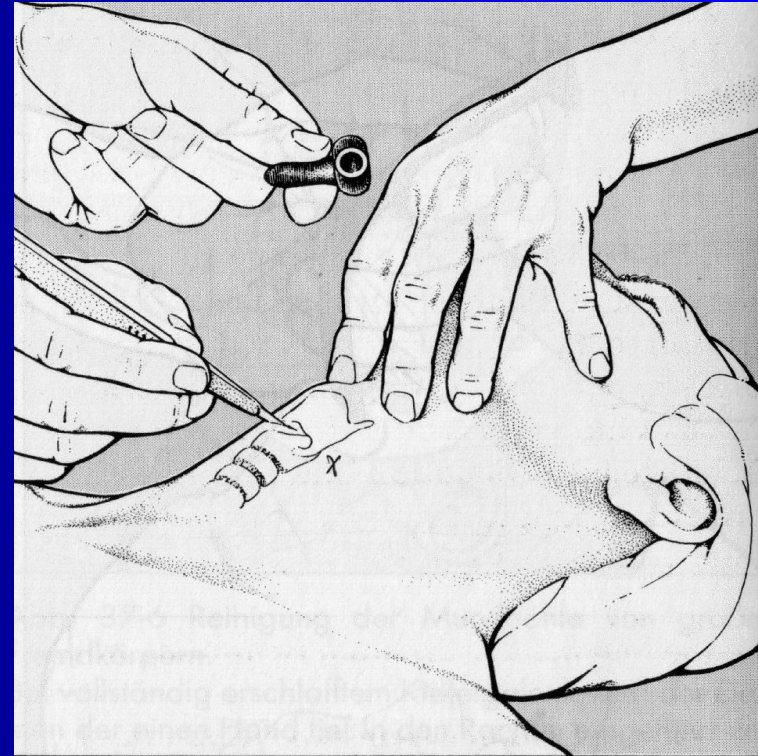
tuberculum corniculatum

zadní komisura



# Coniotomy

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



## B – breathing

## ACLS

positive pressure ventilation

- bug („ambu“), holding mask by 1 or 2 hands
- (ventilator – Volume Control Ventilation)
- 6 ml/kg; 10/min,  $fiO_2$  100%
- ACLS 2 breaths
- inspiration 1ratio – 2 : 30 - ventilated by mask  
no ratio = 10 : 100 – advanced airway
-

# Oxygen

- as high  $FiO_2$  as possible
- Hypoxia and acidosis contra effectiveness of electric and farmakologic therapy

