

# CARDIOPULMONARY RESUSCITATION (CPR)

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# DEFINITION

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- is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing who has stopped breathing (respiratory arrest) and/or whose heart has stopped (cardiac arrest).

# PURPOSE

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- Restore cardiopulmonary functioning.
- Prevent irreversible brain damage from anoxia.

# CARDIAC ARREST

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- Cardiac arrest is the cessation of normal circulation of the blood due to failure of the heart to contract effectively.
- \* A cardiac arrest is different from (but may be caused by) a heart attack, where blood flow to the muscle of the heart is impaired.

# S.C.

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- ▶ Heart may stop (Cardiac Arrest) as a result
- ▶ Brain damage begins 4 - 6 minutes after ca
- ▶ Brain damage becomes irreversible in 8 - 10
- ▶ Dysrhythmia - an abnormal heartbeat may

## THE POSSIBLE TREATABLE OR REVERSIBLE CAUSES OF CARDIAC ARREST


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- 1) Hypoxia
- 2) Hypothermia
- 3) Hypovolemia
- 4) Hyperkalemia
- 5) Hypokalemia
- 6) Hydrogen ion overload (acidosis)
- 7) Tamponade (fluid build up around heart)
- 8) Tension Pneumothorax
- 9) Thrombosis
- 10) Toxins

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- In newborns, the most common cause of cardiopulmonary arrest is:
  - airway obstruction (usually from inhalation of a foreign body)
  - respiratory failure caused by sudden infant death syndrome (SIDS).
  - Sepsis
  - neurologic disease
  - drowning

# WHEN TO PERFORM CPR?

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- **1. not breathing or not breathing normally**  
(in cardiac arrest, some people will take occasional gasping breaths – they still need CPR at this point. Don't wait until they are not breathing at all)
  - **2. No Pulse**
  - **3. Unconscious/unresponsive**
- 



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- If the patient still has a pulse, but is not breathing, this is called respiratory arrest and **artificial respiration is more appropriate** than CPR but it still can be done.

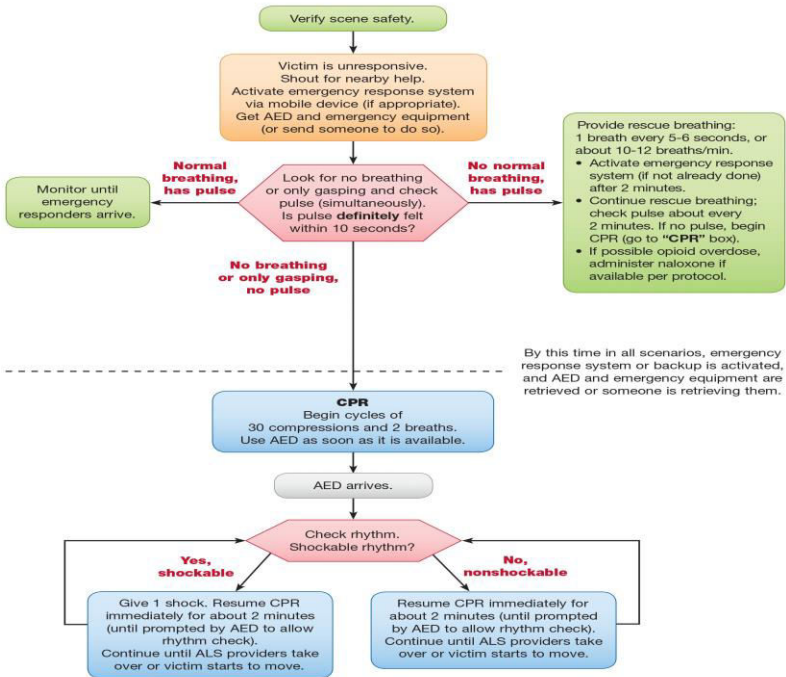
- 
- What is basic life support BLS?

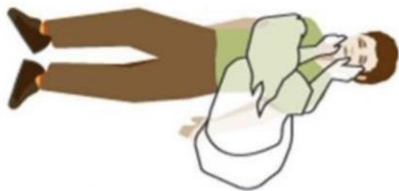
It is life support **without** the use of **special equipment**.

- What is Advanced Life Support ACLS?

It is life support **with** the use of **special Equipment** (e.g. Airway endotracheal tube, defibrillator).

