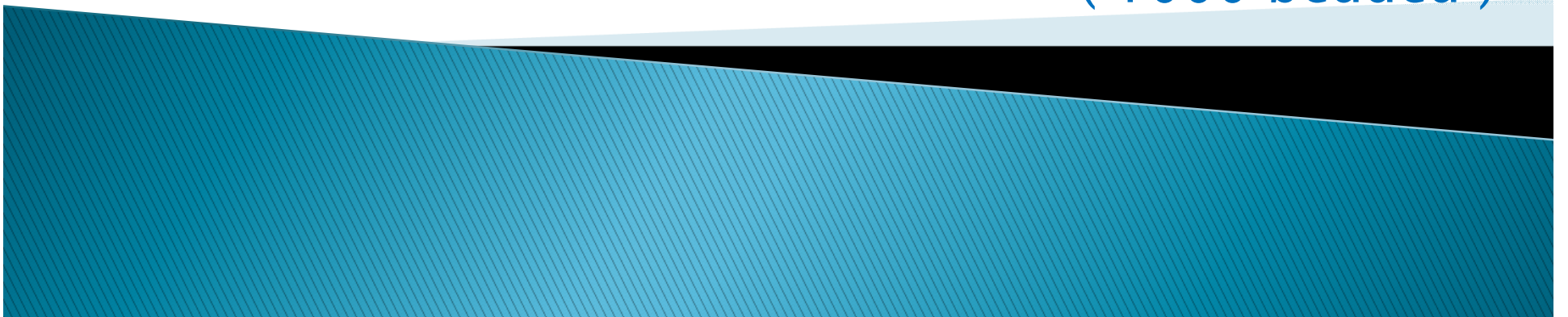


# *Cardio Pulmonary Resucitation*

Dr Nu Nu May  
Senior Consultant Anaesthetist  
Nay Pyi Taw General Hospital  
( 1000 bedded )

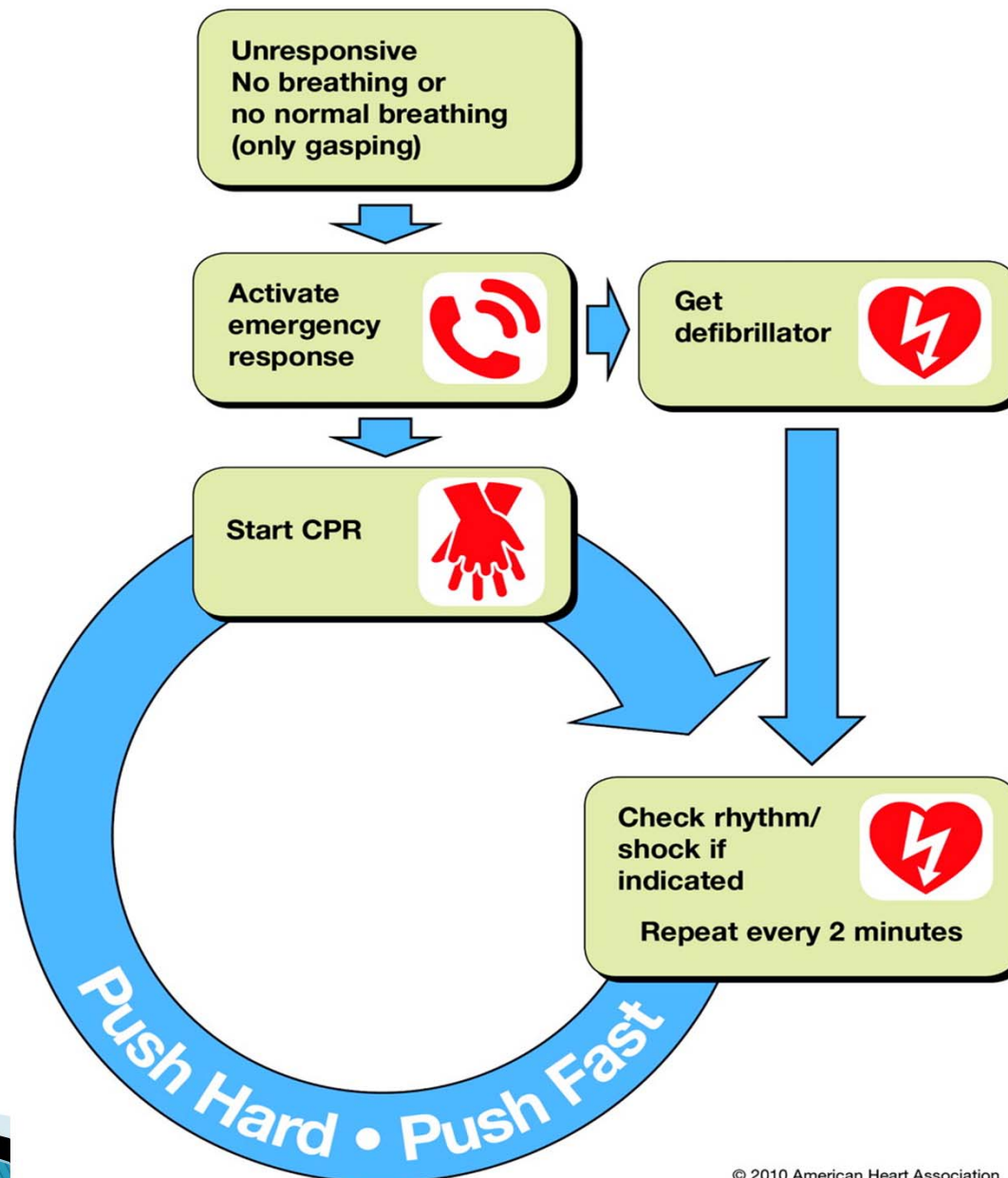


# What does CPR stand for?

- ▶ C = Cardio ( heart )
- ▶ P = Pulmonary ( Lungs)
- ▶ R = Resuscitation ( recovery )



## Simplified Adult BLS



## Definition of Cardiac arrest:

It is loss of cardiac function, breathing and loss of consciousness.

## Diagnosis of cardiac arrest (TRIAD):

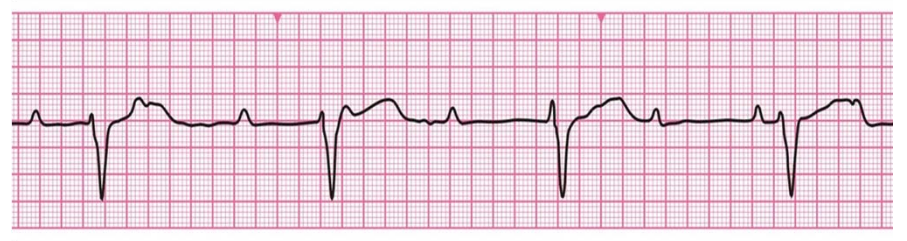
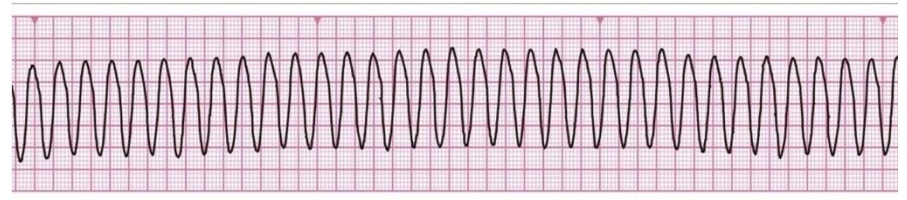
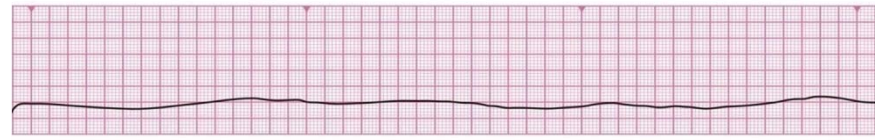
- 1) Loss of consciousness.
- 2) Loss of apical & central pulsations (carotid, femoral).
- 3) Apnea.





## Types (forms) of cardiac arrest:

- 1) **Asystole** (Isoelectric line).
- 2) **Ventricular fibrillation** (VF).
- 3) Pulseless **Ventricular tachycardia** (VT).
- 4) **PEA**: pulseless electrical activity.



## Causes of cardiac arrest (6 H & 4 T):

- 1) Hypoxia.
  - 2) Hypotension.
  - 3) Hypothermia.
  - 4) Hypoglycemia.
  - 5) Acidosis (H<sup>+</sup>).
  - 6) Hypokalemia (electrolyte disturbance).
- 1) Cardiac Tamponade.
  - 2) Tension pneumothorax.
  - 3) Thromboembolism (pulmonary, coronary).
  - 4) Toxicity (eg. digoxin, local anesthetics, TCA, insecticides).

- ▶ Definition of CPR: it is an emergency medical procedure for a victim of **cardiac arrest** or **respiratory arrest**.
- ▶ What is basic life support (BLS)?  
It is life support **without** the use of **special equipment**.
- ▶ What is Advanced Life Support (ACLS)?  
It is life support **with** the use of **special equipment** (eg. Airway, endotracheal tube, defibrillator).



