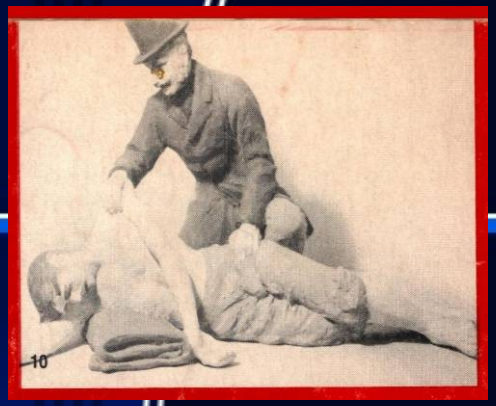
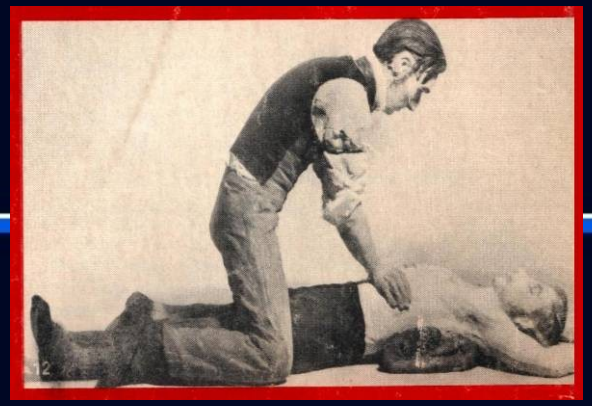
Cardiopulmonary Resuscitation in Adults

Fatma Özdemir, MD

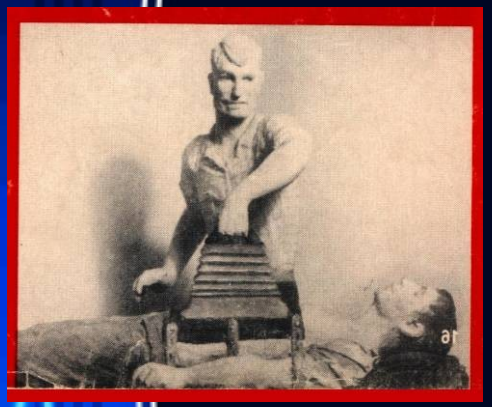
Emergency Deparment of
Uludag University Faculty of Medicine

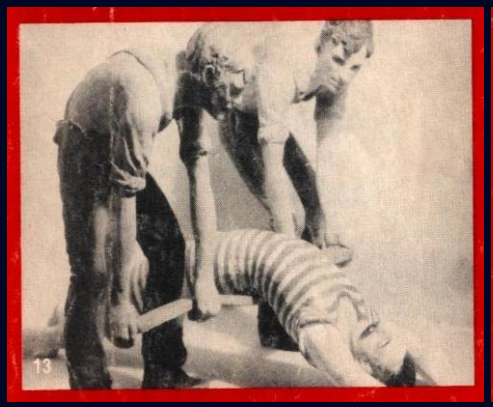

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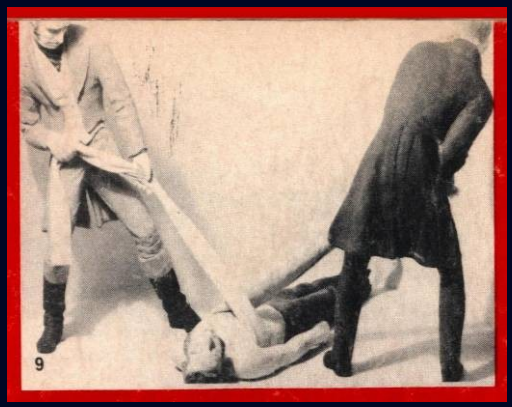

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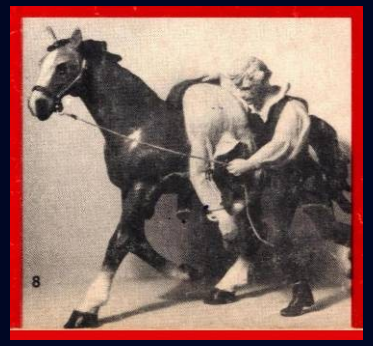

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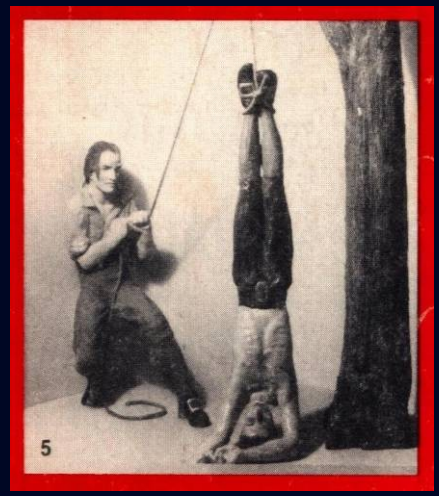

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9


8


1


14


5


15

OVERVIEW

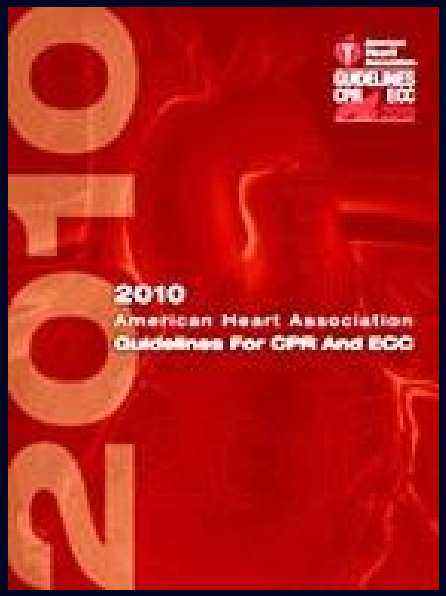
- ✓Introduction
- ✓Pathophysiology
- ✓BLS algorithm
- ✓ALS algorithm
- ✓Post resuscitation care
- ✓Termination of efforts

ILCOR

(*International Liaison Committee on Resuscitation*)

- AHA (American Heart Association)
- ERC (European Resuscitation Council)
- HSFC (Heart and Stroke Foundation of Canada)
- ANZCOR (Australia and New Zeland Council of Resuscitation)
- IAHF (Interamerican Heart Foundation)
- RCA (Resuscitation Council of Asia)

- First meeting of ILCOR at 1999
- First CPR and ECC guideline publication at 2000
- Last guideline published at 17.10.2010



- Sudden cardiac arrest (SCA) is the leading cause of death all over the world.
- Approximately % 40 of SCA is VF (Ventricular fibrillation) as first rhythm of arrest.
- Survival of patient with early CPR and defibrillation is relatively high (%49-75)

- ✓ Delay of CPR reduces the probability of survival (%7-10 per minute)
- ✓ Also delay of defibrillation reduces the probability of survival (%10-15 per minute)



Pathophysiology

Cardiac arrest and absence of circulation

- Quickly beginning anaerobic metabolism
- Production of free radicals , activation of catabolic enzymes……