## BLS Healthcare Provider Adult Cardiac Arrest Algorithm—2015 Update

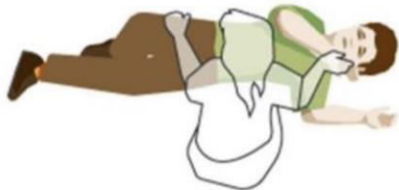




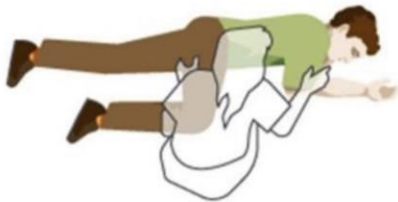
- 1** Tilt head backwards, ensure clear airway and straighten head and neck



- 2** Place arm at side and other arm across chest with hand against cheek



- 3** Bring far knee up to a 90° angle



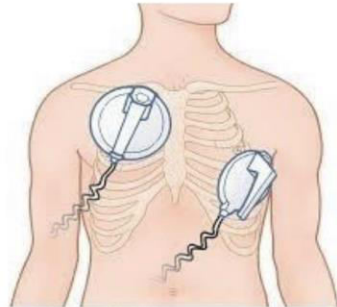
- 4** Roll person over towards you with knee at angle and ensure head is supported

## **Defibrillation paddles** : Soft thin foam pads

- a Layer of gel which picks up the electrical signals
- Must adhere firmly to chest wall – no creases

### **\*\* Position of paddles:**

- One paddle placed on **the right infraclavicular** region
- While the other is placed in the **left 5th or 6th intercostal space, in the anterior axillary line**



Source: Resuscitation 2010; Emergency Medicine Procedures  
Source: Zabram; www.accessmedicine.com/medications  
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## Cardiac Arrest Rhythms



**Coarse Ventricular Fibrillation**  
(Note the chaotic, irregular electrical activity)



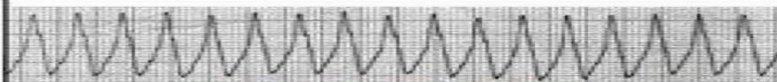
**Shock**



**Fine Ventricular Fibrillation**  
(Note the low-amplitude, irregular electrical activity)



**Shock**



**Ventricular Tachycardia**  
(Note the rapid, wide complexes)



**Shock  
if no  
pulse**



**Asystole**  
(Note the absence of electrical activity)



**CPR**



**Pulseless Electrical Activity (PEA)**  
(Any organized ECG rhythm with no pulse)



**CPR**

# PHASES OF THE CARDIO PULMONARY RESUSCITATION:

<b>Phases</b>		<b>Steps</b>
Phase-1	Basic life support	C= circulation A= Airway B= Breathing
Phase-2	Advance cardiac support	life D= Drugs E= ECG F= fibrillation
Phase-3	Prolonged support	life Post resuscitation care

# 1) EARLY RECOGNITION

Assessment is of crucial importance. It includes :

## 1) Unresponsiveness

- Check the victim for a response.
- Shake shoulders gently
- Ask “Are you all right?”





2) No breathing or no normal breathing (i.e., only gasping)



3) No pulse felt within 10 seconds.



## 2) CPR Sequence

*A Change From A-B-C to C-A-B*

A person is shown performing CPR on a mannequin lying on a surface. The person is leaning over the mannequin, and their hands are positioned on its chest. The background is a blurred indoor setting with windows.

**C**ompressions  
**A**irway  
**B**reathing

# PREPARATION:

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- Positioning: CPR is most easily and effectively performed by laying the patient supine on a relatively hard surface, which allows effective compression of the sternum.



## CHEST COMPRESSIONS



- Place the heel of one hand in the centre of the chest
- Place other hand on top
- Interlock fingers
- Compress the chest
  - Rate  $100 \text{ min}^{-1}$
  - Depth 4-5 cm (1.5 to 2 inch)
  - Equal compression : relaxation
- When possible change CPR operator every 2 min

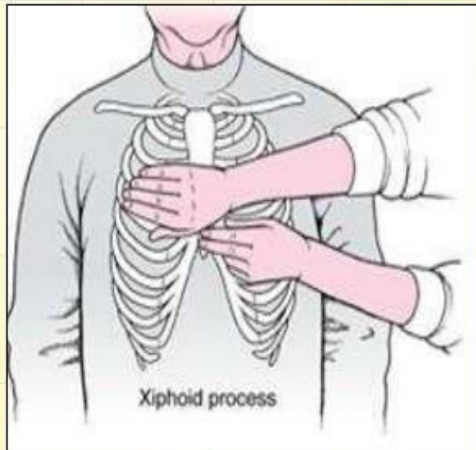
- The other **hand** is placed over the hand on the sternum.
- **Shoulders** should be positioned directly over the hands with the **elbows** locked straight and arms extended. Use your upper body weight to compress.
- Sternum must be depressed **at least 5 cm** in adults, and **2-4 cm** in children, **1-2 cm** in infants .