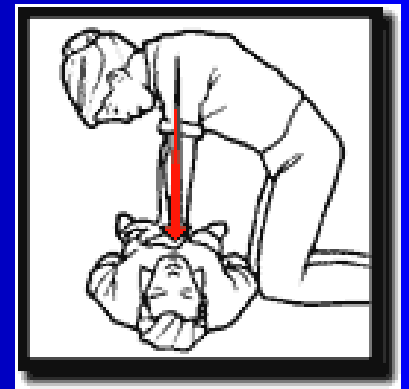
# Top-less CPR

- 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

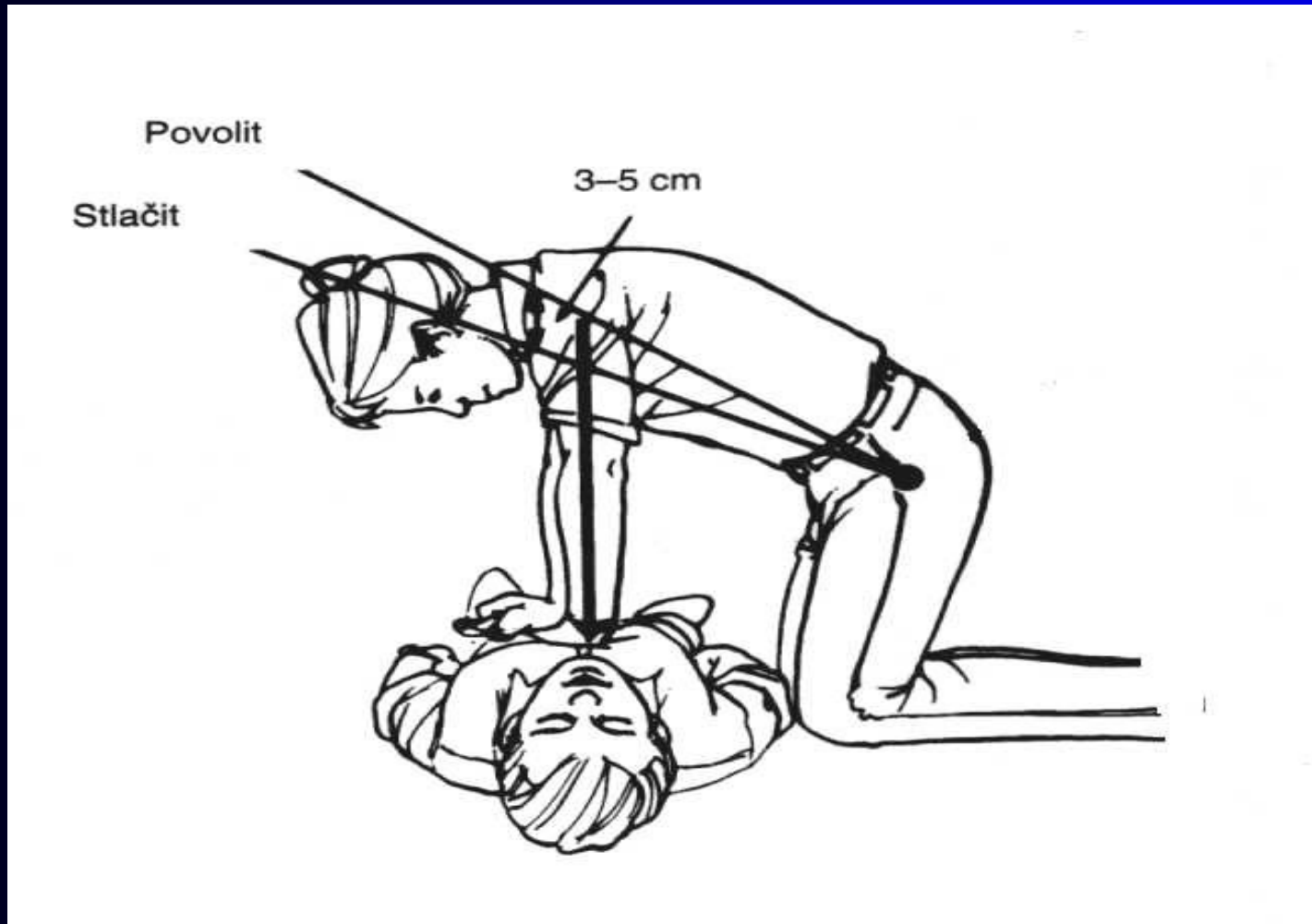
- a. carotis communis
- a. femoralis

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. Endotracheal – ONLY 4:

- adrenalin
- atropin
- naloxon • **2 – 2,5 x higher dose than i.v.**
- lidokain • **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  $\beta$  activity – no effect on consumption of O<sub>2</sub> in  
heart

„long“ halftime - 20 min.

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

D: 40 j (1x)