CELL DEATH

Pathophysiology

- The brain is the most susceptiple to the absence of circulation
- In an arrest state suffers irreversible damage after 5 minutes
- Restoration of prearrest neurologic function is rare with untreatet arret of longer than 10 minutes



Pathophysiology

- The hearth is the second most supceptible organ to the absence of circulation
- Even the best quality compressions can generate only %30 of baseline cardiac output



Pathophysiology

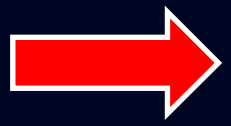
The resuscitation period , thereforei still contributes ‘GLOBAL ISCHEMIA’

Goal of CPR;

- ✓Restore organized myocardial electrical activity
- ✓Minimize ishemic brain injury

BASIC LIFE SUPPORT (BLS)

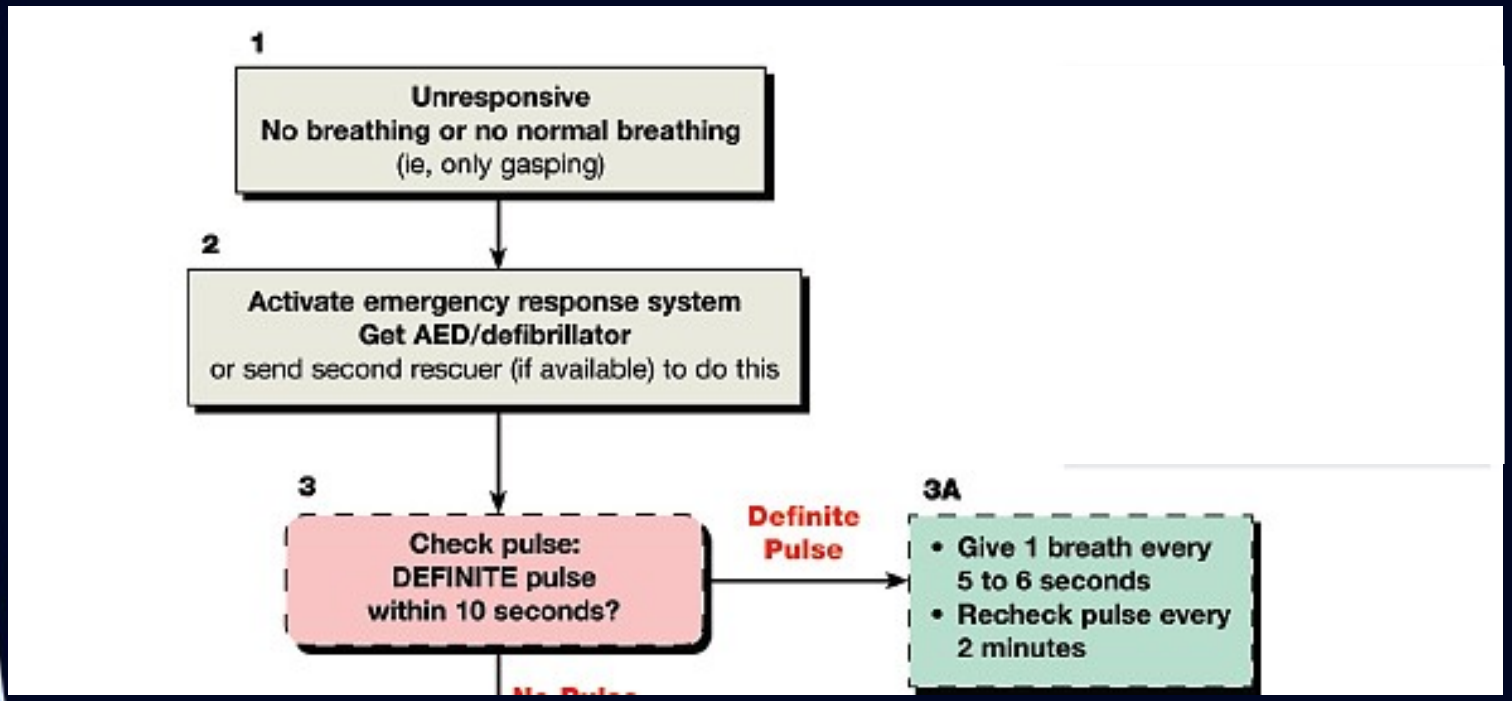
- A
- B
- C



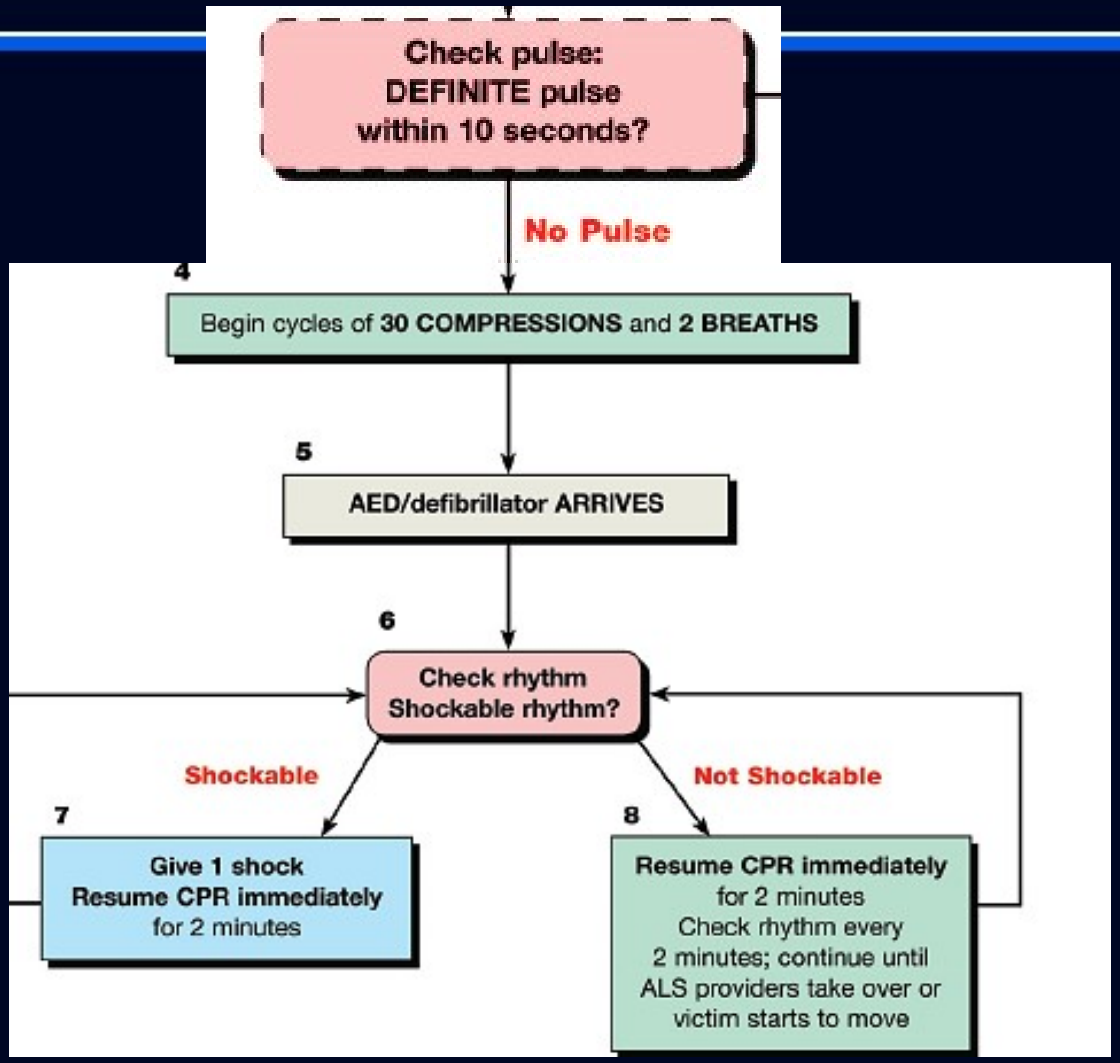
- C
- A
- B

FIRST CHEST COMPRESSION

BLS

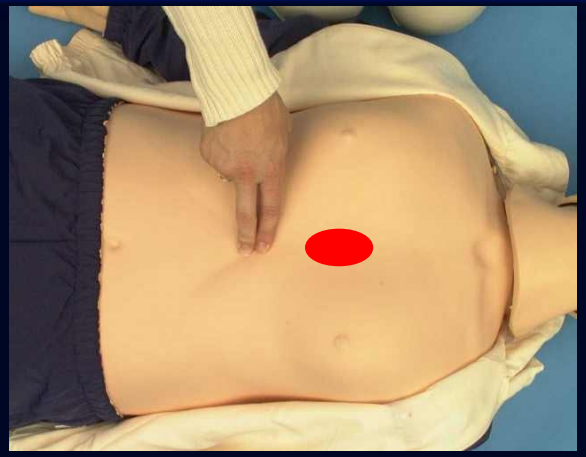

1
Unresponsive
No breathing or no normal breathing
(ie, only gasping)
2
Activate emergency response system
Get AED/defibrillator
or send second rescuer (if available) to do this
3
Check pulse:
DEFINITE pulse
within 10 seconds?
Definite Pulse
3A
• Give 1 breath every 5 to 6 seconds
• Recheck pulse every 2 minutes

BLS


Check pulse:
DEFINITE pulse
within 10 seconds?
No Pulse
4