# PUSH HARD AND PUSH FAST



PresenterMedia



- ▶ 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.





## RESCUE BREATHS

- Pinch the nose
- Take a normal breath
- Place lips over mouth
- Blow until the chest rises
- Take about 1 second
- Allow chest to fall
- Repeat



# INFANT CPR

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- Check for responsiveness and breathing.
- Have a bystander call 9-1-1. If alone, give five cycles of CPR first, and then call.
- Give 15 chest compressions using two fingers.
- Give 2 rescue breaths and put your mouth on both mouth and nose.
- Repeat the compression and breath cycles until an AED is available or EMS personnel arrive



# CHILD CPR

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- ▶ CHECK FOR RESPONSIVENESS AND BREATHING.
- ▶ Have a bystander call 9- 1-1. If alone, give five cycles of CPR first, and then call.
- ▶ Give 30 chest compressions using one or two hands.



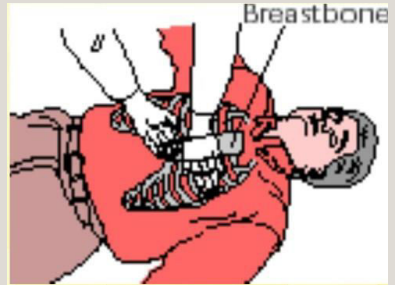
- ▶ Give two rescue breaths.
- ▶ Repeat the compression and breath cycles until an AED is available or EMS personnel arrive.



# PROBLEMS AND COMPLICATIONS OF CHEST COMPRESSIONS

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- 1. RIB FRACTURES
- 2. FRACTURE STERNUM
- 3. RIB SEPARATION
- 4. PNEUMOTHORAX
- 5. HEMOTHORAX
- 6. LUNG CONTUSIONS
- 7. LIVER LACERATIONS
- 8. FAT EMBOLI
- MANAGE ACCORDINGLY BUT CONTINUE CPR



# AIRWAY:

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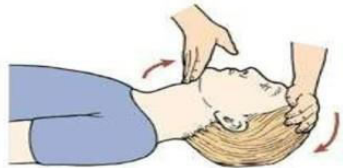
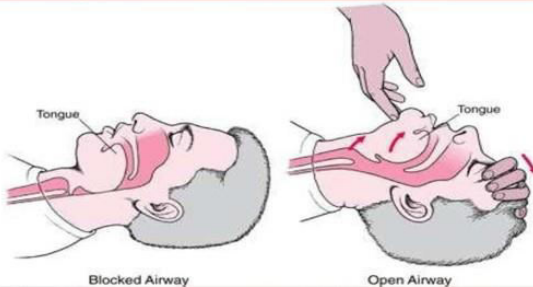
- ► Loss of consciousness often results in airway obstruction due to loss of tone in the muscles of the airway and falling back of the tongue.

- 
- ASSESS THE AIRWAY, ENSURING IT IS
  - - OPEN
  - - CLEAR
  - \*\*JAW THRUST CAN BE USED ( SUSPECTED SPINAL INJURY)
  - LOOK IN MOUTH FOR OBSTRUCTION, TEETH, TONGUE, VOMIT, FOREIGN

# (A) BASIC TECHNIQUES FOR AIRWAY PATENCY:

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- 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.



**Head tilt-chin lift**  
(ดันหน้าผาก-เขยียด)



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- 2. Jaw thrust:



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- **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).



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#### 4) Heimlich manoeuvre:

if the pt is conscious. It is done while the pt is **standing up** or **lying down**. This is a subdiaphragmatic abdominal thrust that elevates the diaphragm expelling a blast of air from the lungs that displaces the foreign body. In infants this can be done by a series of **blows on the back** and chest thrusts.



**B = BREATHING**

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-A case of 58 years old man have lost consciousness suddenly without a trauma and you were present in the situation: ..... We checked Circulation , Airway and now we have to perform

### **Breathing:**

\*maximum time to check for breathing is 10s while simultaneously feeling the carotid pulse.

If No breathing or grasping (agonal) breathing :

- After a good quality 30 compressions we perform 2 rescue breaths (make sure the airway is patent then close the victim's nose and with sealed mouth – mouth technique ,Exhale until the victim's chest rises and allow it to deflate...done two times
- Rescue breaths should take about 10s



The infographic features a red heart icon in the top left corner. The title "RESCUE BREATHS" is written in green, bold, uppercase letters on a yellow rectangular background. Below the title is a list of seven steps in black text. At the bottom of the infographic is an illustration of a rescuer in a white shirt and red tie performing a mouth-to-mouth rescue breath on a victim lying on their back. The victim's eyes are closed, and the rescuer's mouth is sealed over the victim's mouth. The background of the infographic is orange.