# „D“ Atropin

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

# Amiodarone (CORDARONE)

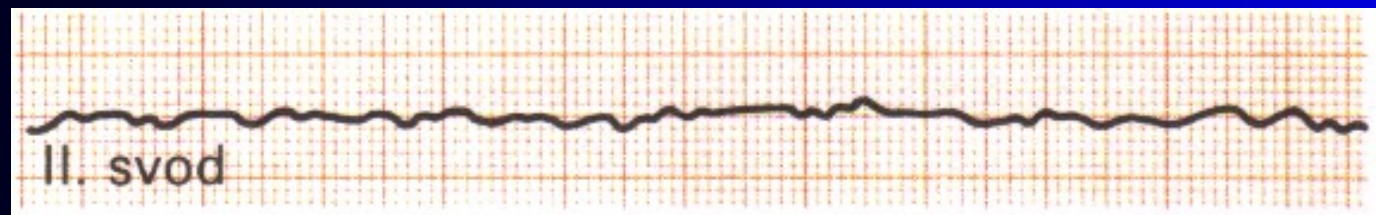
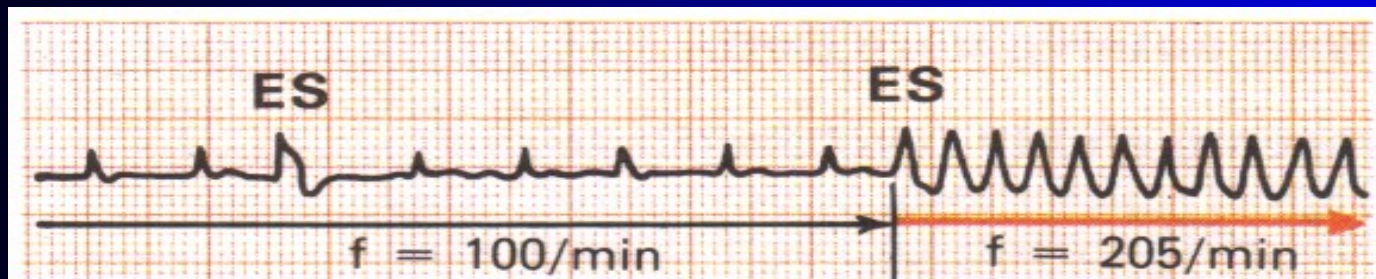
- antiarytmic drug

I:

- recurrent 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**

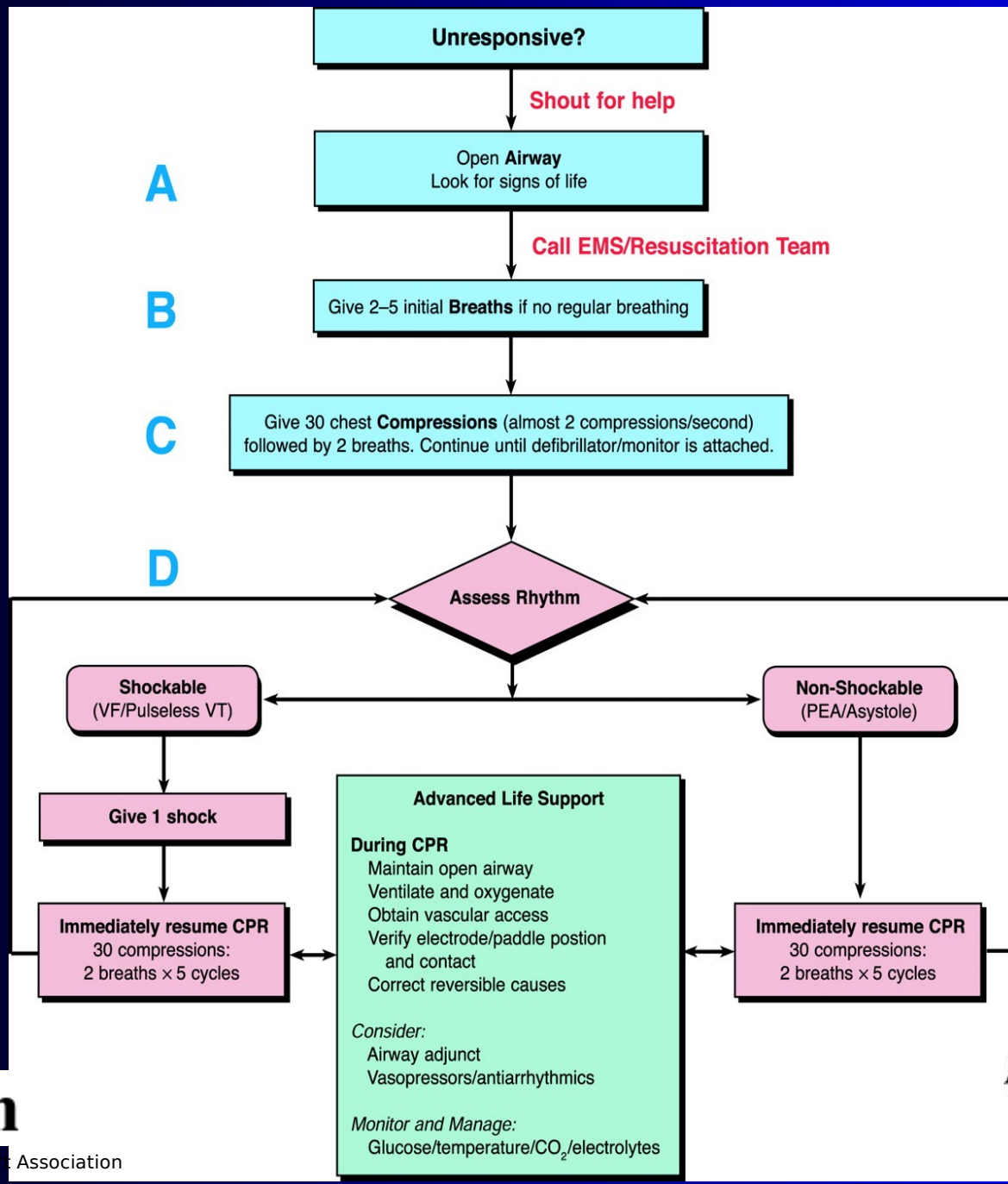
# Fluids

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

## Types:

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

# ILCOR Universal Cardiac Arrest Algorithm (AHA)



Unresponsive ?

Open airway  
Look for signs of life

Call Resuscitation Team

CPR 30:2  
Attach defibrillator/monitor

Assess rhythm

Shockable  
(VF / pulseless VT)

1 Shock  
150-360 J biphasic  
or 360 J monophasic

Immediately resume  
CPR 30:2 for 2 min

Non-Shockable  
(PEA / Asystole)

Immediately resume  
CPR 30:2 for 2 min

**During CPR:**

- Correct reversible causes\*
- Check electrode position and contact
- Attempt / verify: IV access  
airway and oxygen
- Give uninterrupted  
compressions when airway  
secure
- Give adrenaline every 3-5 min
- Consider: amiodarone,  
atropine, magnesium

\*Reversible causes

Hypoxia  
Hypovolaemia  
Hypohyperkalaemia/metabolic  
Hypothermia

Tension pneumothorax  
Tamponade, cardiac  
Toxins  
Thrombosis (coronary or pulmonary)



# 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<sup>+</sup> acidosis**
- **Hyper/hypocalcemia**
- **Hypothermia**

# PEA - reasons:

- „**T**ablets“ (overdose)
- **C**ardiac **T**amponade
- **T**ension pneumothorax
- **T**rombosis of C.a.
- **T**rombosis of a.pulm. (embolie)