Begin cycles of 30 COMPRESSIONS and 2 BREATHS
5
AED/defibrillator ARRIVES
6
Check rhythm
Shockable rhythm?
Shockable
Not Shockable
7
Give 1 shock
Resume CPR immediately
for 2 minutes
8
Resume CPR immediately
for 2 minutes
Check rhythm every
2 minutes; continue until
ALS providers take over or
victim starts to move

CHEST COMPRESSIONS

- Vertical position to thorax of the patient
- Compression depth 5 cm (Class IIa, LOE B)
- Rate of compressions at least 100 per minute (Class IIa, LOE B)





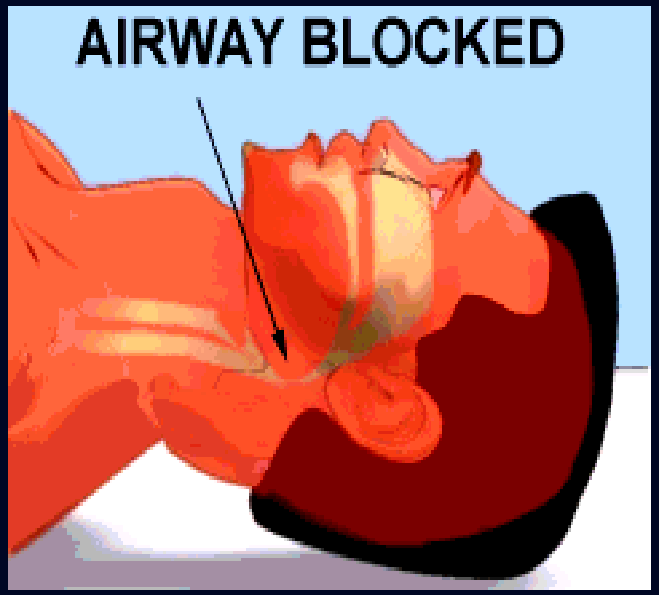

CPR CLASS
WHERE AM I?

- Rescuers should allow complet recoil of the chest after every compression (Class IIa, LOE B)
- Rescuers should attempt to minimize the frequency and duration of interruptions in compressions . İnterruptions shoul not be longer than 10 seconds(Class IIa, LOE C)

PUSH HARD, PUSH FAST!

Airway

- Position



- -Head tilt chin lift
- -Jaw thrust

- '*Tongue*' is responsable for airway obstruction in most unconscious patient.

Ventilation

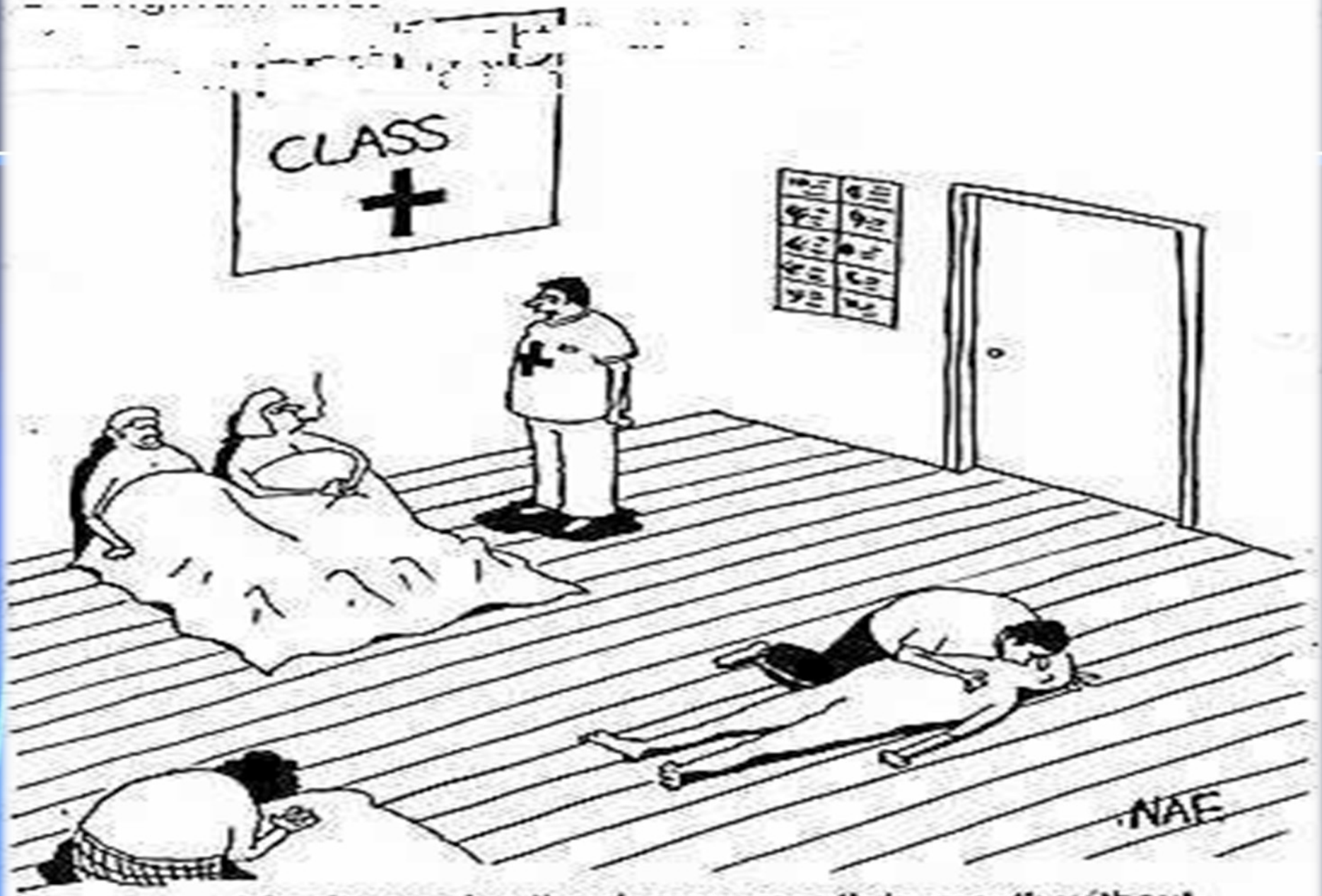
- Deliver each rescue breath over 1 second (Class IIa, LOE C).
- Give a sufficient tidal volume to produce *visible chest rise* (Class IIa, LOE C)
- Use a compression to ventilation ratio of 30 chest compressions to 2 ventilations.