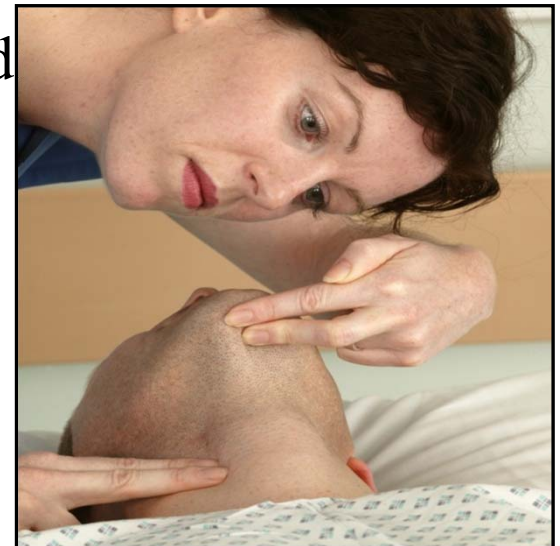
# Basic Life Support (BLS)

- ▶ **3 S** steps before the initiation of resuscitation for management of a collapsed patient:
  - 1) Ensure your own **Safety**.
  - 2) Check the level of responsiveness by gently **Shaking** the patient and **Shouting**: “are you alright?”
  - 3) **S**hout for help.

▶ Then check for **carotid pulsations**.

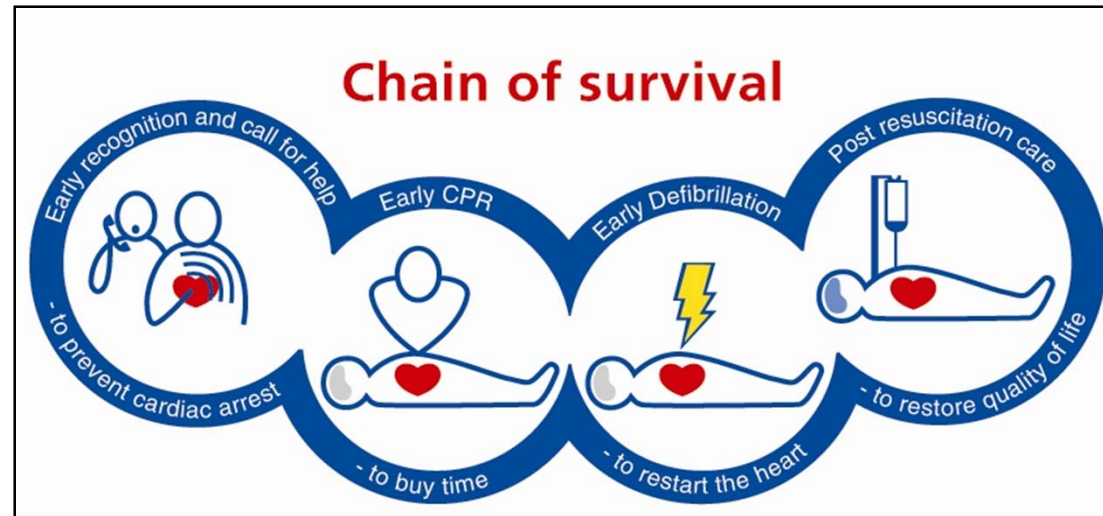
- ▶ **Apnea** (cessation of respiration) is confirmed by:

- 1) **Look**: to see chest wall movement. Seesaw (paradoxical) movement of the chest wall indicates airway obstruction.
  - 2) **Listen**: to breath sounds from the mouth.
  - 3) **Feel**: air flow.
- For at least **10 seconds**





# Chain of Survival



There are 4 cornerstones for optimising the outcome following cardiac arrest:

- ▶ **Early recognition** & call for help: to prevent cardiac arrest.
- ▶ **Early CPR** (with **minimal interruptions**): to buy time.
- ▶ **Early defibrillation**: to restart the heart.
- ▶ **Post resuscitation care**: to restore quality of life & minimize neurological insult.



DANGER

RESPONSE ,BREATHING

SHOUT FOR HELP (AED)

CPR

APPLY AED

TRANSPORT



DRs,C.A.T



# RESPONSE , BREATHING



Life support includes A B C

**A** = Airway (and cervical spines)

**B** = Breathing

**C** = Circulation



# A

## AIRWAY



# B

## BREATHING



# C

## CIRCULATION

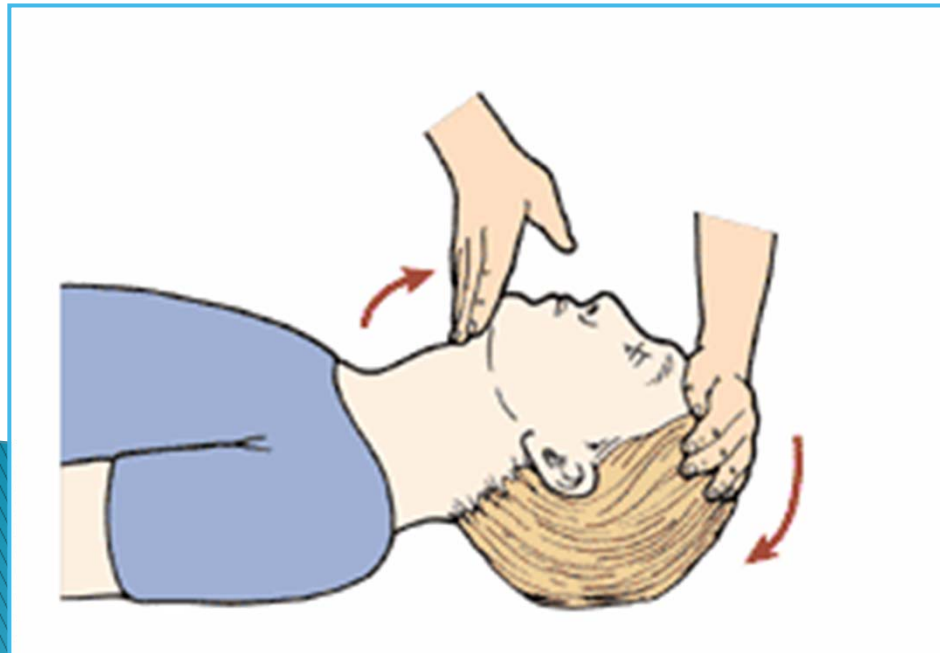


## DEFIBRILLATION

# D



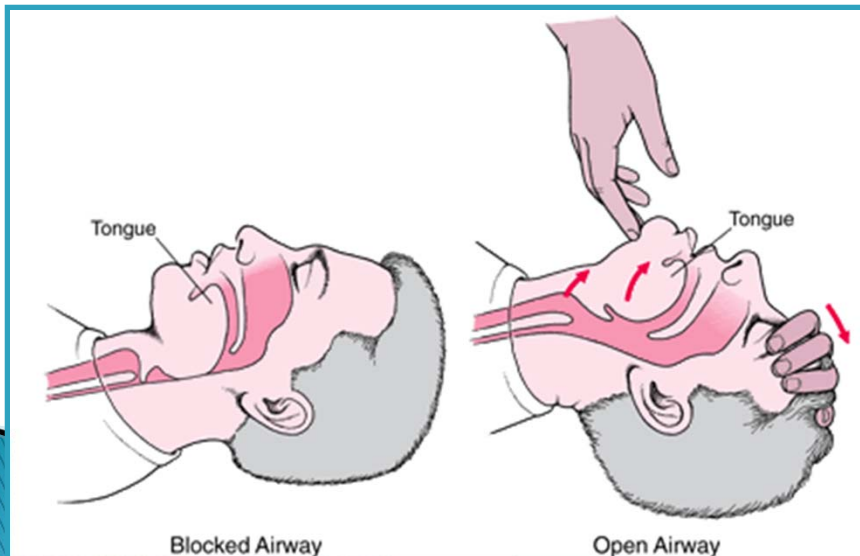
# A = Airway





# Airway

- ▶ Loss of consciousness often results in **airway obstruction** due to loss of tone in the muscles of the airway and falling back of the tongue.
- ▶ (A) **Basic techniques for airway patency:**
  - 1) **Head tilt, chin lift**: one hand is placed on the **forehead** and the other on the **chin** the head is **tilted upwards** to cause **anterior displacement** of the tongue.



## 2) Jaw thrust:





3) **Finger sweep**: Sweep out foreign body in the mouth by index finger (in unconscious pt only. This is **NOT** advised in a conscious or convulsing patient).



## **Cervical Spines:**

- ▶ Special care must be taken during airway management for the **cervical spines**. Any polytraumatised patient may sustain injury to the **cervical spines**, and any rough manipulation may result in cervical spinal cord injury and subsequent **quadriplegia**.
- ▶ Thus in any polytraumatised patient **cervical in-line stabilization** must be routinely performed during transport and airway management.
- ▶ This can be done by a **cervical collar**.
- ▶ And the patient should be transported by specially trained medical personnel as **one unit**.