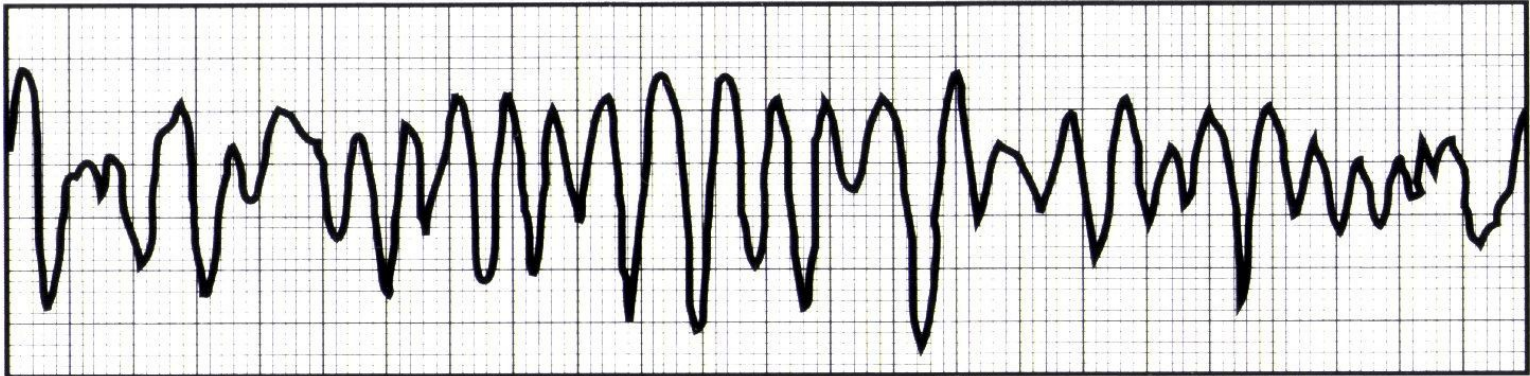


# Pulseless electrical activity are guided by the letters P-E-A

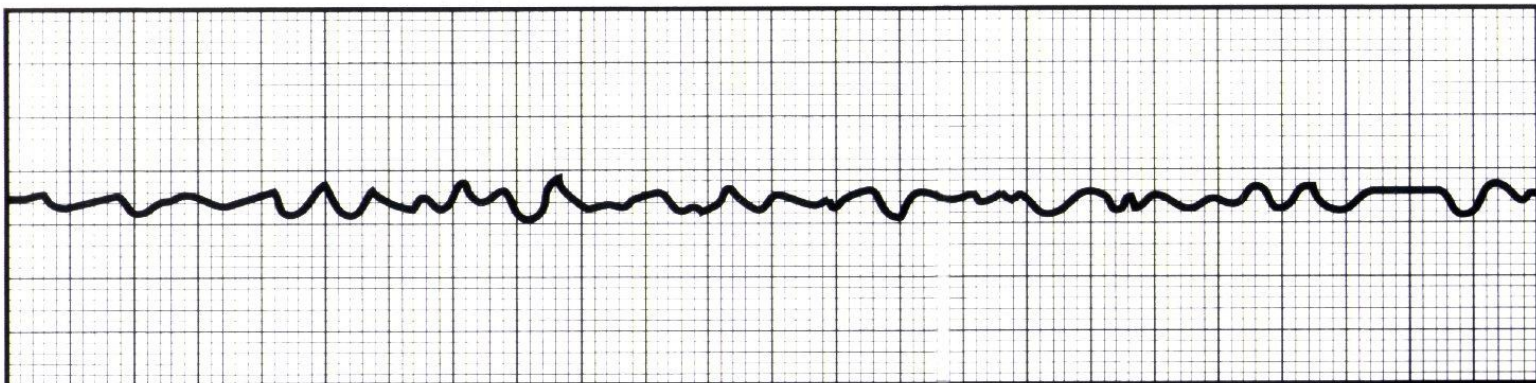
- Problem (H, T)
- Epinephrine
- Atropine

# 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 thump)
- Shock 200J bifasic / 360J mono
- EVerybody = Epinephrine / Vasopressin
  
- And = Amiodarone
- Let's = Lidocaine
- Make = Magnesium
- Patients = Procainamide
- Better = Bicarbonate