Hands only CPR

- VF, rescue breaths are not as important as chest compressions because the oxygen
- If the airway is open, passive chest recoil during the relaxation phase of chest compressions can also provide some air exchange

- Prolonged CPR?



"Can't you give the dummy mouth to mouth without getting romantically involved Mrs Wilks?"

Early defibrillation with AED

Lone rescuer

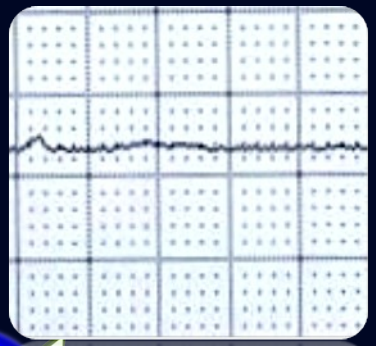
•After activating the emergency response system the should next retrieve an AED (if nearby and easily

•accessible) and then return to the victim to attach and use the AED.

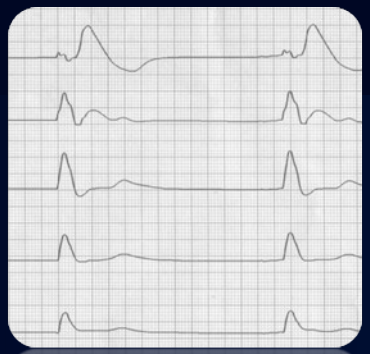
2 or more rescuers

•One rescuer should begin chest compressions while a second rescuer activates the emergency response system and gets the AED (or a manual defibrillator in most hospitals) (Class IIa, LOE C).

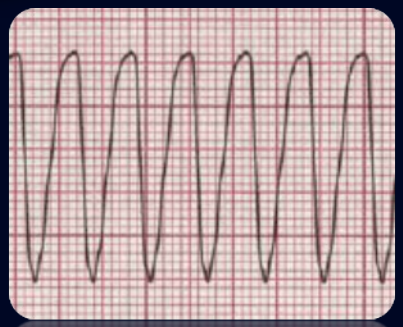
Advanced Cardiovascular Life Support (ACLS)