## **(B) Advanced techniques for airway patency:**

### **1) Face Mask**



**Signs of successful seal and ventilation include:**

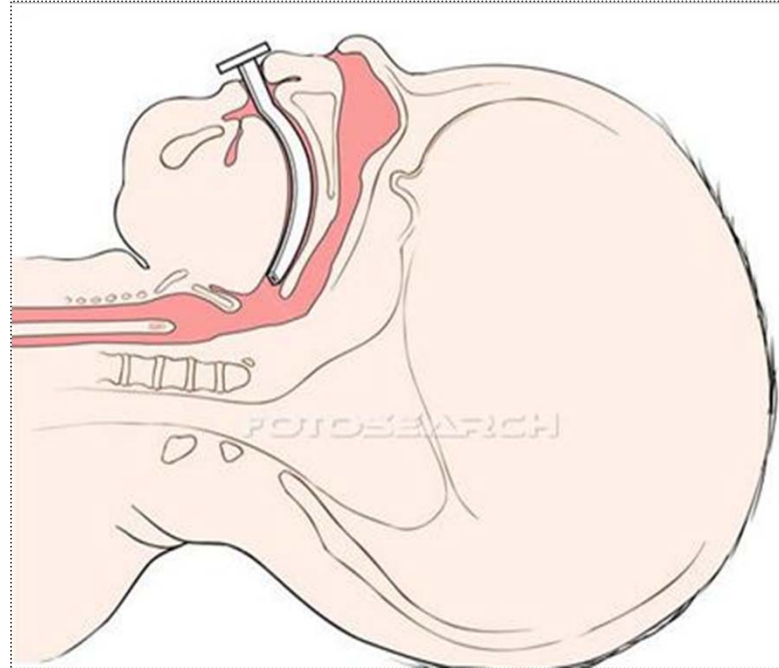
- ▶ - Foggy mask.
- ▶ - Rising chest.

**Advantages:** Easy. Does not require skilled personnel (paramedics).

**Disadvantages:** Stomach inflation. Not protective against regurgitation & aspiration of gastric contents.



## 2) Oropharyngeal airway



**Advantages:** Easy. Does not require highly skilled personnel (can be used by paramedics).

**Disadvantages:** Not protective against regurgitation & aspiration of gastric contents. Poorly tolerated by conscious pts (gag).

### 3) Nasopharyngeal airway



- ▶ Lubricated and inserted through the nose.
- ▶ Better tolerated in conscious patients.
- ▶ **Contraindicated:** in anti-coagulated patients and fractured skull base.
- ▶ **Disadvantages:** Not protective against regurgitation & aspiration of gastric contents.

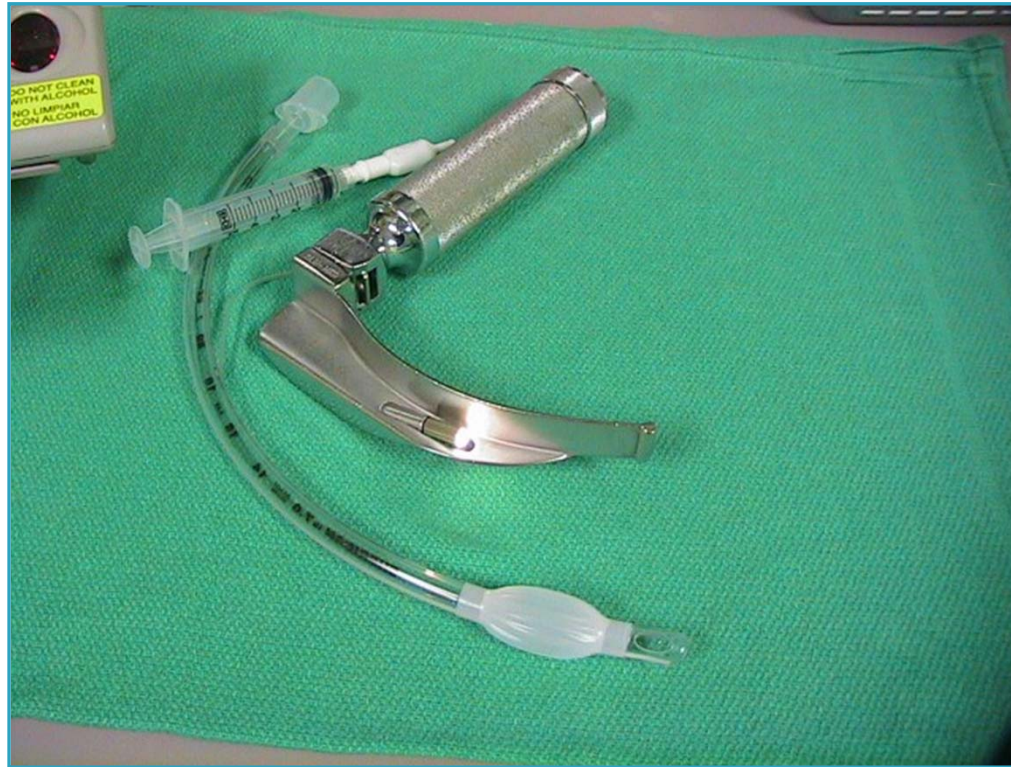
## 4) Laryngeal mask (LMA)

- ▶ **Available** in a variety of **pediatric** and **adult** sizes.
- ▶ **Advantages**: Easy. Does not require highly skilled personnel (can be used by paramedics).
- ▶ **Disadvantages**: Stomach inflation. Not protective against regurgitation & aspiration of gastric contents.





## 5) Endotracheal tube

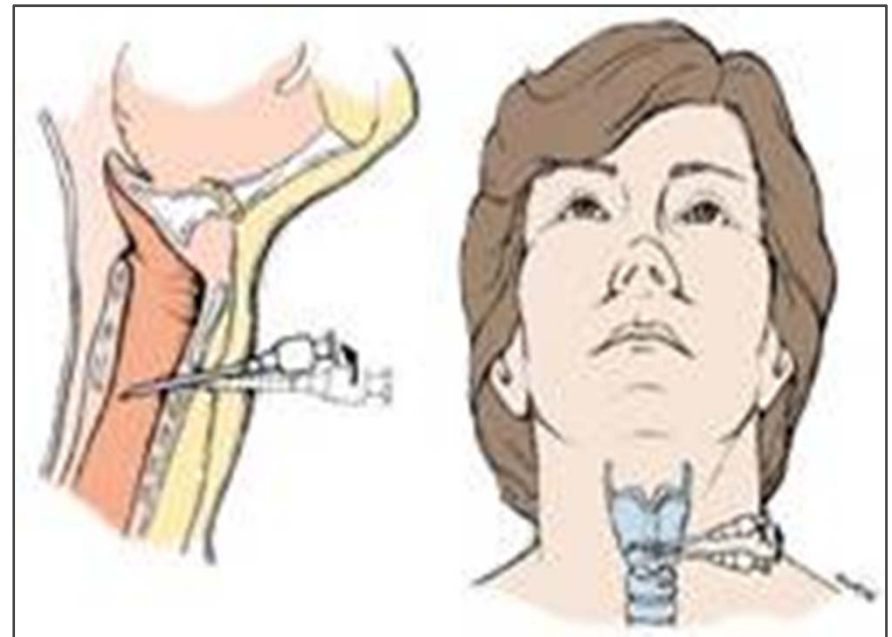


► **Advantages**: Ensures proper lung ventilation. No gastric inflation. No regurgitation or aspiration of gastric contents.

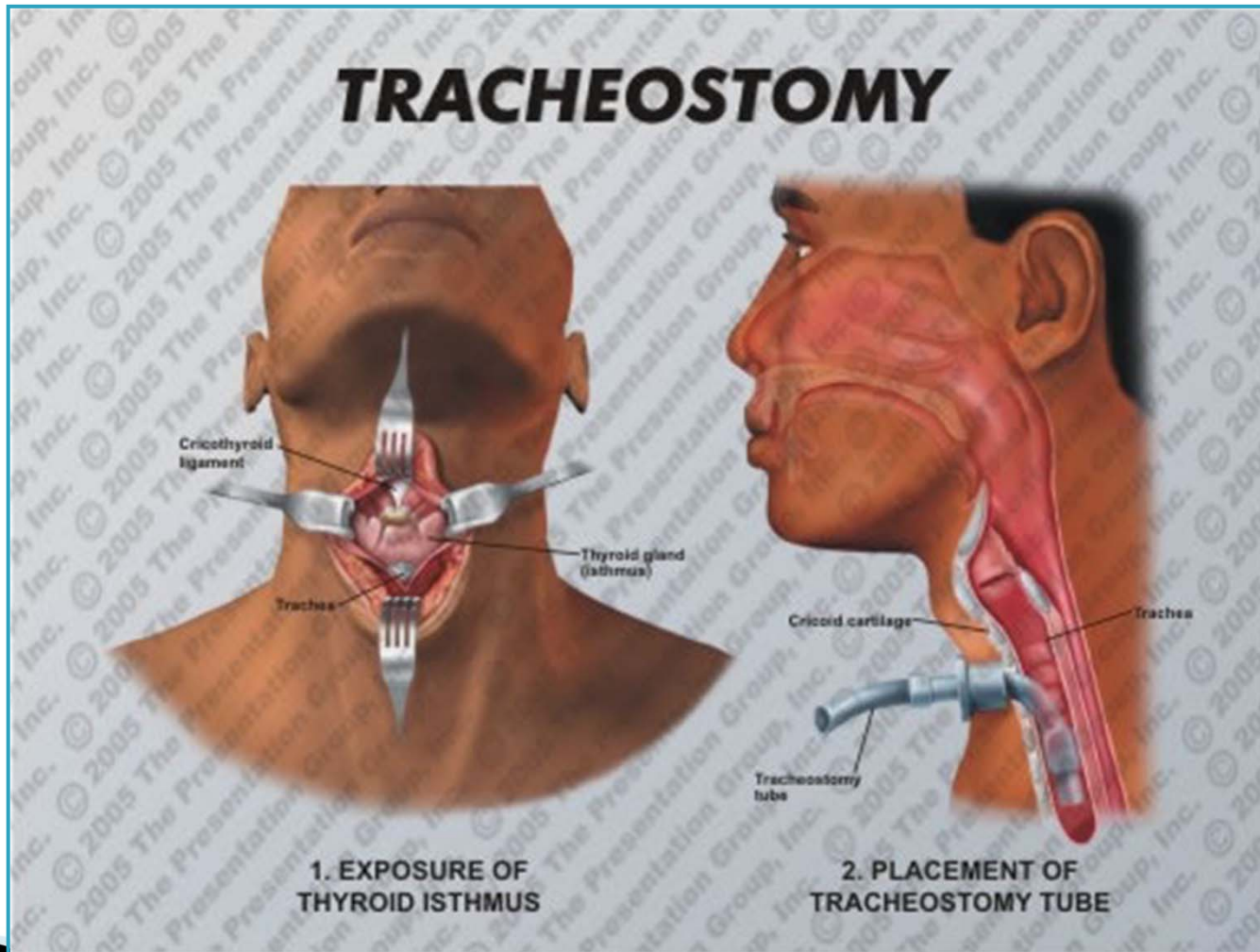
► **Disadvantages**: Requires insertion by highly skilled personnel.

