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.

Efectiveness of ACLS

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

Evaluation of CPR

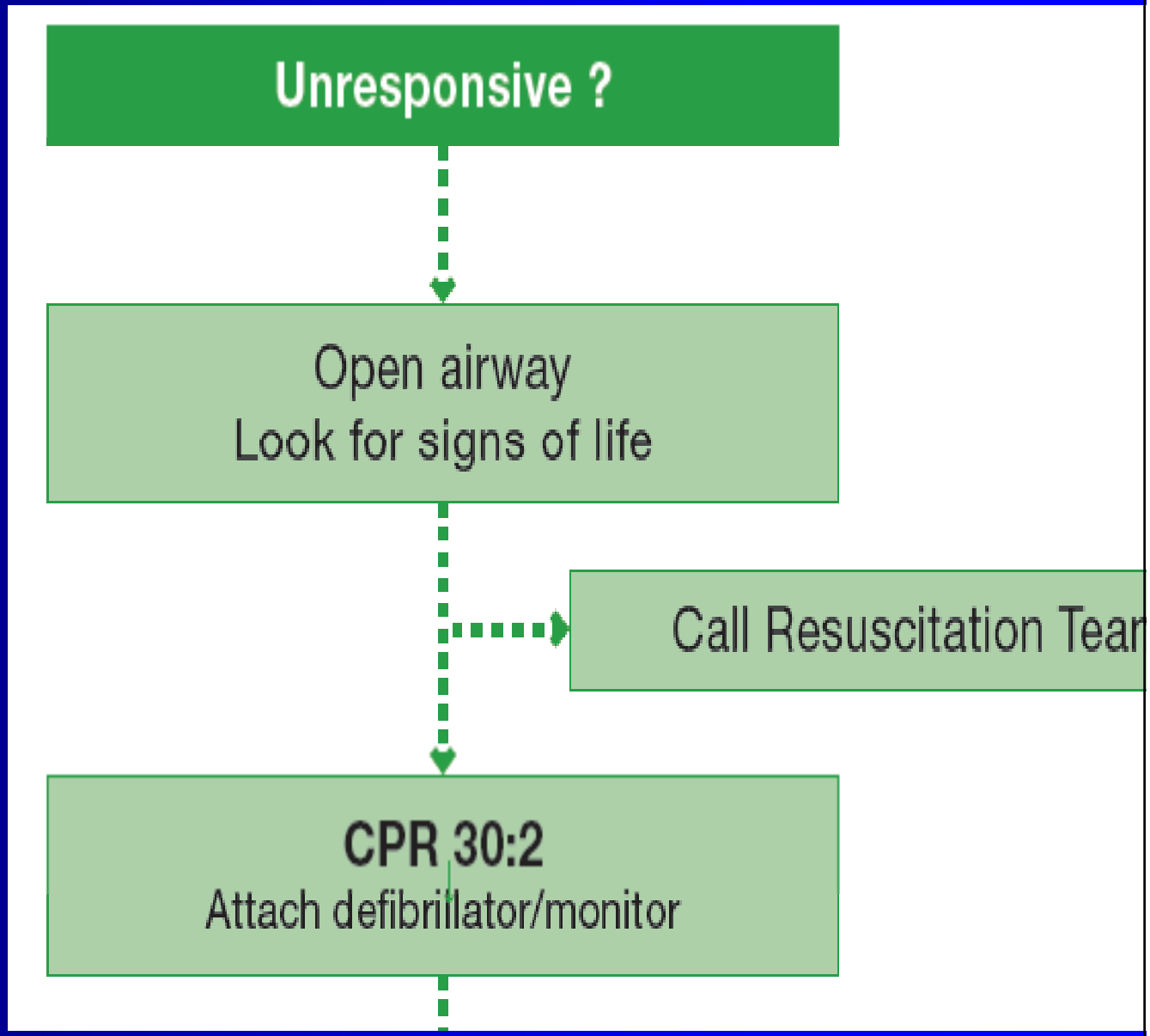
- **resumption of circulation**
- **Successful CPR - sociologic aspect - return to taxpayer**

Basic Life Support 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 - fibrilation treatment

Advanced Cardiac Life Support

= BLS +

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

Danger

Danger

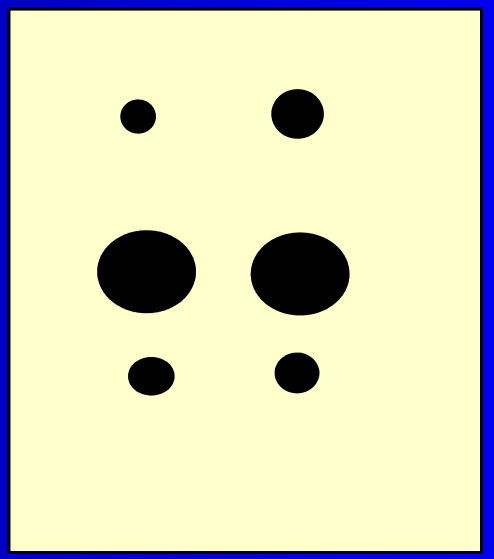
- Location:
  car, fire, gas, ...
- Biologic – bld of victim

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
- expirated gas - free airway
- frequency

Skin color:

- pink
- cyanotic

Signs of airway obstruction

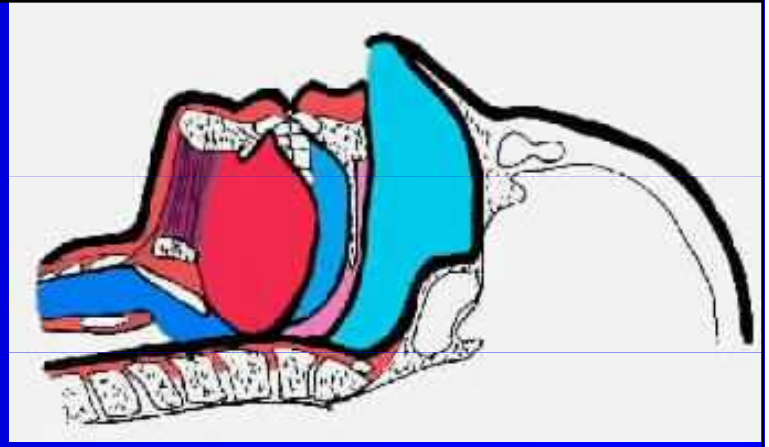
Breathing

- haed titl
- inspiration 1s. insp. exp. ratio 1:1
- frequency 10/min.
- Vt 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