Asystole



Pulseless electrical activity

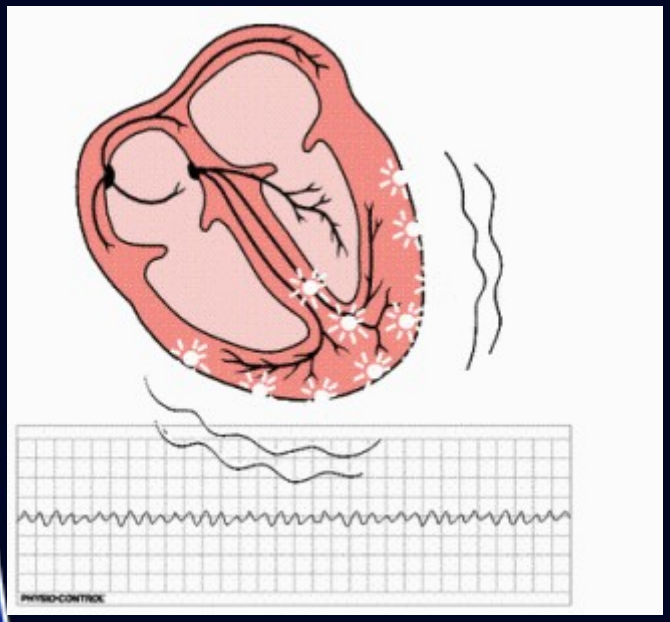


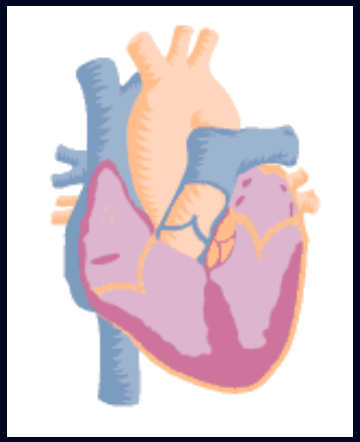
Pulseless Ventricular Tachycardia



Ventricular Fibrillation

Ventricular Fibrillation



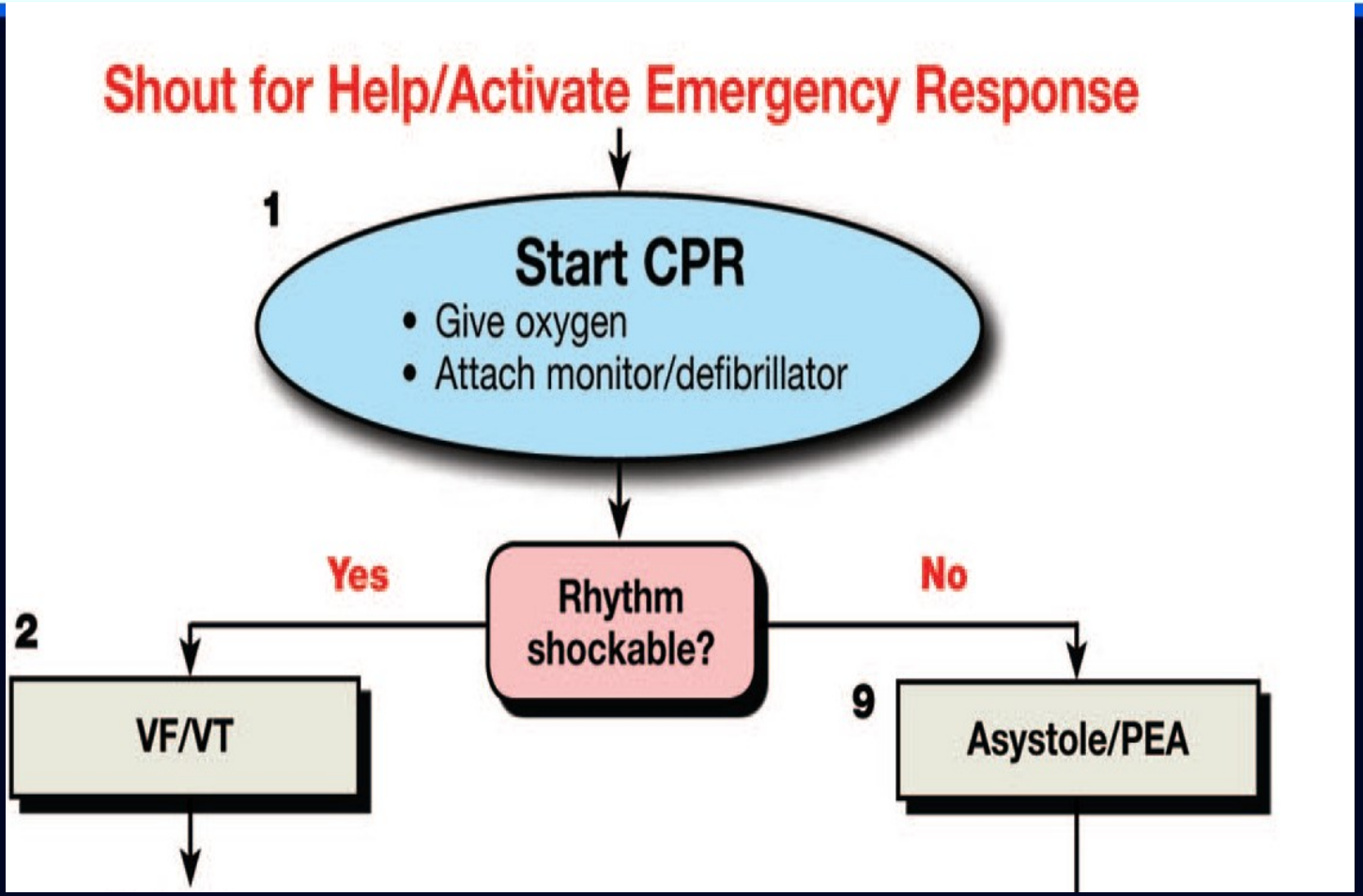




Defibrillation

- Electrical shock more than the electrical potential of cardiac cells.
- Biphasic waveforms are more safe .
- Equal or more effective than monophasic for treatment of VF.
- Monophasic defibrillators can be used in the case of absence of biphasic defibrillator (Class IIb, LOE B).

ACLS


Shout for Help/Activate Emergency Response
1
Start CPR
• Give oxygen
• Attach monitor/defibrillator
Rhythm shockable?
Yes
No
2
VF/VT
9
Asystole/PEA

Shockable
(VF/ pulseless VT)

1. shock
120- 200 J Biphasic / 360 J Monophasic

CPR 30:2 / 2 minutes *IV/ IO accsess*

2. shock

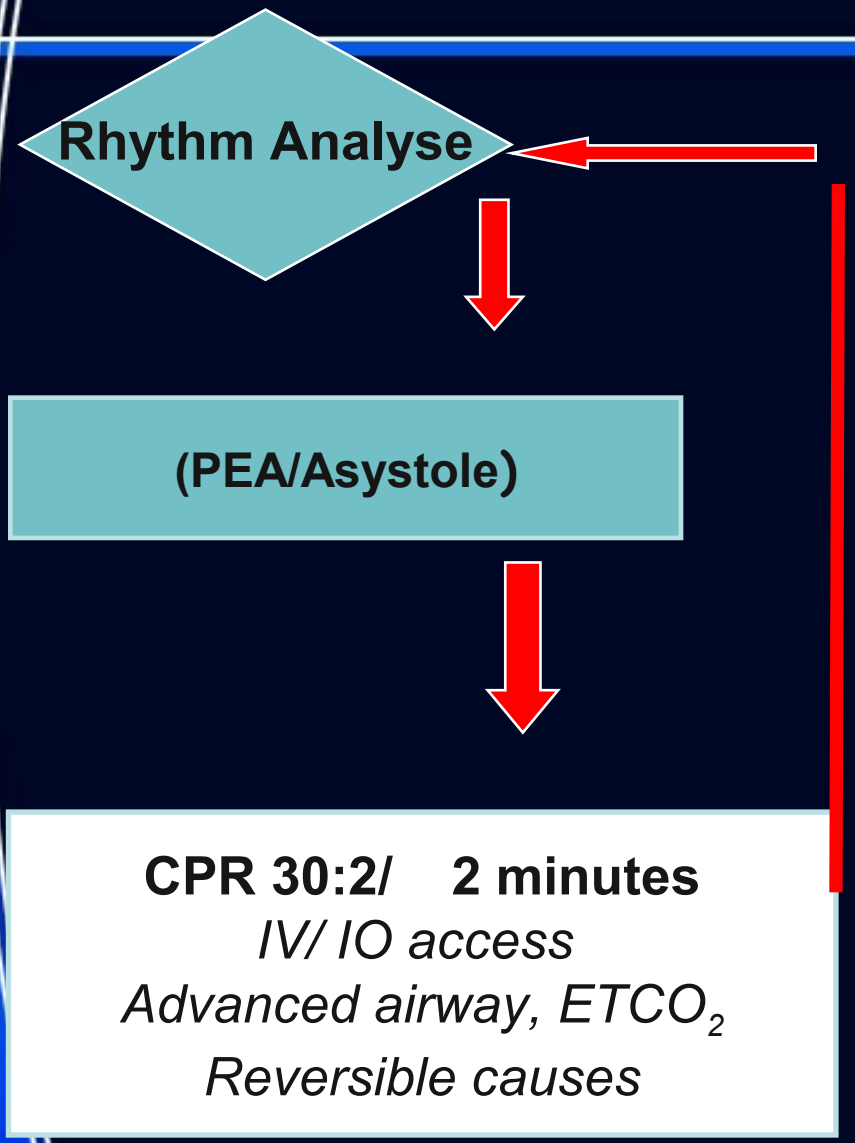
Epinephrine

CPR 30:2 / 2 minutes *Advanced airway, $ETCO_2$*

3. shock

Amiodorane

CPR 30:2 / 2 minutes *Reversible causes*



Epinephrine

Every 3- 5 min

Airway- ACLS

- **Bag-Mask Ventilation**
- Airway
- Endotracheal tube
- *Laryngeal Mask Airway*
- İLMA
- *Esophageal-Tracheal Tube(*Combitube)

Airway- ACLS

During CPR performed by providers trained in its use, the supraglottic airway is a reasonable alternative to bag-mask ventilation (Class IIa, LOE B) and endotracheal intubation (Class IIa, LOE A).