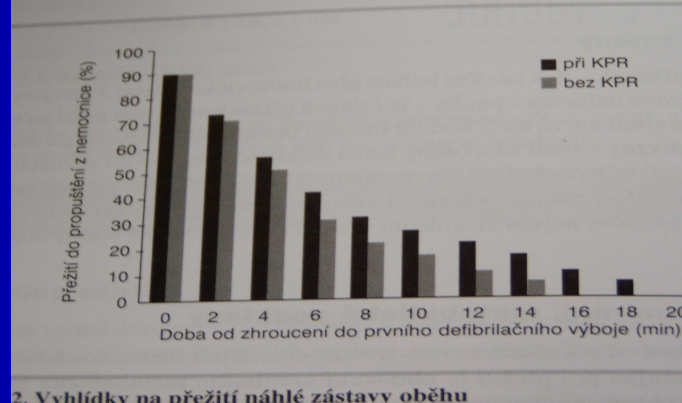
# VF

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

**(Vazopresin 40 j (1x))**

- **Antiarhythmic: 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

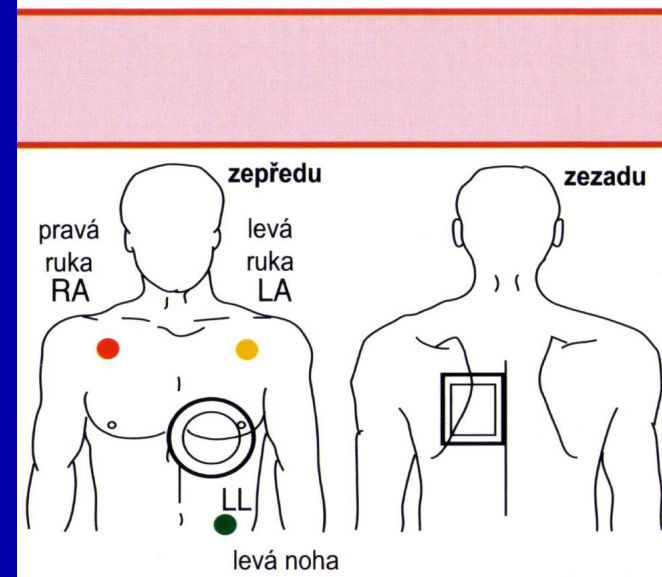
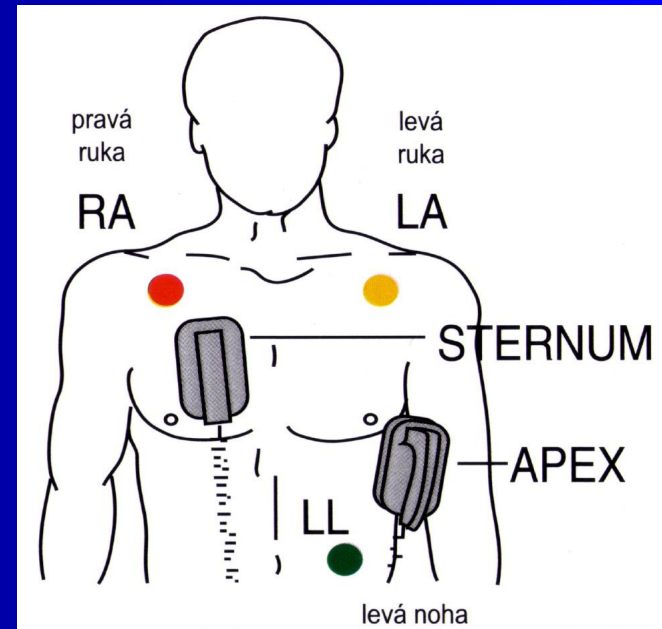
360 J

biphasic shock

200 J

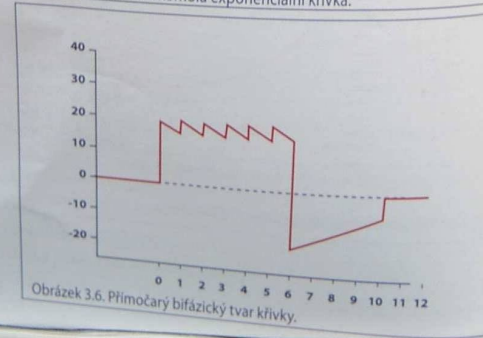
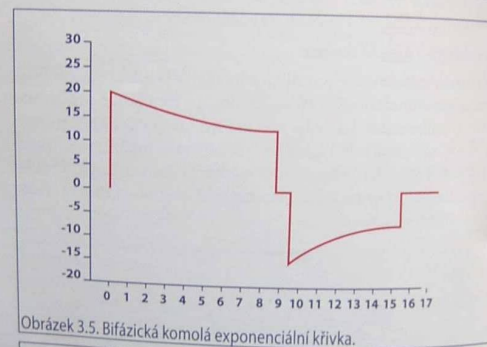
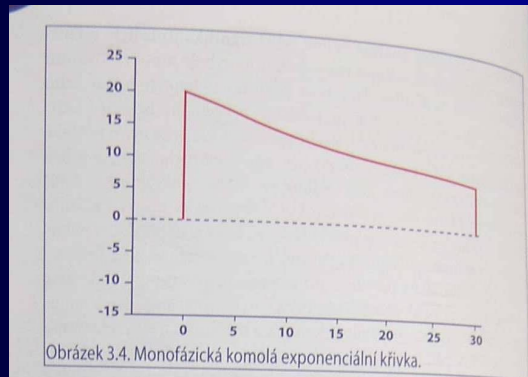
internal shock

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