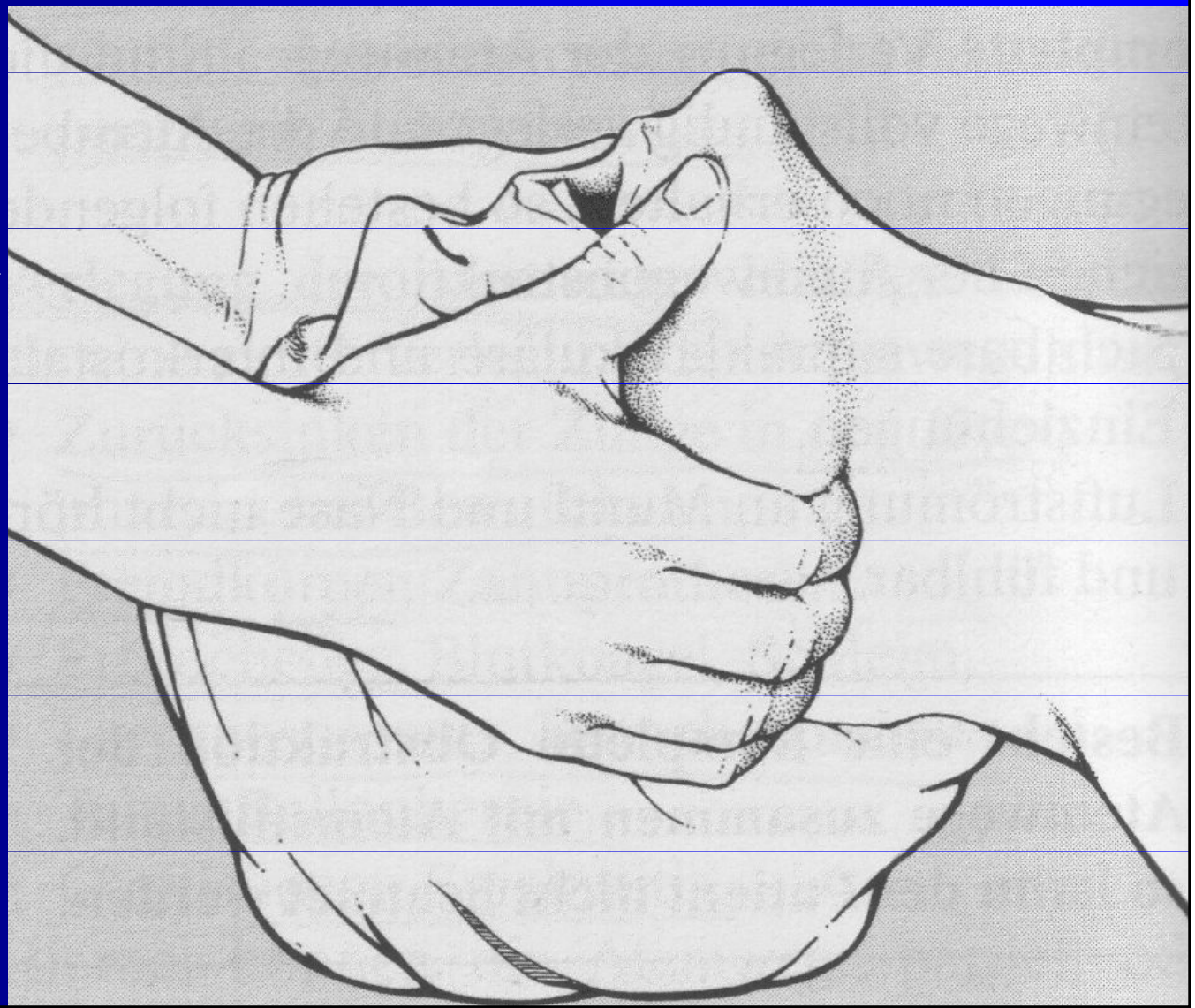
- relaxed tongue and neck muscles in an unconscious person
- forein body

Solution:

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

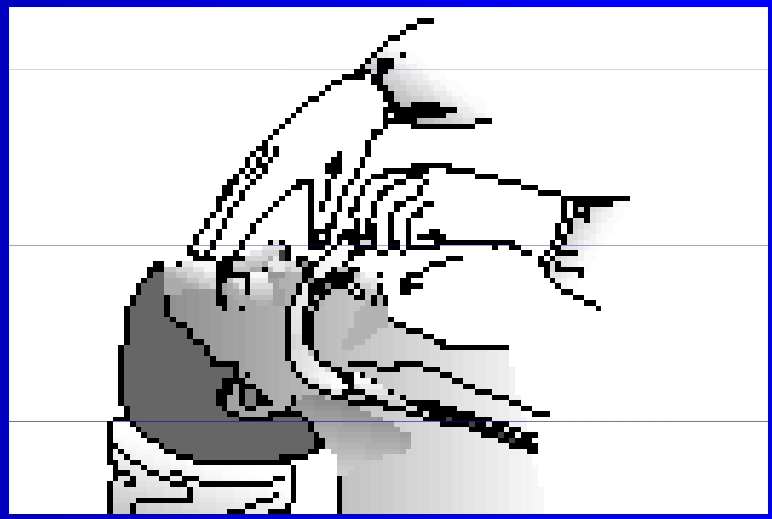
Esmarch:

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

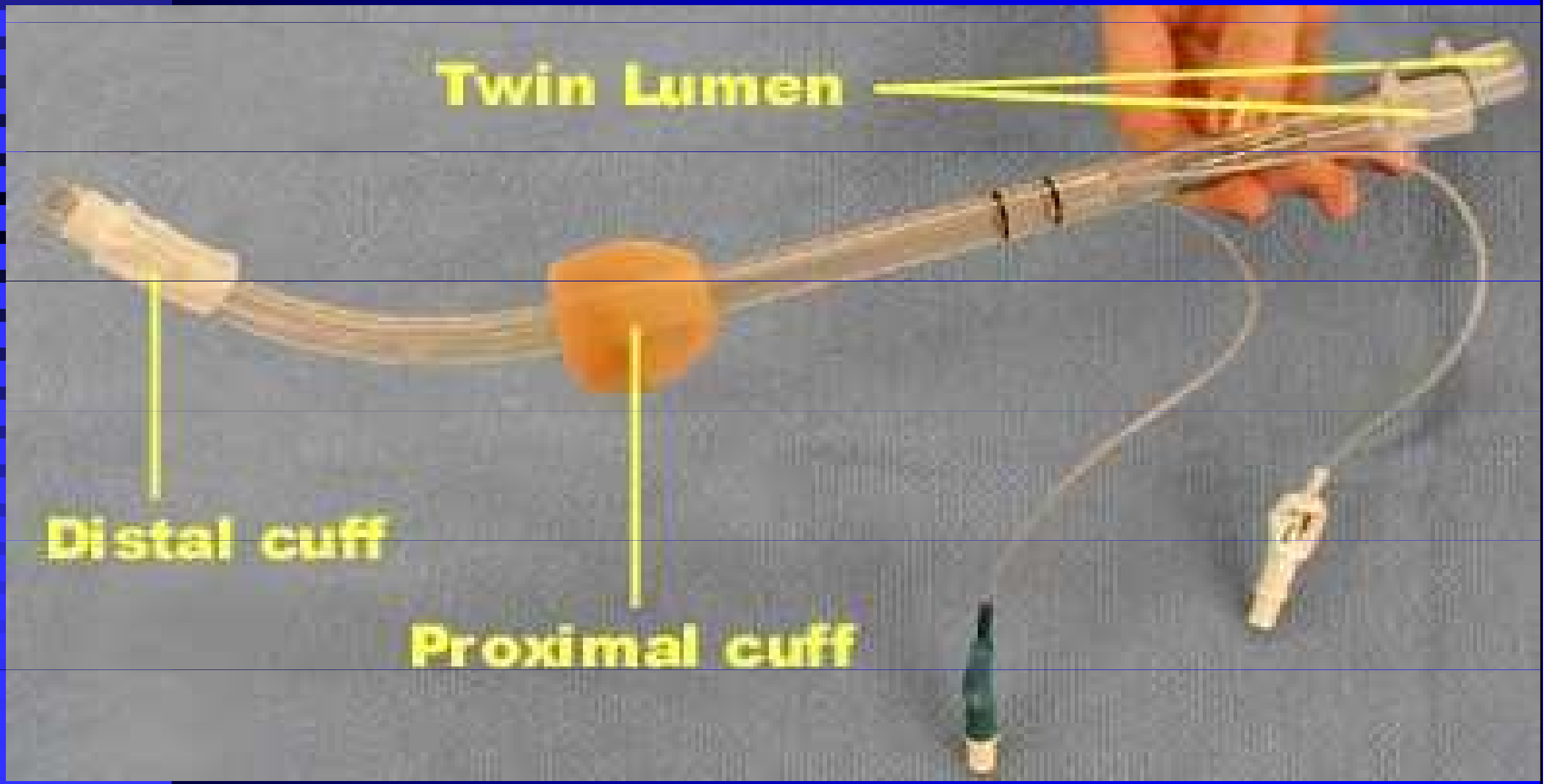


Airway

LM



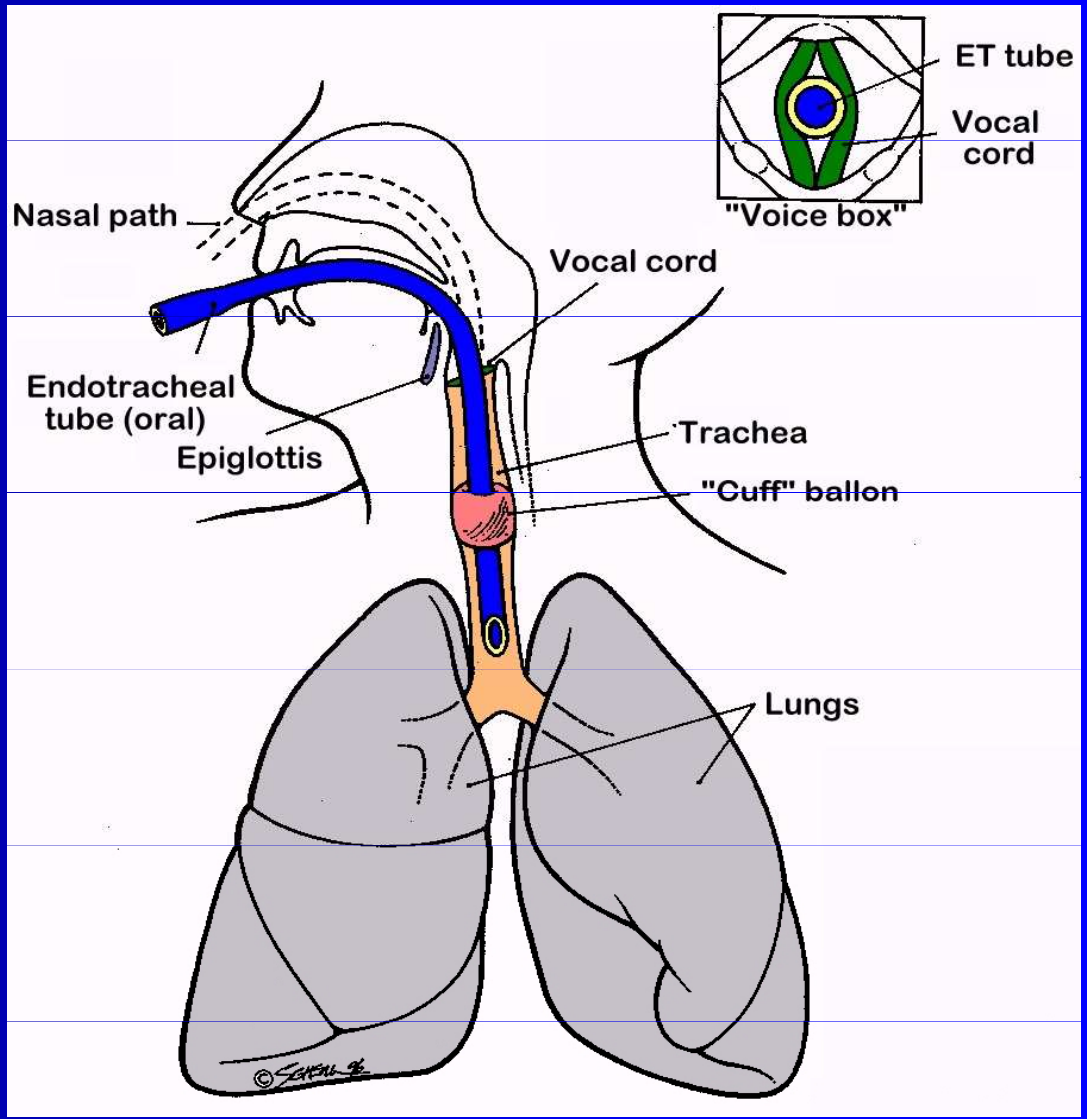
Combitube



Intubation

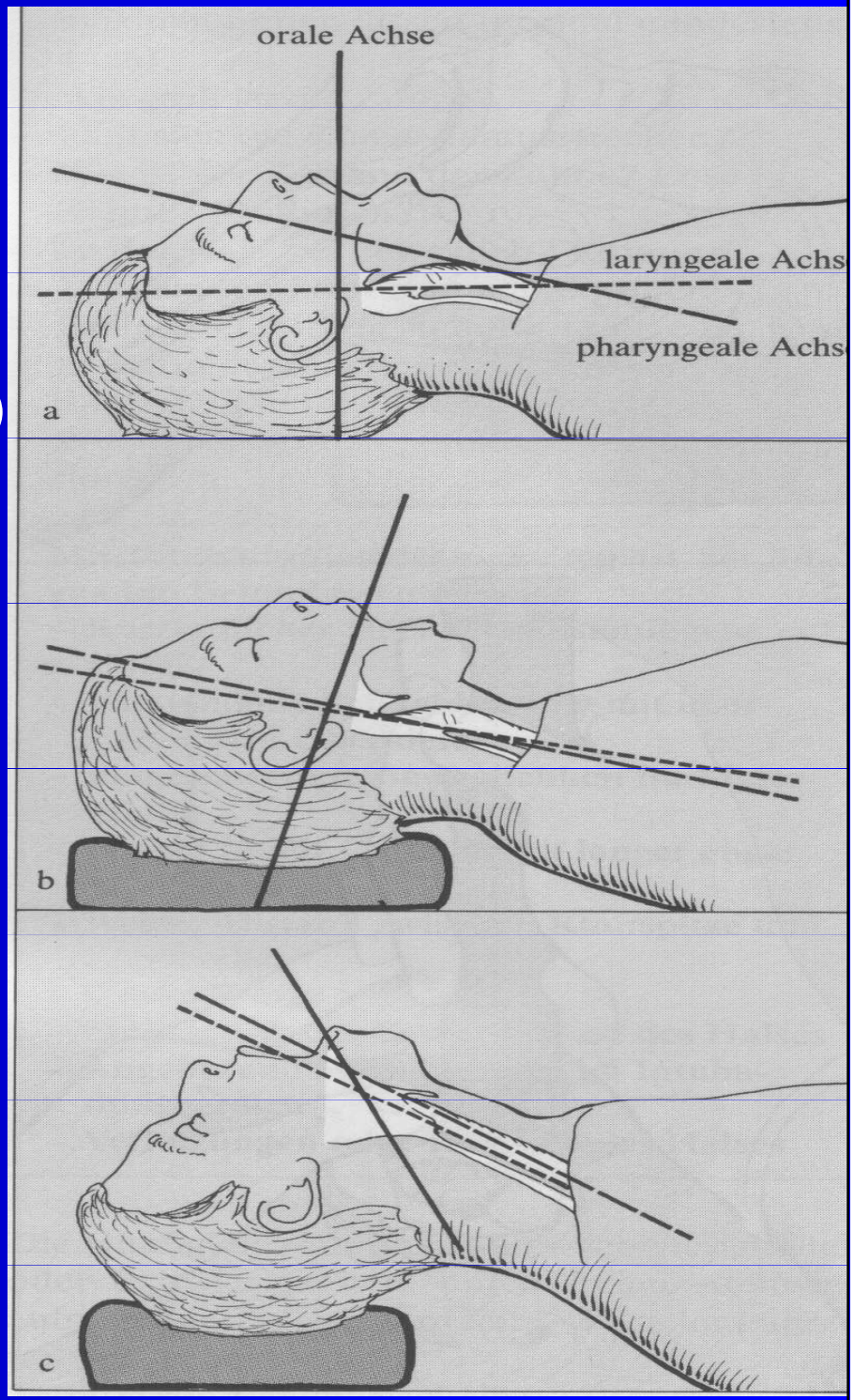
- Laryngoskope
- Magill pincers
- tracheal tubes
- Introducer
- syringe