Airway- ACLS

- ✓ Compressions should be interrupted only for the time required by the intubating provider to visualize the vocal cords and insert the tube(less than 10 seconds)
- ✓ If the initial intubation attempt is unsuccessful, a second attempt may be reasonable, but early consideration should be given to using a supraglottic airway..

Airway- ACLS

Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an endotracheal tube (Class I, LOE A).

Ventilation ratio after advanced airway

- ✓ 8-10 ventilation/min without interruption of compressions (Class f IIb, LOE C)

CPR monitoring

End-Tidal CO2

- Persistently low PETCO2 values (10 mm Hg) during CPR in intubated patients suggest that ROSC is unlikely.
- If PETCO2 abruptly increases to a normal value (35 to 40 mm Hg), it is reasonable to consider that this is an indicator of ROSC (Class IIa, LOE B).
- Consider using quantitative waveform capnography in intubated patients to monitor CPR quality, optimize chest compressions, and detect ROSC during chest compressionsı (Class IIa, LOE C).

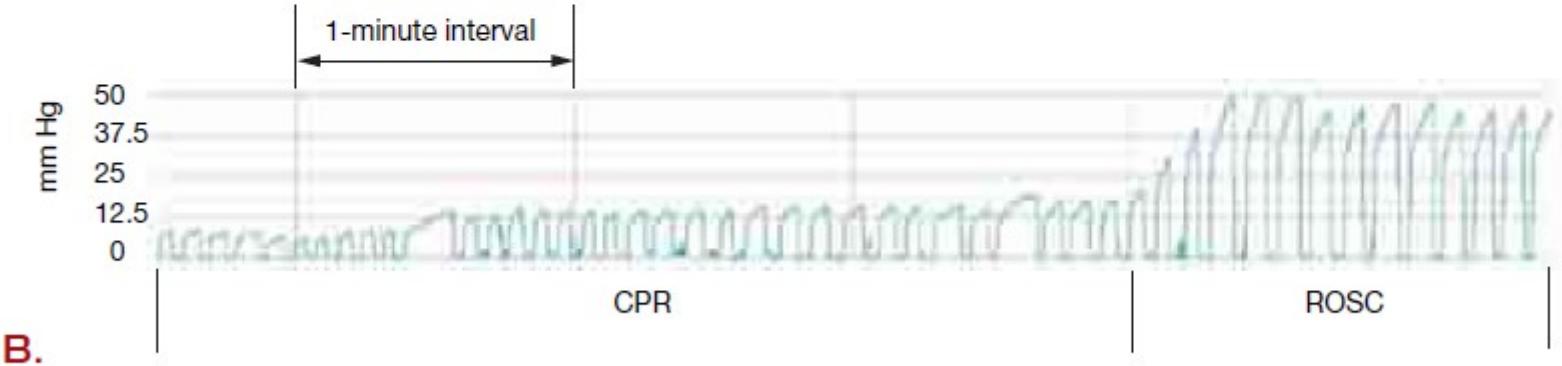
Figure 3

Capnography Waveforms



A.

Capnography to confirm endotracheal tube placement. This capnography tracing displays the partial pressure of exhaled carbon dioxide (P_{ETCO_2}) in mm Hg on the vertical axis over time when intubation is performed. Once the patient is intubated, exhaled carbon dioxide is detected, confirming tracheal tube placement. The P_{ETCO_2} varies during the respiratory cycle, with highest values at end-expiration.



B.

Capnography to monitor effectiveness of resuscitation efforts. This second capnography tracing displays the P_{ETCO_2} in mm Hg on the vertical axis over time. This patient is intubated and receiving CPR. Note that the ventilation rate is approximately 8 to 10 breaths per minute. Chest compressions are given continuously at a rate of slightly faster than 100/min but are not visible with this tracing. The initial P_{ETCO_2} is less than 12.5 mm Hg during the first minute, indicating very low blood flow. The P_{ETCO_2} increases to between 12.5 and 25 mm Hg during the second and third minutes, consistent with the increase in blood flow with ongoing resuscitation. Return of spontaneous circulation (ROSC) occurs during the fourth minute. ROSC is recognized by the abrupt increase in the P_{ETCO_2} (visible just after the fourth vertical line) to over 40 mm Hg, which is consistent with a substantial improvement in blood flow.

CPR monitoring

- ***Arterial Relaxation Pressure***

- diastolic")pressure,
- radial, brachial, or femoral artery catheter

- CPR quality, optimize chest compressions, and guide vasopressor therapy. (Class IIb, LOE C).

CPR monitoring

Central Venous Oxygen Saturation

If ScvO2 is 30%, it is reasonable to consider trying to improve the quality of CPR by optimizing chest compression parameters (Class IIb, LOE C).

CPR monitoring

Arterial Blood Gases

•Arterial blood gas monitoring during CPR is not a reliable indicator of the severity of tissue hypoxemia, hypercarbia (and therefore adequacy of ventilation during CPR), or tissue acidosis.

• Routine measurement of arterial blood gases during CPR has uncertain value (Class IIb, LOE C).

Post resuscitation care

After ROSC

- Primary survey

- Secondary survey
  - Physical examination(especially thorax)
  - Vital signs:
    * Blood pressure
    * SpO2
    * Blood glucose
    * Body temperature
    * ECG

Post resuscitation care

- Hyperoxemia may be harmfull after ROSC

  - **SaO_2 / SpO_2 %94-98**

  Not %100 !!!!

- Treat hyperglisemia (if > 180 mg/dl)

  Avoid Hypoglisemia !!!!

Post resuscitation care

Body temperature

- Avoid hypertermia (≥ 37.6◦C)

Convulsions after ROSC ;

- Benzodiazepines..

Induced Hypothermia

- Comatose adult patients with ROSC after out-of hospital VF cardiac arrest should be cooled to 32°C to 34°C (89.6°F to 93.2°F) for 12 to 24 hours (Class I, LOE B).

- Comatose adult patients with ROSC after in hospital cardiac arrest of any initial rhythm or after out-of hospital cardiac arrest with an initial rhythm of pulseless electric activity or asystole (Class IIb, LOE B).