## 6) Cricothyrotomy (Surgical Airway)

- It is done either by a commercially available cannula in a specialized cricothyrotomy set or a large bore IV cannula 12-14 gauge.
- Is done in case of **difficult endotracheal intubation**.
- Nu-trake canula is specially designed to allow ventilation by a self-inflating bag (AMBU)
- An IV canula needs a special connection to a high pressure source to generate sufficient gas flow (trans-tracheal jet ventilation)



## 7) Tracheostomy (Surgical Airway)



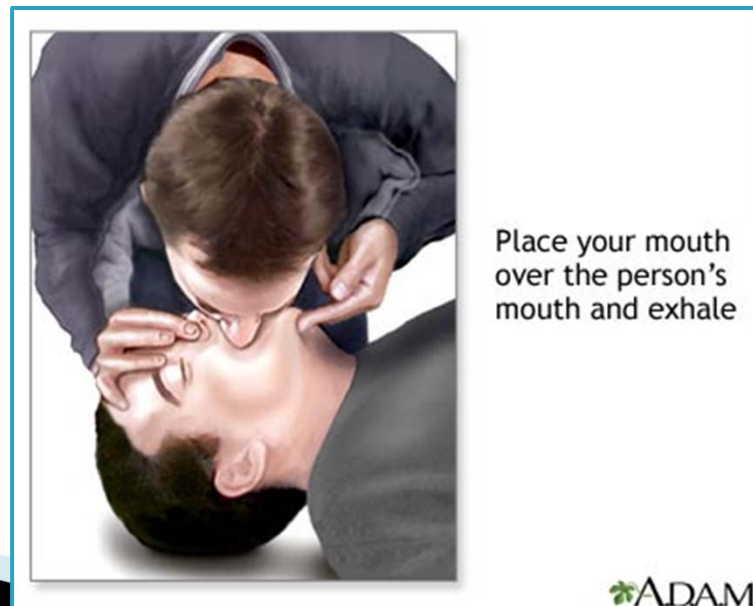


**B = Breathing**



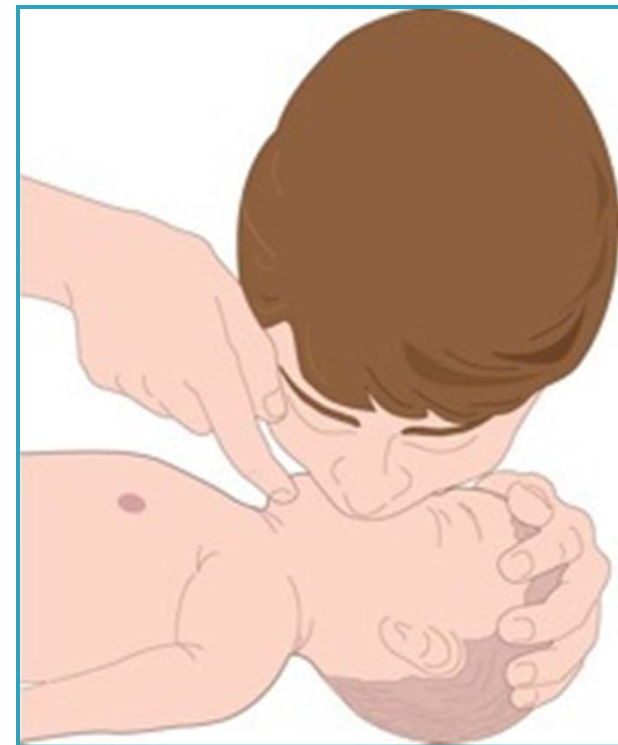
## (A) Basic techniques include:

1) **Mouth to mouth breathing**: with the airway held open, pinch the nostrils closed, take a deep breath and seal your lips over the patient's mouth. Blow steadily into the patient's mouth watching the chest rise as if the patient was taking a deep breath.



2) **Mouth to nose breathing**: seal the mouth shut and breathe steadily through the nose.

3) **Mouth to mouth and nose**: is used in infants and small children.





- ▶ Expired air contains **16% O<sub>2</sub>** so supplemental 100% O<sub>2</sub> should be used as soon as possible.
- ▶ Successful breathing is achieved by delivery of a tidal volume of **800-1200 ml** in adults at a rate of **10-12 breaths/min** in adults.

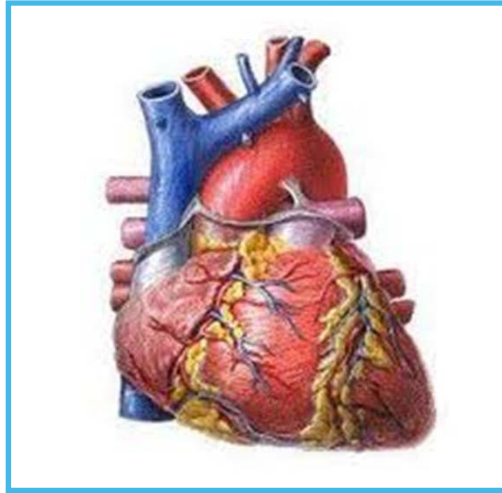
(B) Advanced techniques include:

- ▶ **1) Self-inflating resuscitation bag** (Ambu bag):
  - ▶ When used without a source of O<sub>2</sub> (room air) gives **21% O<sub>2</sub>**.
  - ▶ When connected to a source of O<sub>2</sub> (10-15 L/min) gives **45% O<sub>2</sub>**.
  - ▶ If a reservoir bag is added it can give up to **85% O<sub>2</sub>**.
- ▶ **2) Mechanical ventilator in OR or in ICU**



- ▶ Expired air = **16% O<sub>2</sub>**
- ▶ Ambu Bag (room air) = **21% O<sub>2</sub>**
- ▶ Ambu bag + O<sub>2</sub> (10-15L) = **45% O<sub>2</sub>**
- ▶ Ambu Bag + O<sub>2</sub> + Reservoir bag = **85% O<sub>2</sub>**





## **C = Circulation**

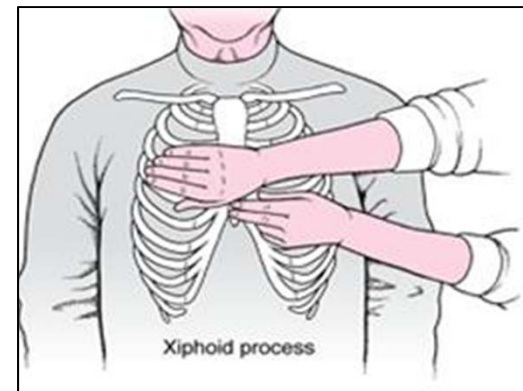
- (A) Chest compressions (BLS & ACLS).**
- (B) IV access (ACLS).**
- (C) Defibrillation (ACLS).**

(A) Chest compressions (cardiac massage):

The human brain cannot survive more than 3 minutes with lack of circulation. So chest compressions must be started immediately for any patient with absent central pulsations.

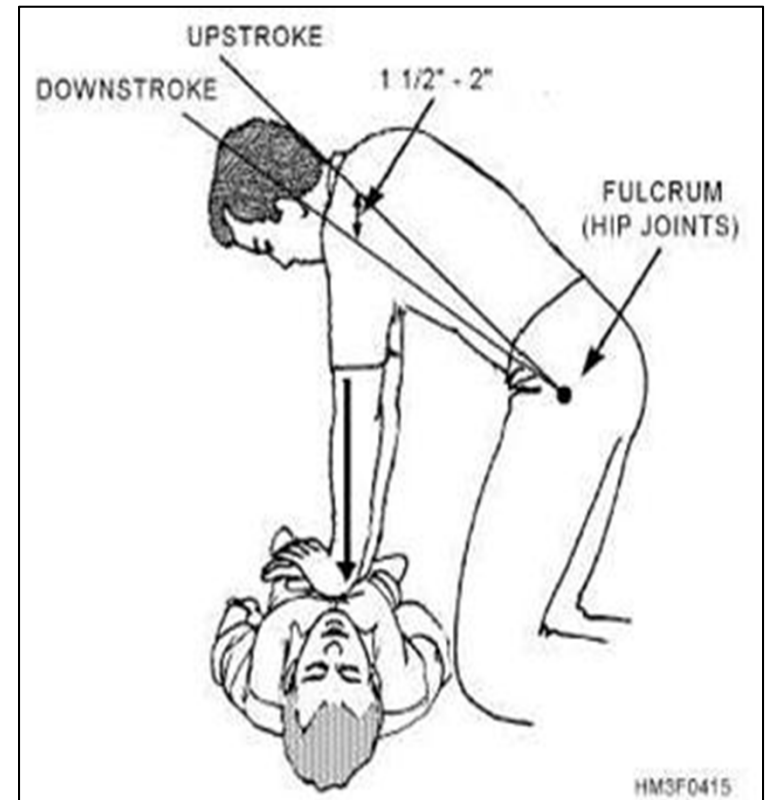
**Technique of chest compressions:**

- Pt must be placed on a hard surface (wooden board).
- The palm of one hand is placed in the concavity of the lower half of the sternum 2 fingers above the xiphoid process. (AVOID xiphisternal junction → fracture & injury).