- broncho-fibroskoscope

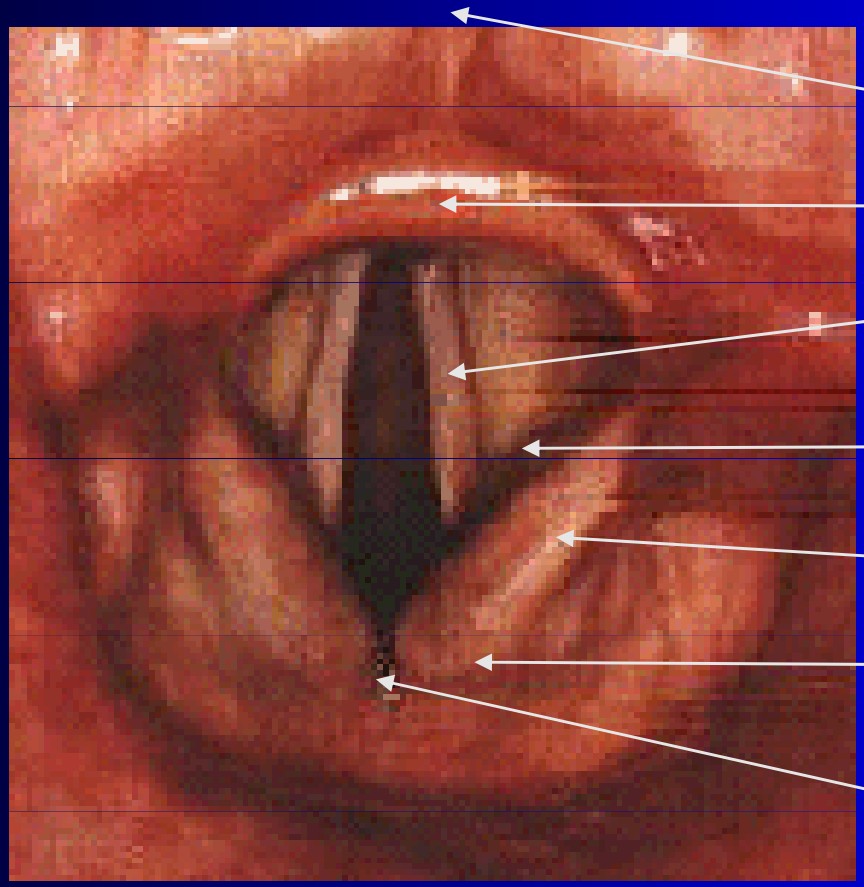


Intubation:

- prepare instruments (ventilate)
- position of patient
- (Anaest. / unconsciousness)
- direct laryngoscopy
- introduce Trach. tube
- fill baloon
- check possition
- fix tube



direct laryngoscopy - view:



tonque

epiglotis

vocal cords

recessus piriformis

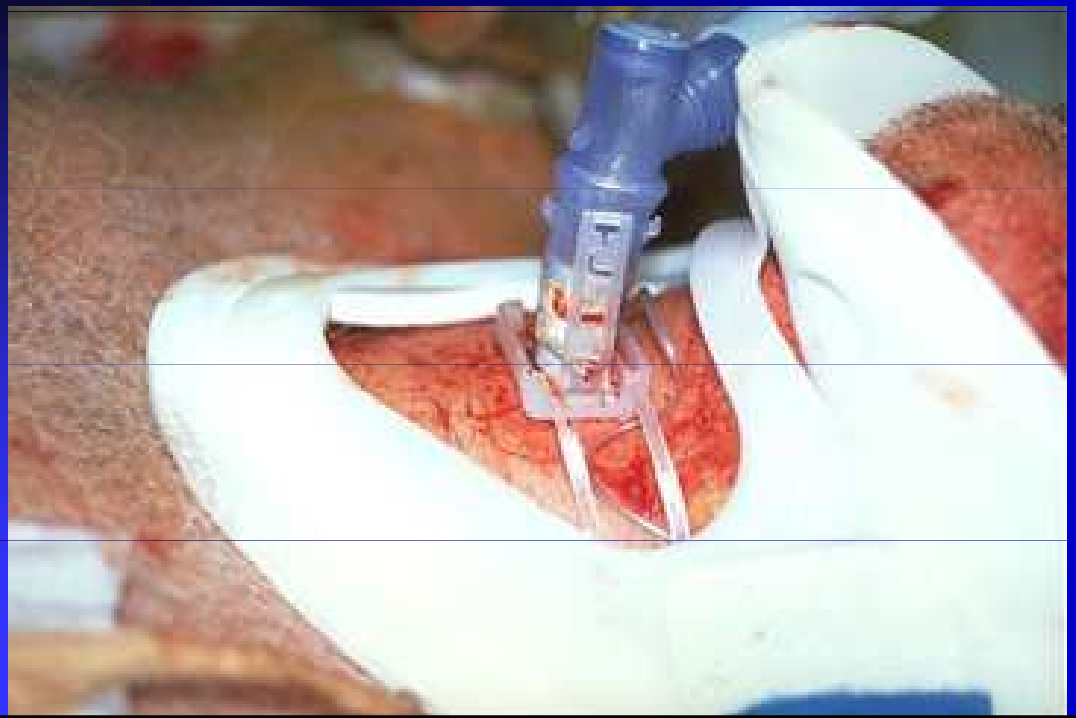
plica aryepigottica

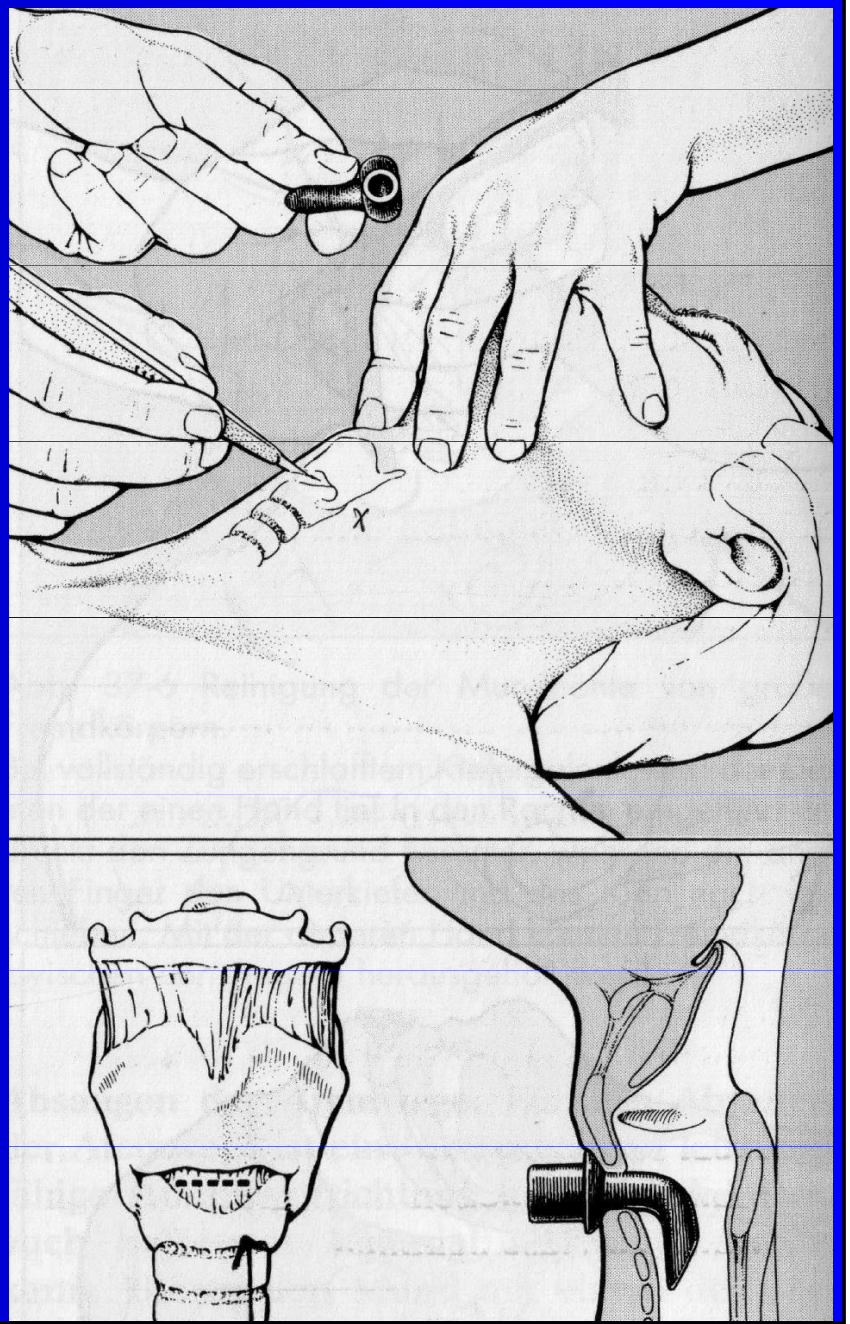
tuberculum corniculatum

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; 10/min, fiO2 100%
- ACLS 2 breaths
- inspiration 1sratio – 2 : 30 - ventilated by mask
  no ratio = 10 : 100 – advanced airway
-

Oxygen

- as high FiO2 as possible
- Hypoxia and acidosis contra efectivness of elektric and farmakologic therapy

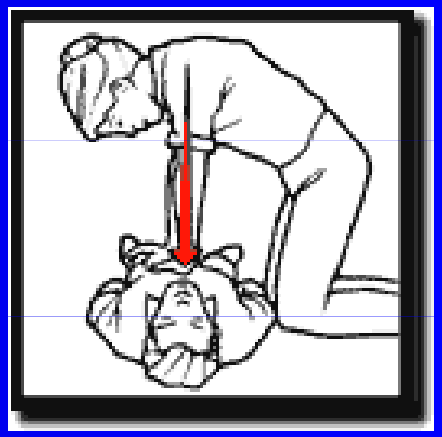
Top-less CPR

- 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 - (capilary 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

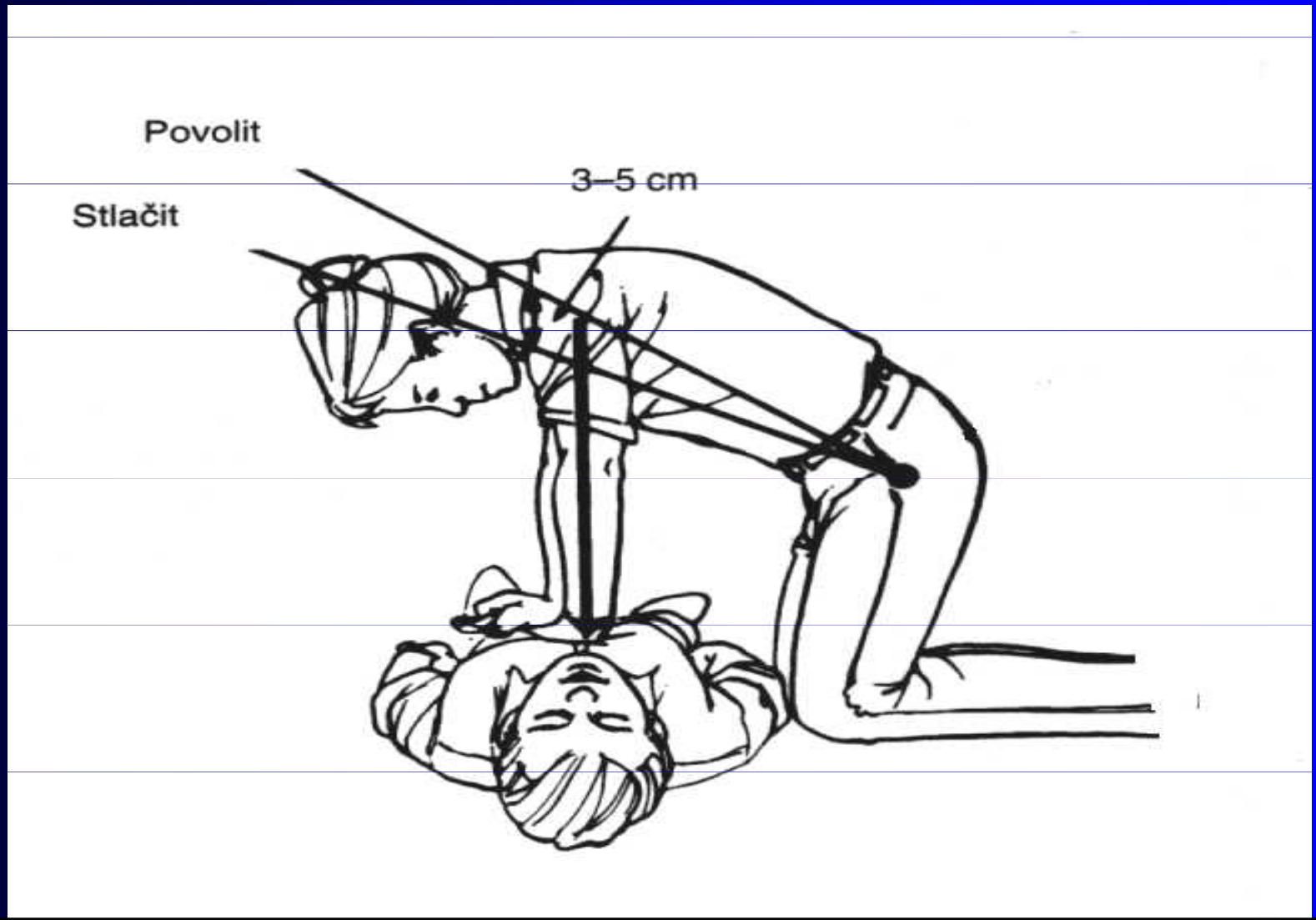
Signs of circulation = pulsations

- 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. Endotrachealy – ONLY 4:
   - adrenalin
   - atropin
   - naloxon
   - lidokain

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

3. (Intraoseal 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 aktivity – no effect on consumption of O2 in heart

„long“ halftime - 20 min.