Induced Hypothermia

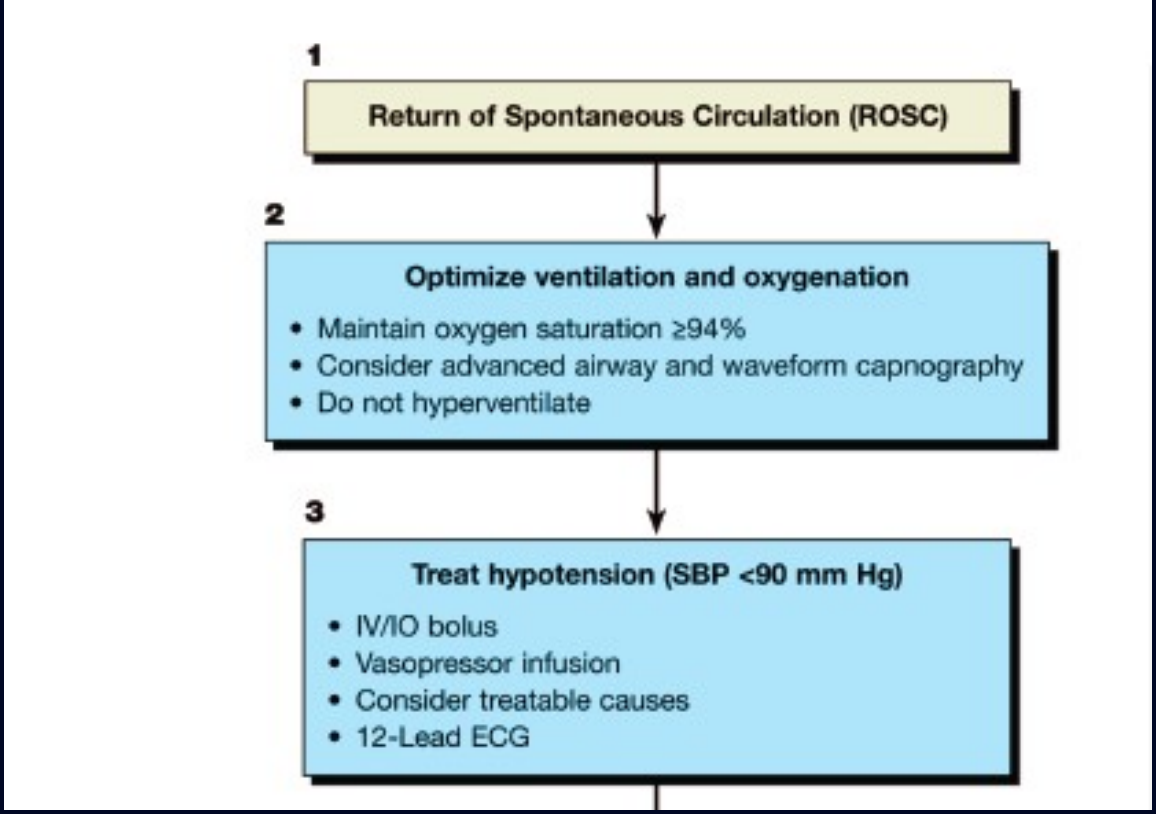
- Prehospital

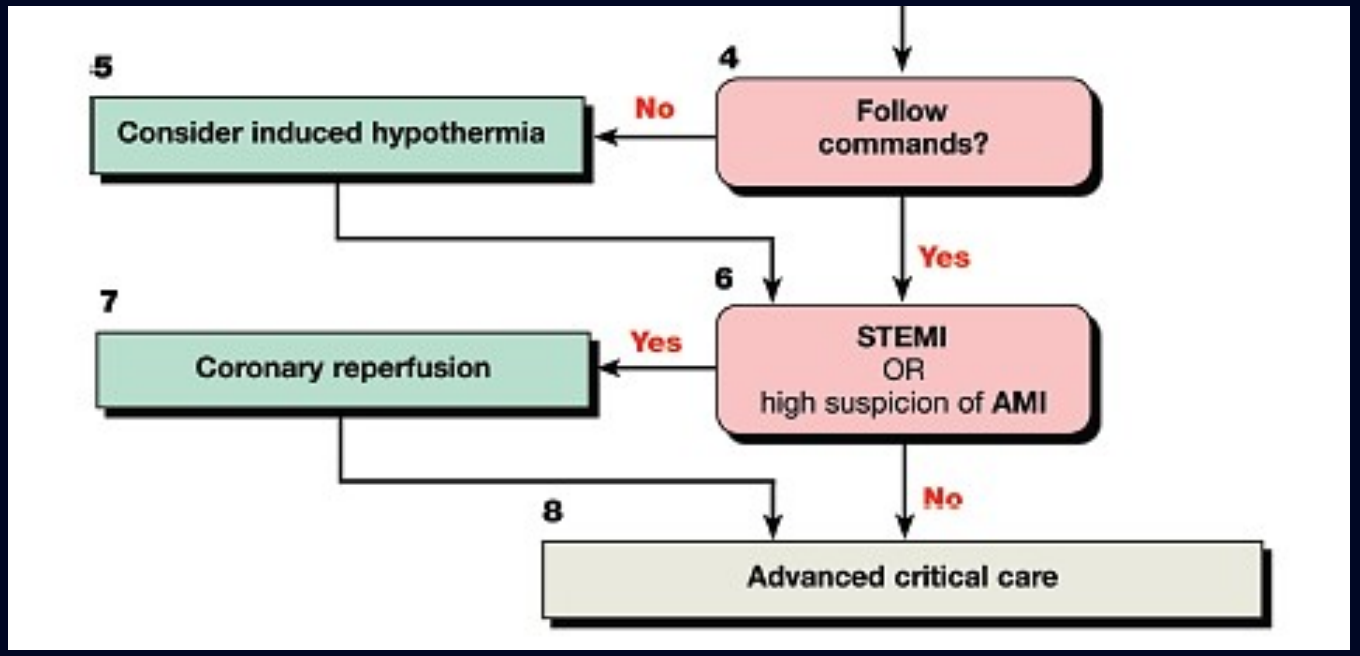
4°C /NaCl / 30 ml/kg / İV or IO

- Rewarming

At hospital and slowly (0.25-0.5°C/hour)

- Avoid hyperthermia


1
Return of Spontaneous Circulation (ROSC)
2
Optimize ventilation and oxygenation
• Maintain oxygen saturation ≥94%
• Consider advanced airway and waveform capnography
• Do not hyperventilate
3
Treat hypotension (SBP <90 mm Hg)
• IV/IO bolus
• Vasopressor infusion
• Consider treatable causes
• 12-Lead ECG


4
Follow commands?
No
5
Consider induced hypothermia
Yes
6
STEMI
OR
high suspicion of AMI
Yes
7
Coronary reperfusion
No
8
Advanced critical care