- ▶ The other **hand** is placed over the hand on the sternum.
- ▶ **Shoulders** should be positioned directly over the hands with the **elbows** locked straight and arms extended.
- ▶ Sternum must be depressed **4-5 cm** in adults, and **2-4 cm** in children, **1-2 cm** in infants
- ▶ Must be performed at a rate of **100-120/min**
- ▶ During CPR the ratio of chest compressions to ventilation should be as follows:
- ▶ Single rescuer = **30:2**
- ▶ In the presence of 2 rescuers **chest compressions must not be interrupted** for ventilation.



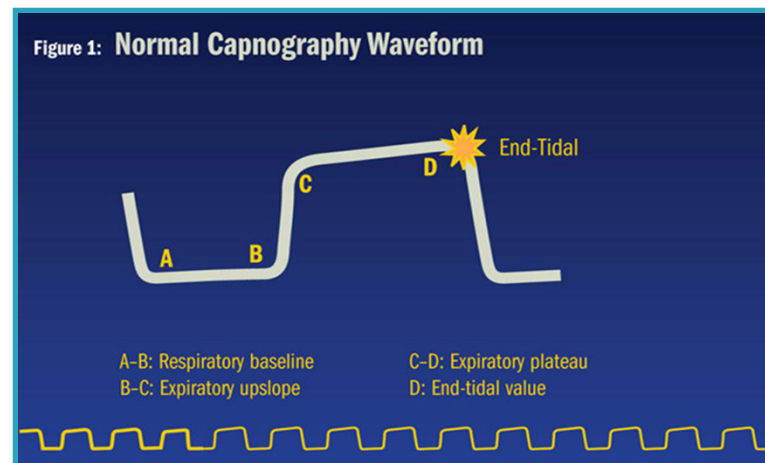
## **Complications of chest compressions:**

- ▶ Fractured ribs (**MOST commonly**).
- ▶ Pneumothorax.
- ▶ Sternal fracture.
- ▶ Anterior mediastinal hemorrhage.
- ▶ Injury to abdominal viscera (eg. liver laceration or rupture).
- ▶ Pulmonary complications (contusion).
- ▶ Rarely injury to the heart and great vessels (eg. myocardial contusion) (very rarely).
- ▶ **Usually AVOIDABLE by performing the technique correctly.**



# Assessment of the adequacy of chest compressions:

- ▶ **Systolic BP:** 60-80 mmHg
- ▶ **Diastolic BP:** > 40 mmHg
- ▶ **Capnography:** End-tidal (expired  $\text{CO}_2$ ): successful CPR is indicated by expired  $\text{CO}_2$  > 20 mmHg.



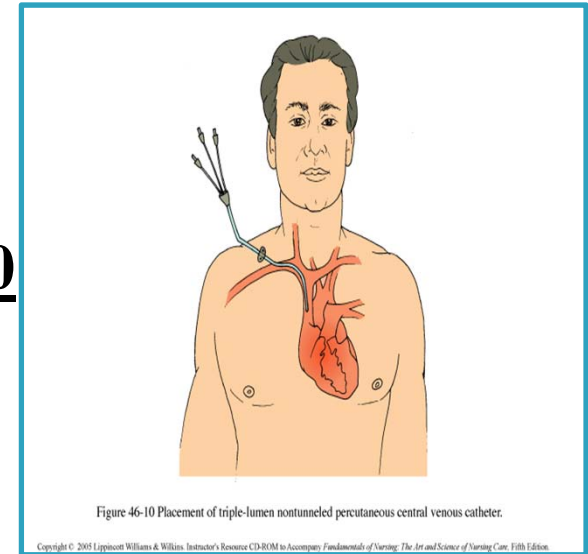
- ▶ Chest compressions must be continued for **2 minutes** before reassessment of cardiac rhythm.
- ▶ (2 minutes = equivalent to 5 cycles 30:2).
- ▶ **Golden rules:**
  - ▶ Ensure high quality chest compressions: rate, depth, recoil.
  - ▶ Plan actions before interrupting CPR.
  - ▶ **MINIMIZE** interruption of chest compressions.
  - ▶ **Early defibrillation** of shockable rhythm.



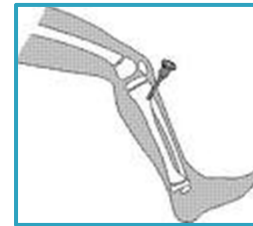
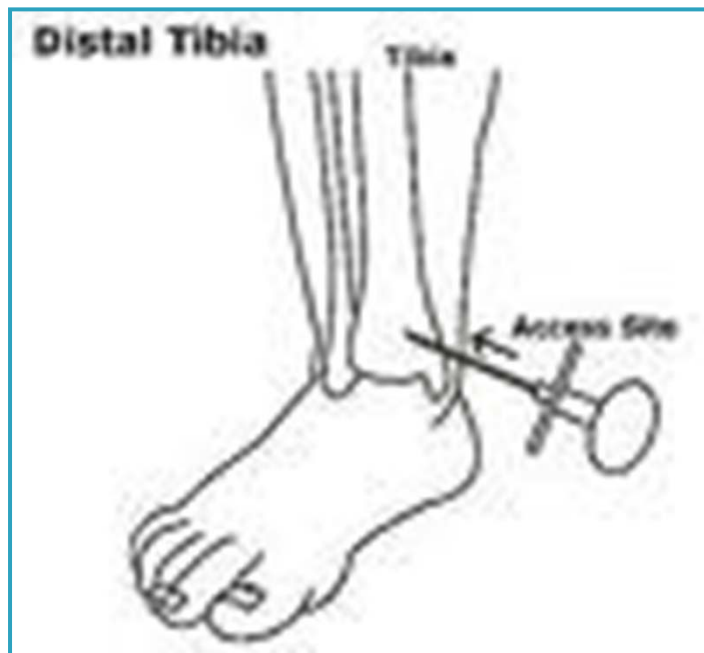


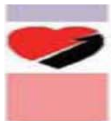
## (B) IV access

- A pre-existing **central venous line** is ideal in CPR, but if it is not present it will be time-consuming. Drug administration must be followed by **10 ml IV** fluid bolus.
- **Peripheral IV line** is associated with significant delay between drug administration and delivery to the heart, since peripheral blood flow is drastically reduced during resuscitation. So drug administration must be followed by **20 ml IV** fluid bolus in adults and elevation of the limb to ensure delivery to the central circulation.

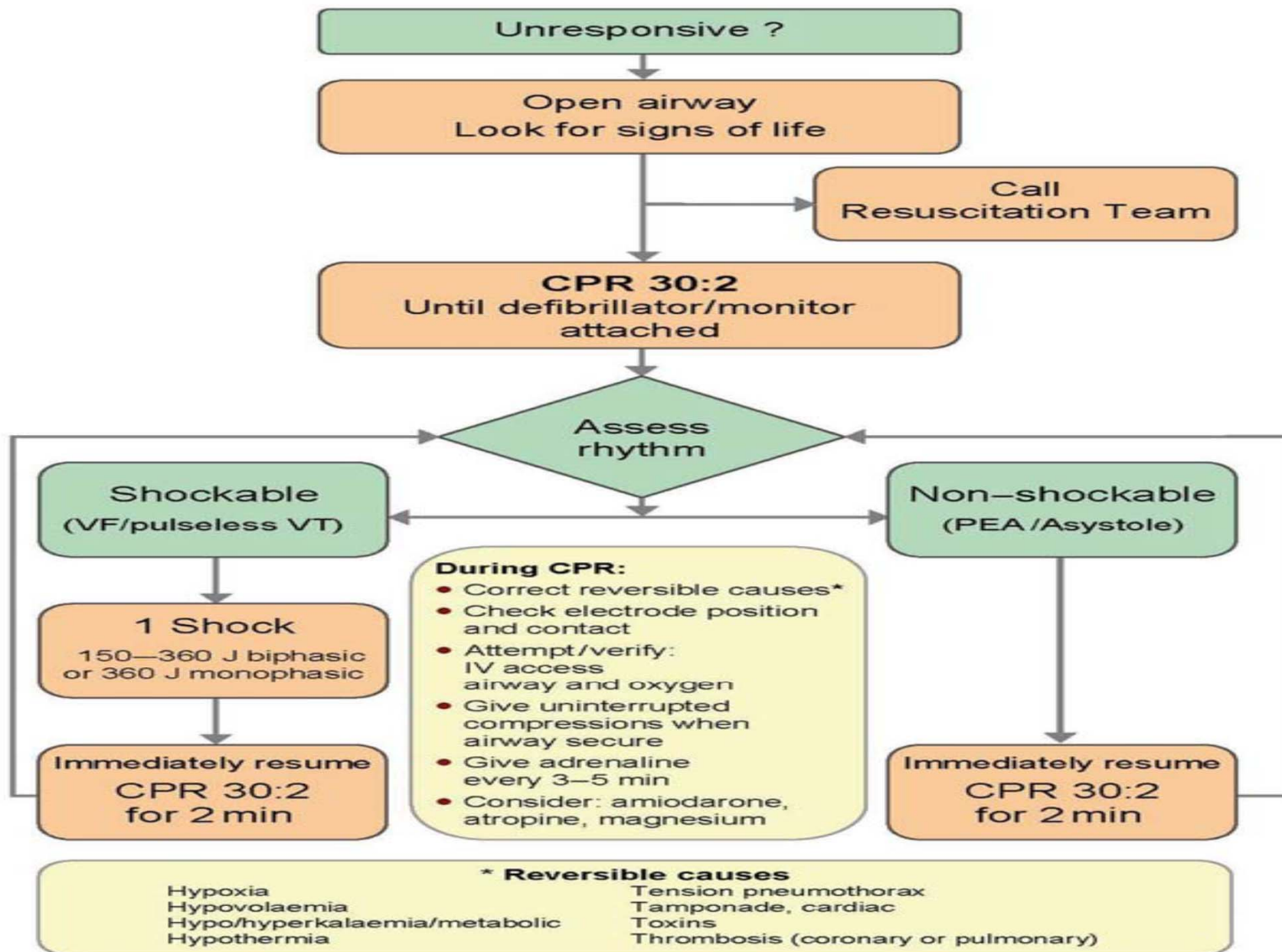


- ▶ Also in cases of difficult venous access , **Intraosseous** drug and fluid administration can be performed.