I: alternativly 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)

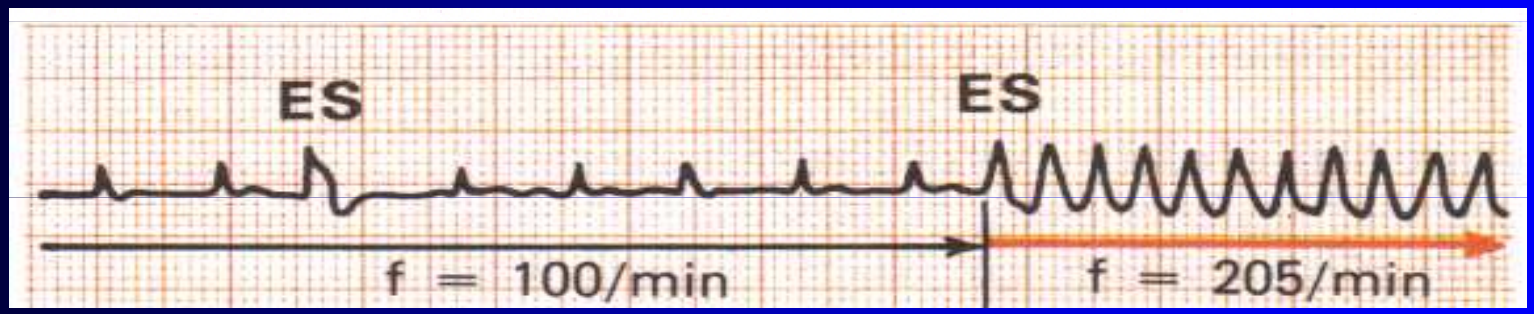
- antiarytmic drug

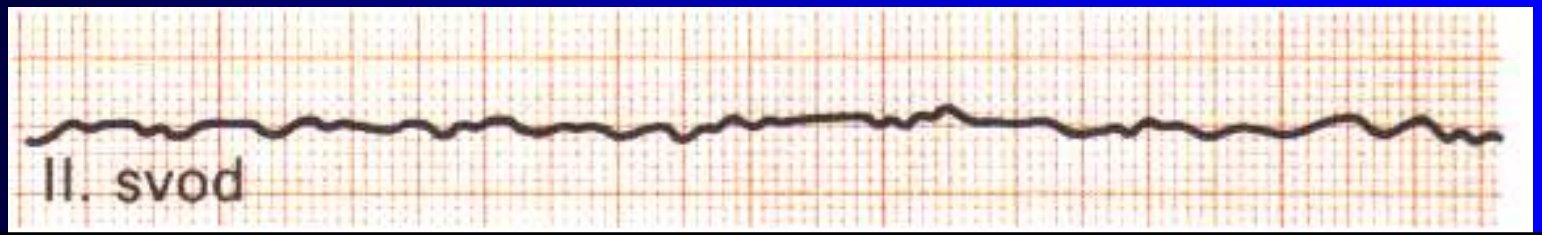
I:

- 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

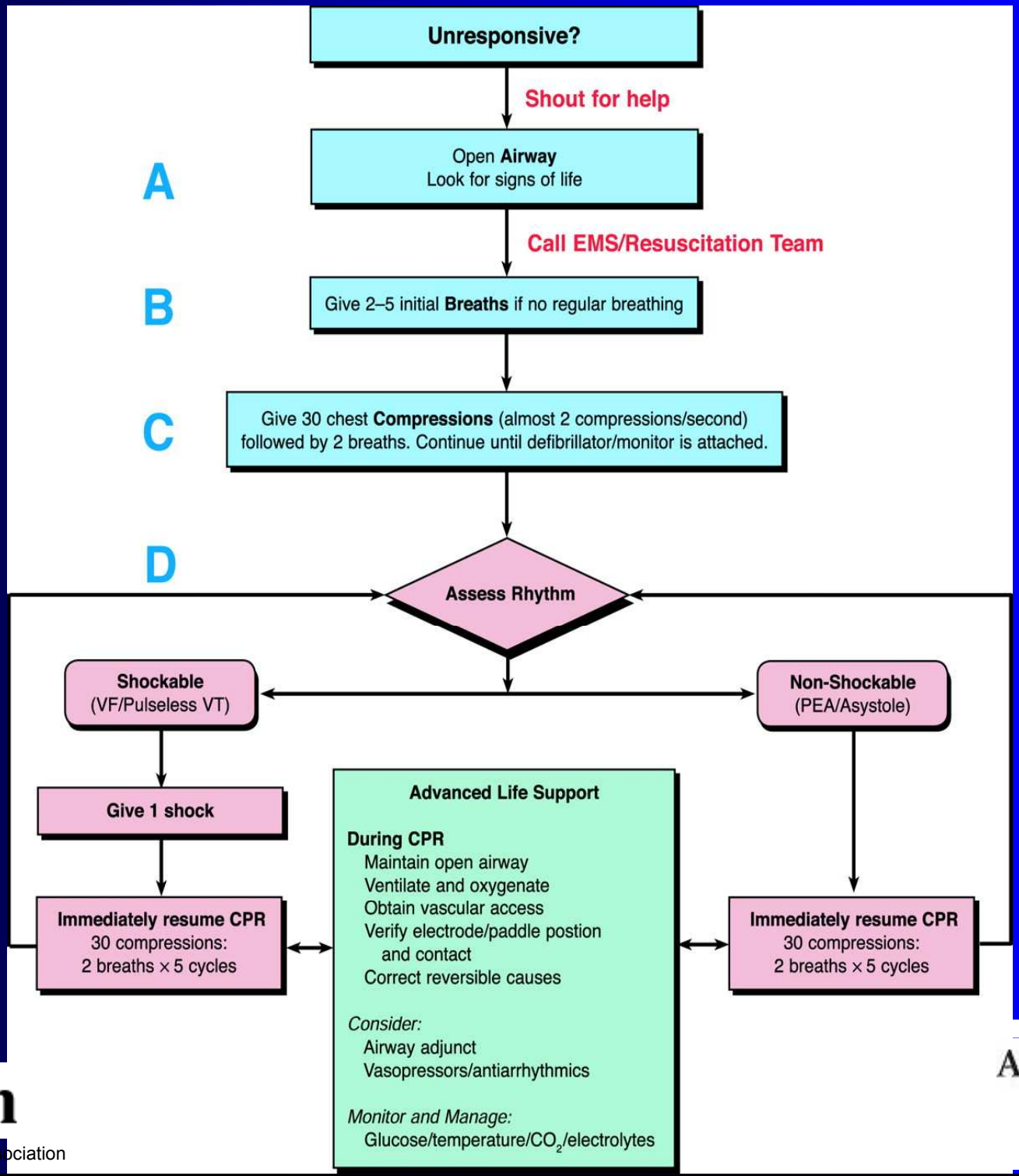
Fluids

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

Types:

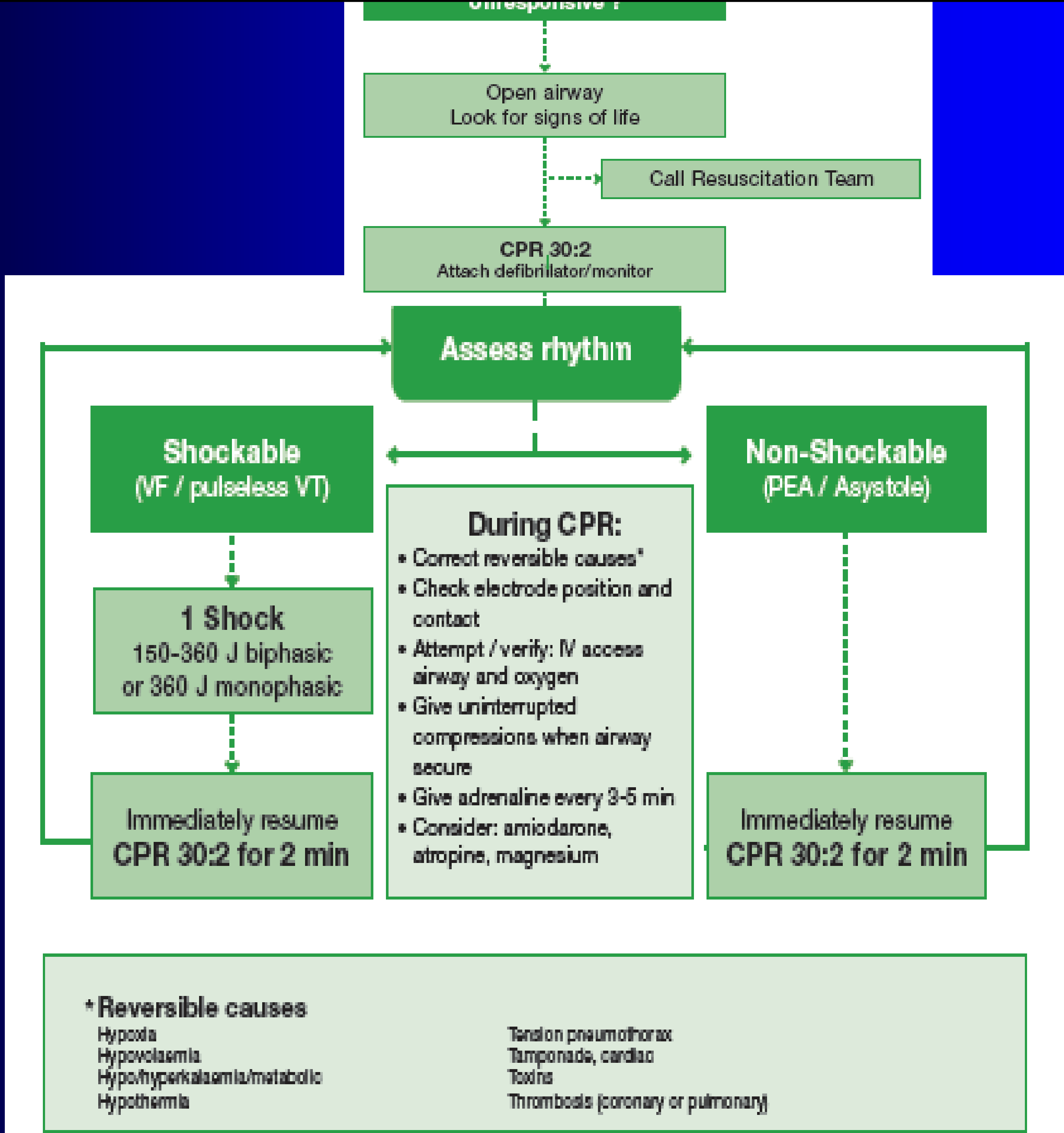
- Crystaloids – Ringer, Hartman, physiol. sol.
- Coloids – Gelatina, HAES = stark
- Glc – do NOT use – wrong neurology result

ILCOR Universal Cardiac Arrest Algorithm (AHA)



Circulation

American Heart Association®
Learn and Live℠



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
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
Non-Shockable
(PEA / Asystole)
Immediately resume
CPR 30:2 for 2 min
*Reversible causes
Hypoxia
Hypovolaemia
Hypo/hyperkalaemia/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+ acidosis
- Hyper/hypocalemia
- Hypothermia

PEA - reasons:

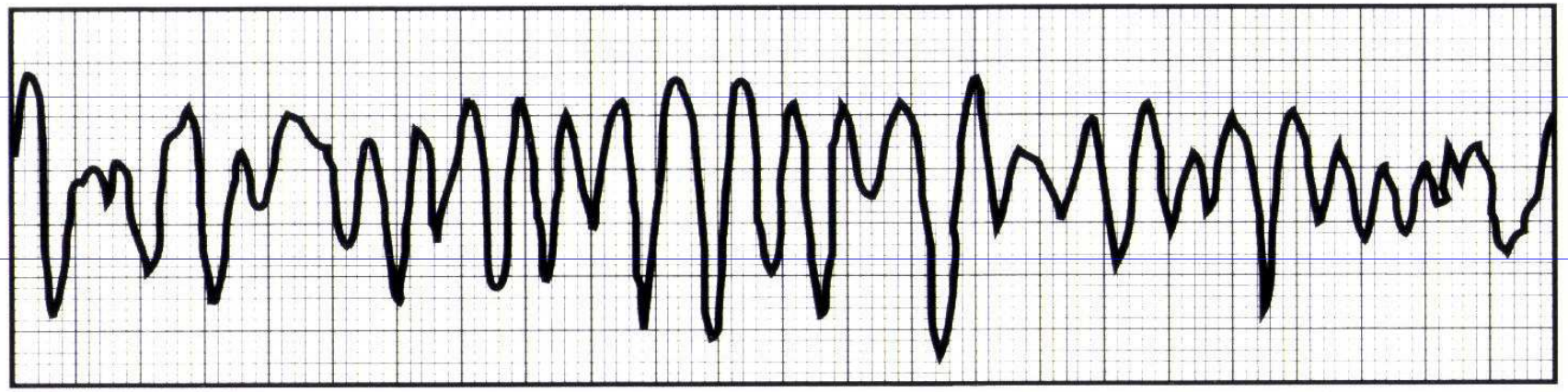
- „**T**ablets“ (overdose)
- **Cardiac T**amponade
- **T**ension pneumothorax
- **T**rombosis of C.a.
- **T**rombosis of a.pulm. (embolie)

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

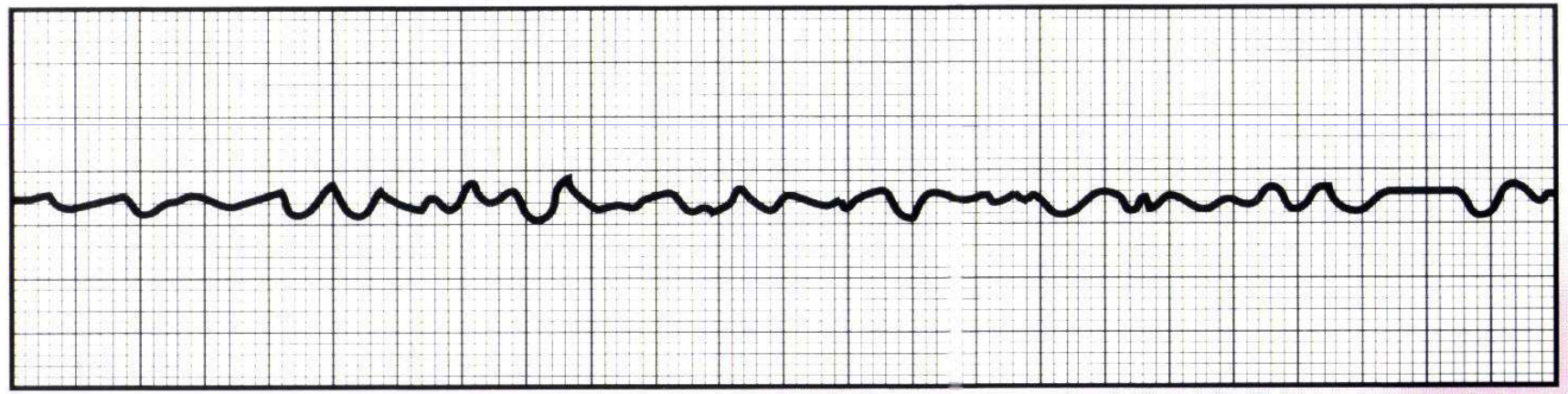
- Problem (H, T)
- Epinephrine
- Atropine