Termination of efforts

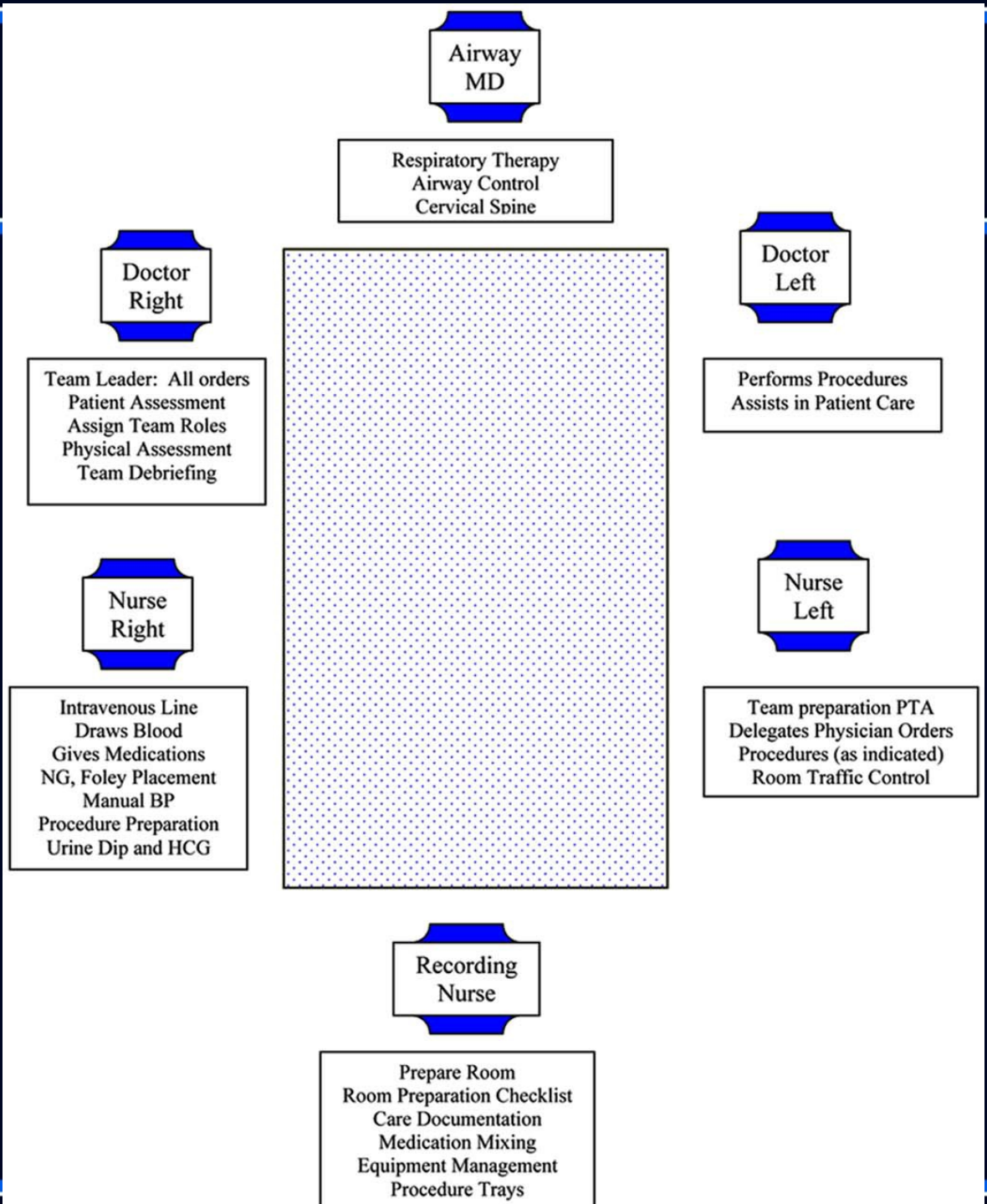
- Longer efforts would not be successful at the patients whom ROSC was not possible at the 30 minutes of resuscitation

- Consider reversible causes at the time of resuscitation and before terminating CPR

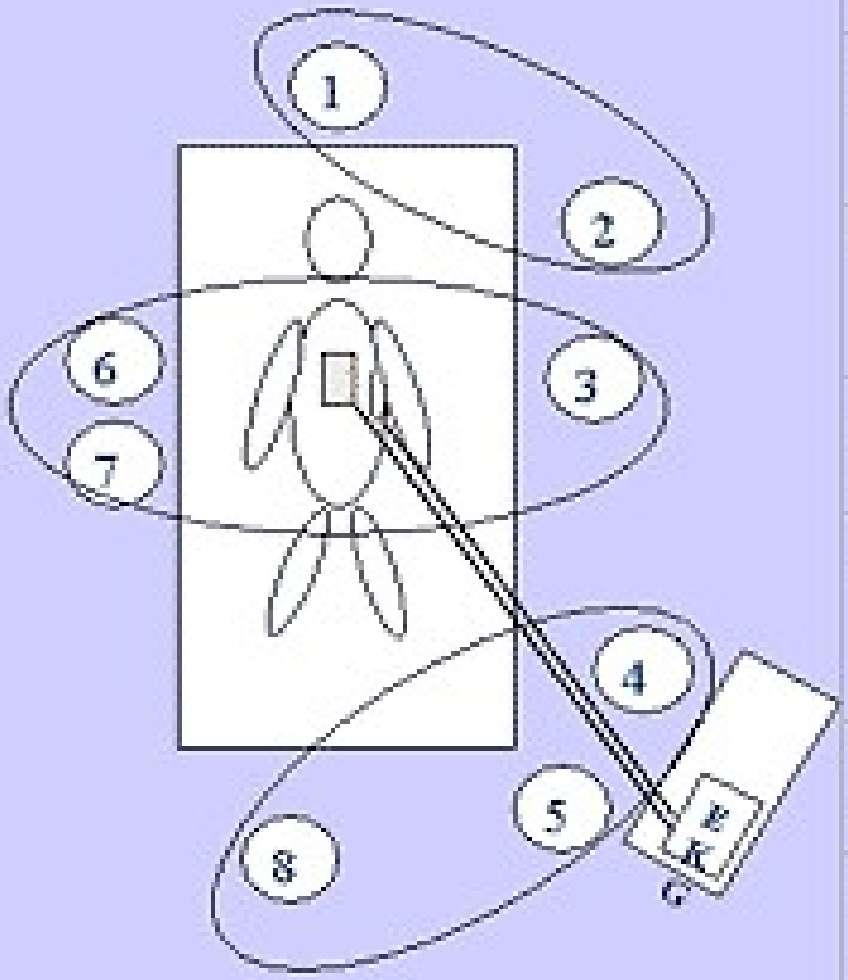
Reversible causes

- Hypoxia
- Hypovolemia
- Hydrogen ion
- Hypo-Hyperkalemia
- Hypothermia
- Tamponade
- Tension pneumothorax
- Thrombosis
- Toxins

Resuscitation team at ED


Airway
MD
Respiratory Therapy
Airway Control
Cervical Spine
Doctor
Right
Team Leader: All orders
Patient Assessment
Assign Team Roles
Physical Assessment
Team Debriefing
Doctor
Left
Performs Procedures
Assists in Patient Care
Nurse
Right
Intravenous Line
Draws Blood
Gives Medications
NG, Foley Placement
Manual BP
Procedure Preparation
Urine Dip and HCG
Nurse
Left
Team preparation PTA
Delegates Physician Orders
Procedures (as indicated)
Room Traffic Control
Recording
Nurse
Prepare Room
Room Preparation Checklist
Care Documentation
Medication Mixing
Equipment Management
Procedure Trays

Team Roles & Goals



Personnel	Role, responsibility
1. Airway Manager	Assist ventilation, intubate
2. Airway Assistant	Assist ventilation, oxygen and suction setup, suction
3. Bedside RN	Assess enough patent IV's, push meds, defib pads, check pulse.
4. Crash cart manager	Prepare meds, record code events
5. Team Leader	Assess team, responsibilities, data, direct treatment, set priorities, triage patient.
6. Chest compressions	Perform chest compressions
7. Procedure MD	Perform procedures: Iv, chest tubes, ABGs.
8. Data Manager	AMPLE, Results, chart, record interventions

Michael DeVita, MD
University of Pittsburgh





THANK YOU..