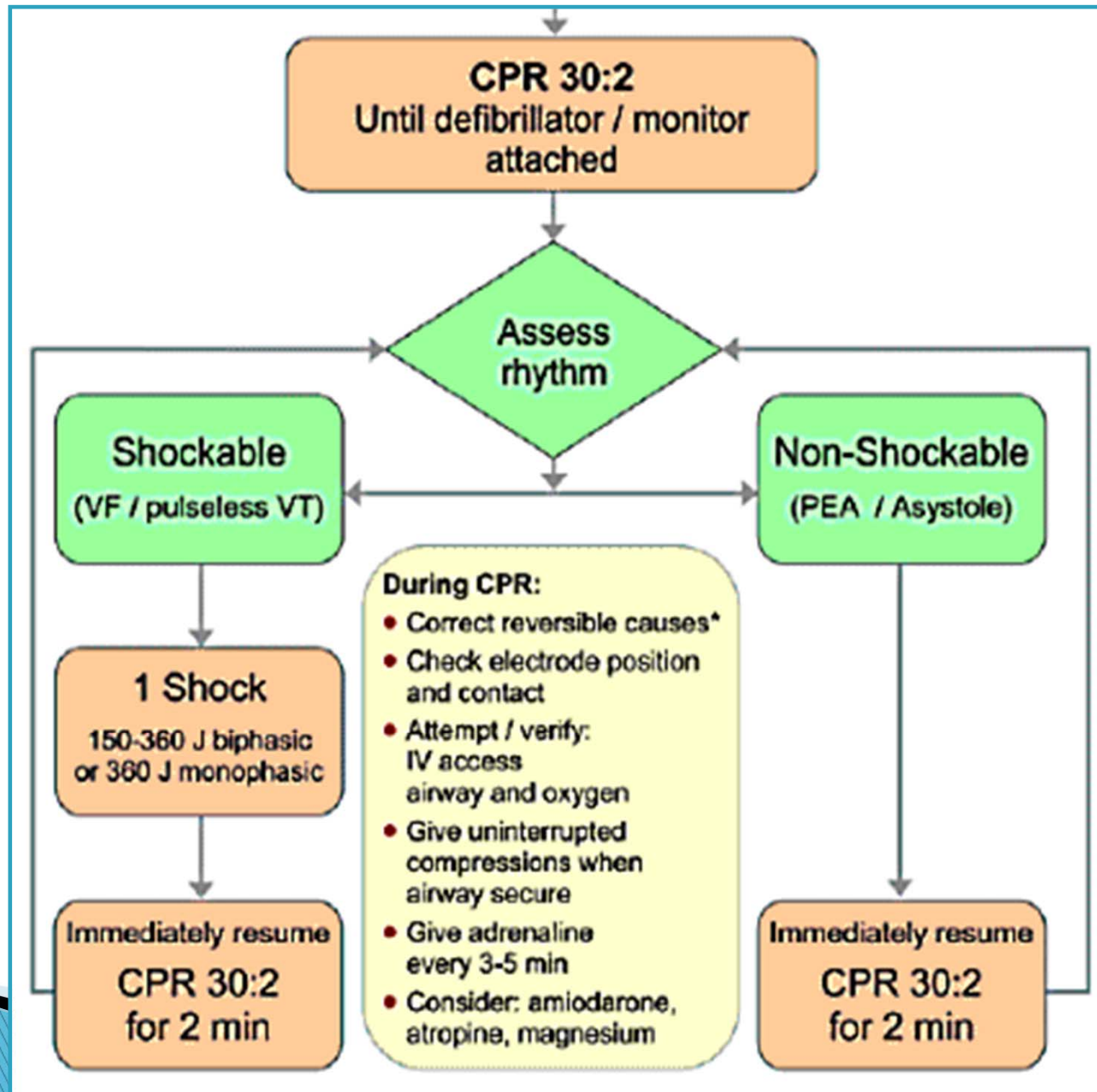




## Adult ALS algorithm

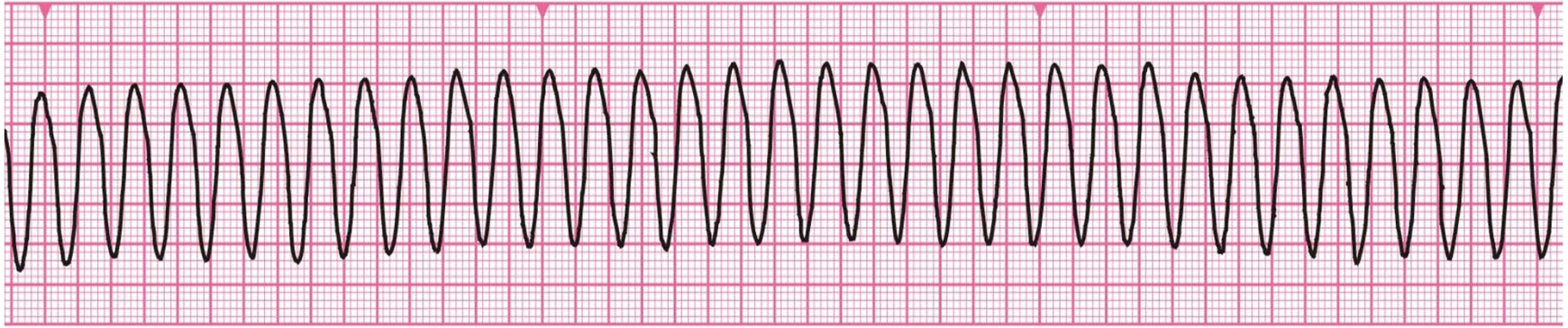


## (C) Defibrillation: Adult ALS algorithm

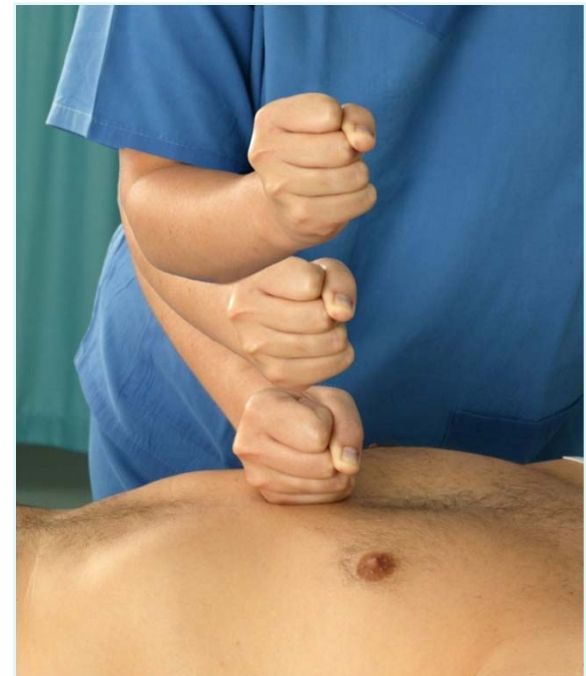




# Ventricular Tachycardia (VT) shockable

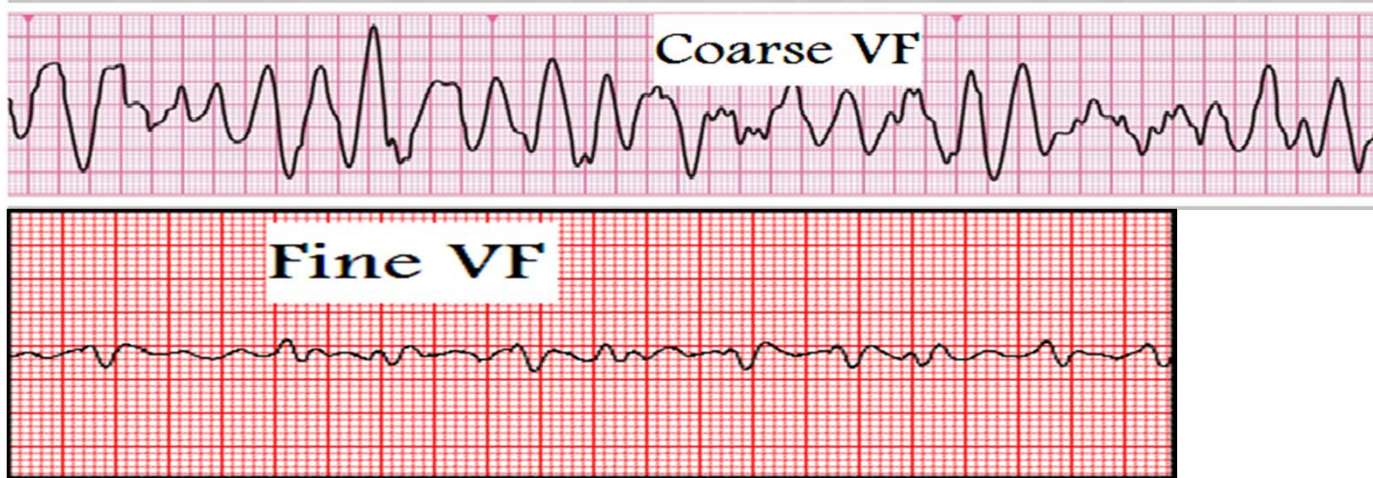


- ▶ Broad bizarre-shaped complexes.
- ▶ Rapid rate: 120-250/min.
- ▶ Regular.
- ▶ **Precordial thump:** Rapid treatment of a witnessed and monitored VF/VT cardiac arrest.