VENTRICULAR Fibrillation

Hrubovlnná komorová fibrilace



Jemnovlnná komorová fibrilace



Ventricular fibrillation

- electrical instability of heart muscle (ischemia, hypothermia)

sings:

- 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

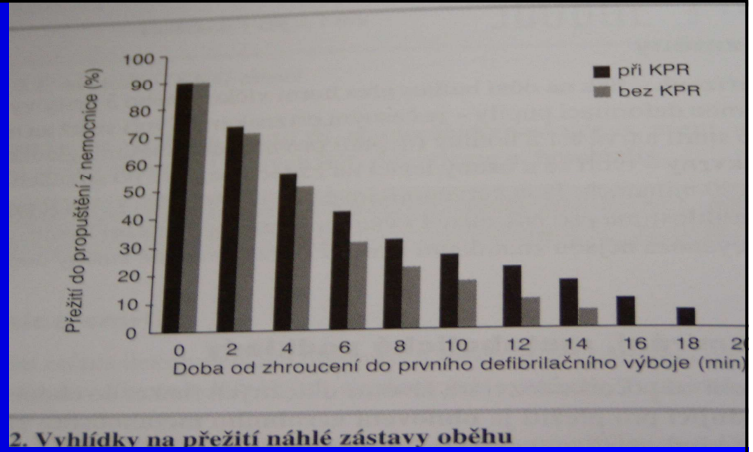
VF

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

(Vazopresin 40 j (1x))

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

Defibrillation



2. Vyhlídky na přežití náhlé zástavy oběhu

- 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

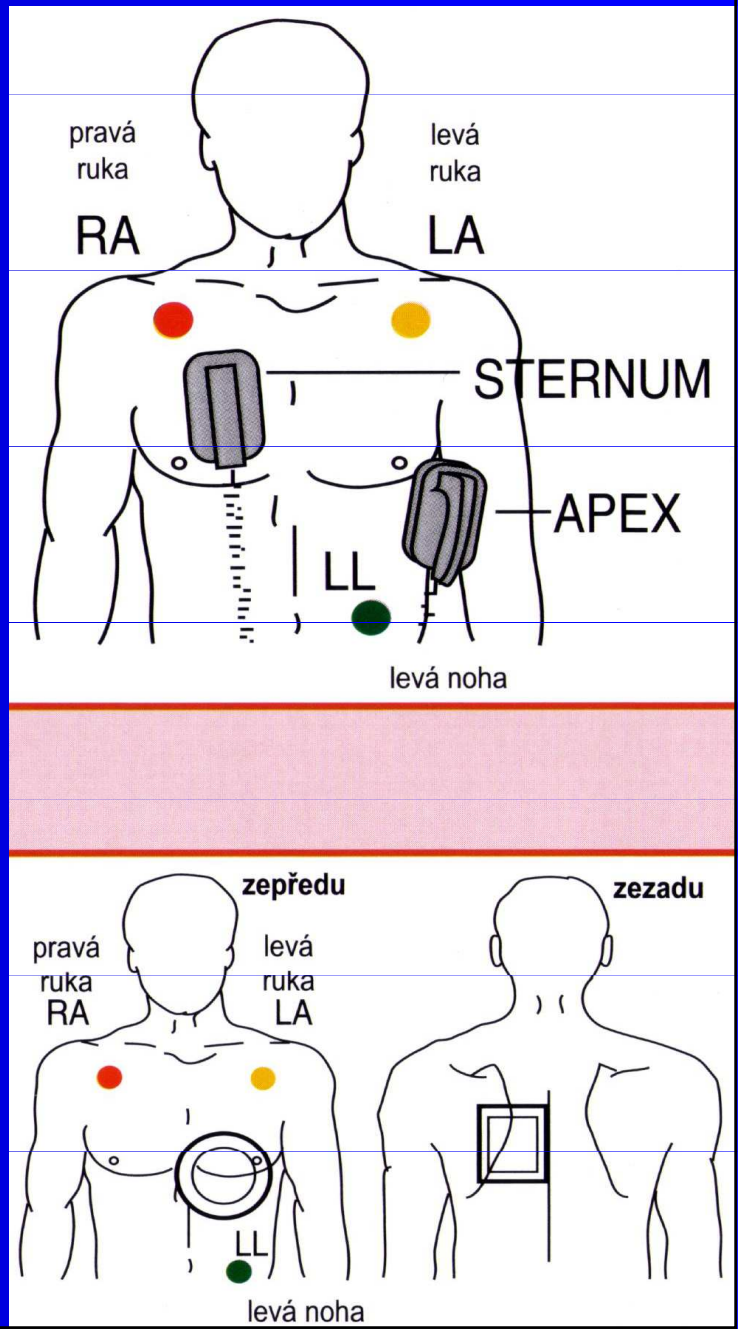
360 J

biphasic shock

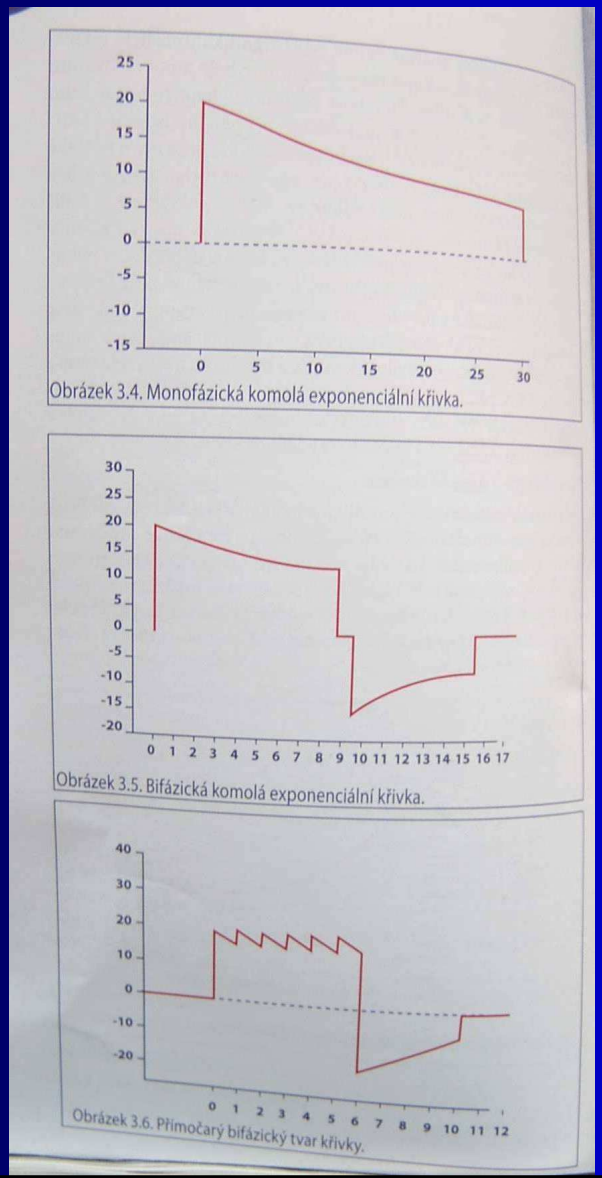
200 J

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
- Hypotermia 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