# Ventricular fibrillation (VF)

## shockable



- ▶ Bizarre irregular waveform.
- ▶ No recognizable QRS complexes.
- ▶ Random frequency and amplitude.
- ▶ Coarse / fine.
- ▶ Exclude **artifact**:
  - movement
  - electrical interference



# Asystole (**non-shockable**)

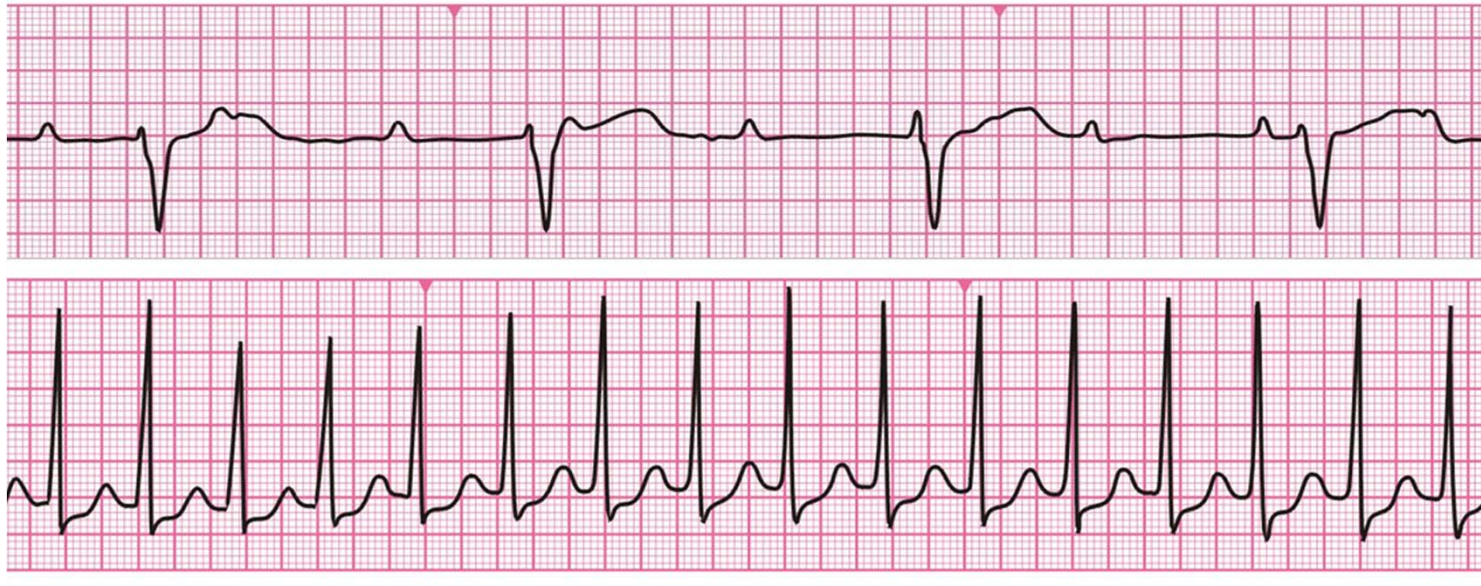


- ▶ Check that all leads are attached.
- ▶ Adrenaline 1 mg IV every 4 mins (2 cycles) (until a shockable rhythm is achieved).



# PEA: Pulseless Electrical Activity

## **non-shockable**



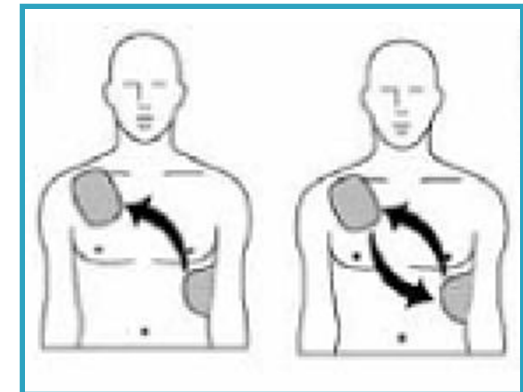
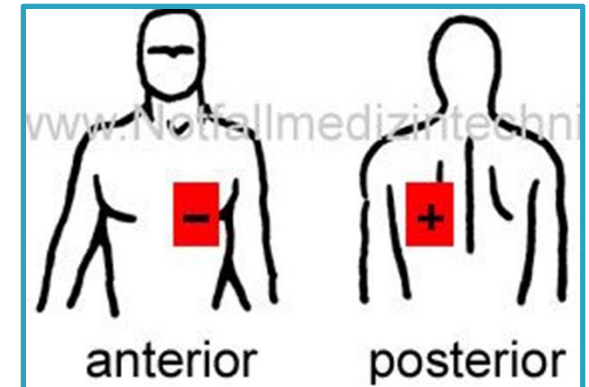
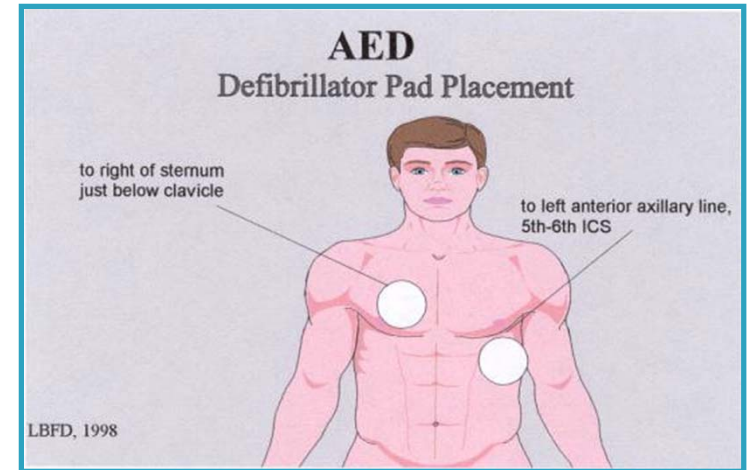
- ▶ Exclude / treat reversible causes.
- ▶ **Adrenaline 1 mg IV every 4 mins (2 cycles) (until a shockable rhythm is reached).**




## (C) Defibrillation

### Position of Paddles:

- ▶ One paddle is placed in the right infraclavicular region, while the other is placed in the left 5<sup>th</sup>–6<sup>th</sup> intercostal space anterior axillary line.
- ▶ Alternatively antero–posterior position may be used: one paddle is placed in the left infrascapular region while the other is placed in the left 5<sup>th</sup>–6<sup>th</sup> intercostal space anterior axillary line.



## Precautions:


- ▶ **Make sure the paddles have conducting gel on them:**  
(Why??)
    - 1- The electricity will not be properly transmitted to the chest wall without it.
    - 2- Even with the gel these paddles will often cause a second-degree skin burn.
  - ▶ **Make sure that you have cleared the bed:** make sure that no one is in contact with the bed otherwise this person may be electrocuted and develop VT or VF.
  - ▶ **Hold the paddles down firmly:** 25 pounds of pressure (= 11 kg)!!
  - ▶ Chest compressions must be continued for **2 minutes** after DC shock before reassessment of cardiac rhythm.
  - ▶ **Complications of defibrillation:** skin burn, injury to myocardium and elevation of cardiac enzymes, electrocution of person in contact with the bed.
- 

# Drugs used in CPR

## ► Adrenaline:

- Given as a **vasopressor**  $\alpha$ -1 effect (not as an inotrope).
- **Dose: 1 mg (0.01 mg/kg) IV every 4 minutes** (alternating cycles) while continuing CPR.
- **Given:**
  - 1) **Immediately in non-shockable** rhythm (non-VT/VF).
  - 2) In VF or VT given **after the 3<sup>rd</sup> shock**.
- **Repeated**: in alternate cycles (every 4 minutes).
- ***Once adrenaline → ALWAYS adrenaline.***

## ► Amiodarone:

- **Dose: 300 mg IV bolus (5 mg/kg).**
  - **Given**: in shockable rhythm **after the 3<sup>rd</sup> shock**.
  - If unavailable give **lidocaine** 100 mg IV (1-1.5 mg/kg).
- 

► **Vasopressin** (ADH): 40 IU single dose once.

► **Magnesium**:

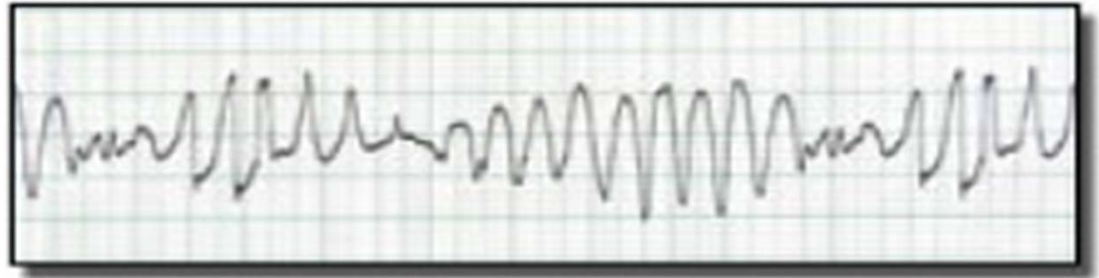
- **Dose**: 2 g IV.

- **Given**:

1- VF / VT with hypomagnesemia.

2- Torsade de pointes.

3- Digoxin toxicity.



► **Calcium**:

◦ **Dose**: 10 ml of 10% Calcium chloride IV.

◦ **Indications**: PEA caused by: hyperkalemia, hypocalcemia, hypermagnesemia, and overdose of calcium channel blockers.

◦ Do NOT give calcium solutions and NaHCO<sub>3</sub> simultaneously by the same route.



## ► IV Fluids:

- Infuse fluids rapidly if hypovolemia is suspected.
- Use normal saline (0.9% NaCl) or Ringer's solution.
- Avoid dextrose which is redistributed away from the intravascular space rapidly and causes hyperglycemia which may worsen neurological outcome after cardiac arrest.
- Dextrose is indicated only if there is documented hypoglycemia.

## ► Thrombolytics:

- Fibrinolytic therapy is considered when cardiac arrest is caused by proven or suspected acute pulmonary embolism.
- If a fibrinolytic drug is used in these circumstances consider performing CPR for at least 60-90 minutes before termination of resuscitation attempts.
- Eg: Alteplase, tenecteplase (old generation: streptokinase).



## **Sodium bicarbonate:**

### ► Used in:

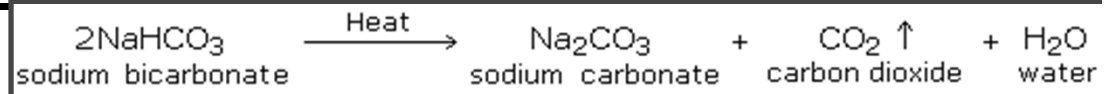
- 1- Severe metabolic acidosis ( $\text{pH} < 7.1$ )
- 2- Life-threatening hyperkalemia.
- 3- Tricyclic antidepressant overdose.

### ► Dose: (half correction)

$\frac{1}{2}$  Base Deficit  $\times$   $\frac{1}{3}$  Body weight.

## **Avoid its routine use due to its complications:**

1- Increases  $\text{CO}_2$  load:



2- Inhibits release of  $\text{O}_2$  to tissues.

3- Impairs myocardial contractility.

4- Causes hypernatremia.

5- Adrenaline works better in acidic medium.



## **Atropine:**

- ▶ Its routine use in PEA and asystole is not beneficial and has become **obsolete**.
- ▶ **Indicated** in: sinus bradycardia or AV block causing hemodynamic instability.
- ▶ **Dose**: **0.5 mg IV**. Repeated up to a maximum of 3 mg (*full atropinization*).



# CPR: Children

## 1 to 8 years of age

- A. Check for unresponsiveness
- B. If you are alone with the child give 4-5 cycles of 30 compressions before calling 911.
- C. Open the airway
- D. Check for breathing: look, listen, feel
- E. Not breathing: give 2 breaths
- F. Perform chest compressions on the nipple line in the center of the chest.
- G. If the child is small, use one hand for compressions. **If the child is larger,** use 2 hands.
- H. Press the sternum down 1" to 1 ½".
- I. Give 30 compressions to 2 breaths (ratio of 30:2).
- J. Pump at the rate of 100 compressions per 1 minute
- K. You should perform 5 cycles of 30 compressions in 2 minutes.





# CPR: Infant; 0 to 1 year check for unresponsiveness; call for help

- A. Check for unresponsiveness: tickle, touch, pinch the infant gently.
- B. If there is no response, perform 5 cycles of 30 compressions before calling 911.



# CPR: Infant; open airway

C. A = Open The Airway.

D. Tilt the head back gently, only far enough so that the infant's mouth is facing the ceiling. Do not tilt the head too far back! This may injure the neck, and collapse the airway.



# CPR: INFANT; check breathing

- E. B = breathing: Look, listen, and feel for air.
- F. If the infant is NOT breathing give 2 small gentle “puffs” of air.
- G. Cover both the baby's mouth AND nose with your mouth.
- H. You should see the baby's chest rise with each breath.



# CPR: Infants; check circulation

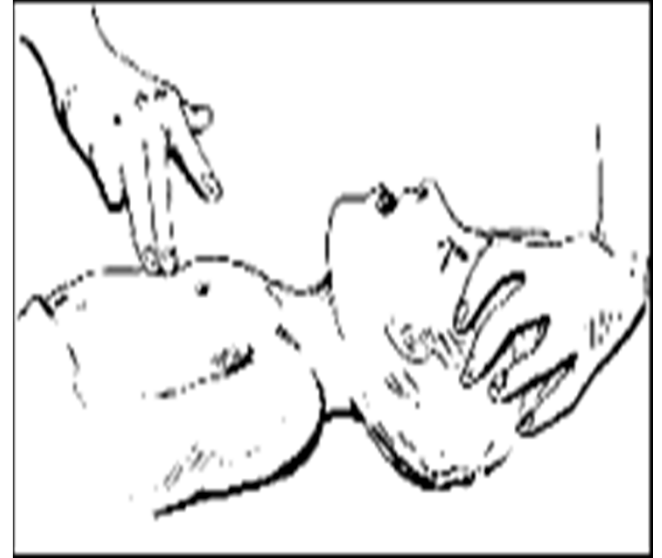
I. The proper placement for chest compressions is just below the nipple line.

J. Position your 3rd and 4th fingers in the center of the chest  $\frac{1}{2}$  inch below the nipples.

K. Press down  $\frac{1}{2}$ " to 1".

L. Perform 30 chest compressions at a ratio of 30:2 (30 compressions for every 2 breaths)

M. At least 100 compressions should be given within 1 minute.



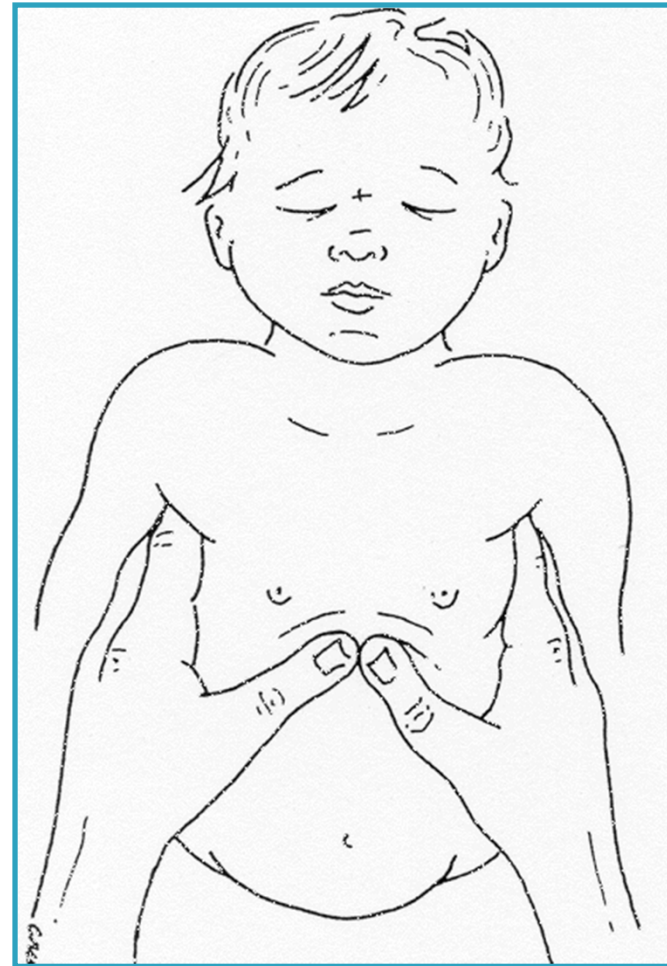


# CPR: Infants

If the infant recovers, put them in the recovery position by gently supporting the neck and picking them up.



## Chest compressions in infants (0-12 months)



## **Managing the Cardiac Arrest Team**

- ▶ During cardiac arrest the **team leader** should allocate and assign the various roles and tasks to the team members. Assign one person for each of the following roles:
  - **Airway management & ventilation** (Eg. bag & mask. Intubation).
  - **Chest compressions.**
  - **IV drug administration.**
  - **Defibrillation (DC shock).**
  - **Timing and documentation.**
- ▶ The person responsible for the airway may take turns with the person responsible for chest compressions in order to diminish fatigue & exhaustion.
- ▶ It is also the responsibility of the team leader to use the 2-minute periods of chest compressions to plan tasks, give orders and eliminate & exclude/ **correct** the **reversible causes** of cardiac arrest.



# When to stop CPR???







*Thank You*