**RESCUE BREATHS**

- Pinch the nose
- Take a normal breath
- Place lips over mouth
- Blow until the chest rises
- Take about 1 second
- Allow chest to fall
- Repeat

**NOTE:**

**\*Always call for help .**

**\*If there is a person trained to do CPR  
around**

**make sure you collaborate with them for  
the best outcome**

**Switch between doing compressions and  
breathing to maintain a good quality  
compressions and avoiding excessive  
fatigue.**

# METHODS OF RESCUE BREATHING



- **MOUTH-TO-MOUTH BREATHING METHOD**
- **MOUTH-TO-NOSE METHOD (IF YOU CANNOT OPEN THE VICTIM'S MOUTH OR THE VICTIM'S MOUTH IS SEVERELY INJURED)**
- **MOUTH TO MOUTH AND NOSE (MOSTLY CHILDREN )**
- **VENTILATION BY FACE MASK**
- **MOUTH-TO-STOMA METHOD (SMALL, PERMANENT OPENING IN THE NECK, DO NOT PERFORM AS A NON-SPECIALIZED DOCTOR)**

## Signs of a successful CPR :

Return of pulses and  
blood pressure

Struggling movements

Free movements of chest wall

Return of skin color

Contraction of pupils



## **When do we stop CPR?**

- **Victim shows signs of life (Successful resuscitation )**
- **Emergency medical services (EMS) personnel take over.**

**You become too tired to continue (switch if possible)**

- **there is danger on your life**

## ADVANCED LIFE SUPPORT

The Advanced Life Support ((ALS)) is a set of life saving protocols and skills that extend basic life support to further support the circulation and provide an open airway and adequate ventilation (breathing) -hospital based-

These include:

Airway management by equipments  
Breathing by advanced techniques  
Defibrillation by manual defibrillator  
Drugs.

**Airway maintaining equipments:**



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

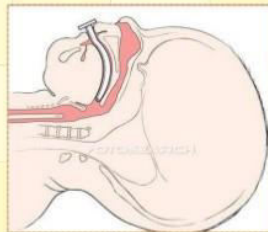
### 1) Face Mask



# **Blind insertion tools:**



## 2) Oropharyngeal airway



### 3) Nasopharyngeal airway

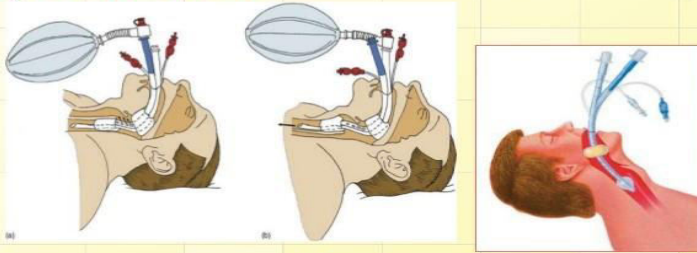


## 4) Laryngeal mask (LMA)





## 6) Combitube



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Double lumen tube

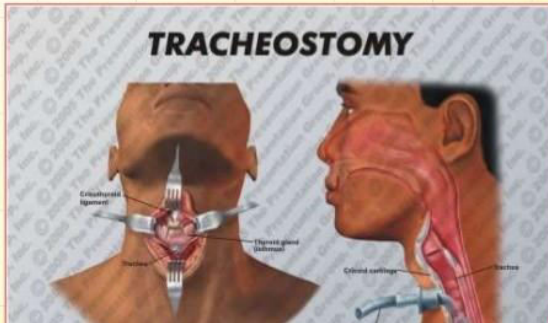
# Visualization Based:

## 5) Endotracheal tube



# Surgical airway access

## 8) Tracheostomy (Surgical Airway)



## 7) Cricothyrotomy (Surgical Airway)

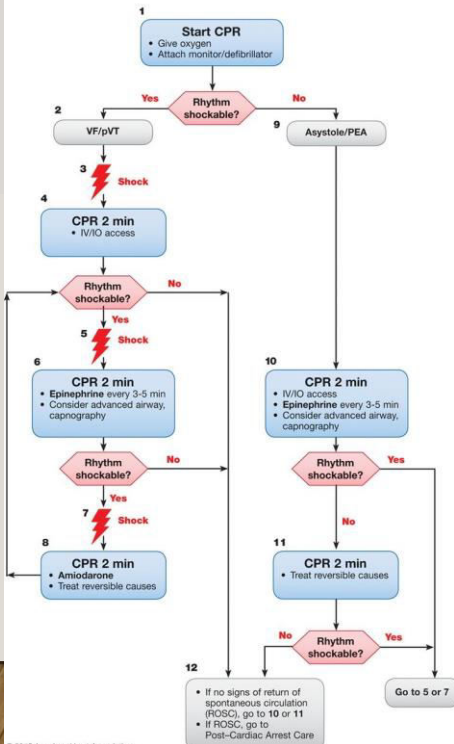


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Less time, less experience needed , less bleeding

## **When the patient arrives to hospital or having an in patient arrest:**

- Continue CPR!
- Admit into Intensive Care Unit
- O2 supplement and connect to monitors
- identify heart rhythm(Shockable or non-Shockable)
- follow ACLS algorithm



CPR Quality

- Push hard (at least 2 inches [5 cm] and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If PETCO<sub>2</sub> <10 mm Hg, attempt to improve CPR quality.
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Shock Energy for Defibrillation

- **Biphasic:** Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- **Monophasic:** 360 J

Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway

- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)

- Pulse and blood pressure
- Abrupt sustained increase in PETCO<sub>2</sub> (typically >40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

# O<sub>2</sub> supplementation

- ▶ 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)
  - ▶ 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>



Place your mouth  
over the victim's  
mouth and exhale





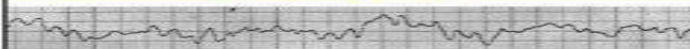
# DEFIBRILLATIO

• **N** Defibrillation consists of delivering a therapeutic dose of electrical energy to the affected heart with a device called a defibrillator

In cardiac arrest, the associated heart rhythms can be categorised into two groups :

- 1) Shockable rhythm: VT/VF
- 2) Non shockable rhythm: asystole and PEA

## Cardiac Arrest Rhythms



**Coarse Ventricular Fibrillation**  
(Note the chaotic, irregular electrical activity)



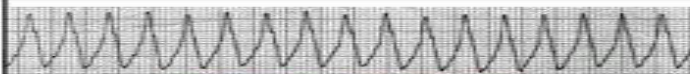
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**Fine Ventricular Fibrillation**  
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**Shock**



**Ventricular Tachycardia**  
(Note the rapid, wide complexes)



**Shock  
if no  
pulse**



**Asystole**  
(Note the absence of electrical activity)



**CPR**



**Pulseless Electrical Activity (PEA)**  
(Any organized ECG rhythm with no pulse)



**CPR**

## AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

- Portable, battery operated
- For use by trained first aiders
- Will analyse the rhythm
- AED's accurately diagnose cardiac rhythms and separate them into 2 groups
  - those *responsive to defibrillation*
  - those *unresponsive to defibrillation*
- Will only 'shock' a shockable rhythm

Position of paddles:

One paddle placed on the right infraclavicular region

While the other is placed in the left 5th or 6th intercostal space ,in the anterior axillary line

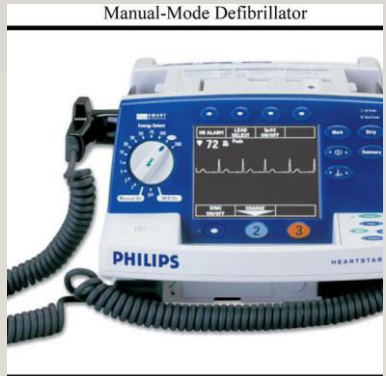
Voltage of electricity discharge High from

150 J to 360J(biphasic)

360 J(monophasic)



What's the difference between manual defibrillation and an AED? Manual defibrillation allows the rescuer to adjust the level of energy delivered to the patient, as well as when a shock should be delivered, while an AED does not. Manual defibrillators are meant to be used by trained professionals, whereas AEDs are considered public access devices that can be used by anyone whether trained or untrained.



# Drug used in Cpr

## Adrenaline

-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 2nd shock.

-Repeated: in alternate cycles (every 4 minutes).

-Once adrenaline → ALWAYS adrenaline.

## Amiodarone:

- First Dose: 300 mg IV bolus (5 mg/kg) second dose second dose 150 mg.
- Given: in shockable rhythm after the 3rd shock.
- If unavailable give lidocaine 100 mg IV (1-1.5 mg/kg).

## Vasopressin

The new CPR guidelines of both the American Heart Association, and European Resuscitation Council recommend 40 U vasopressin intravenously, and 1 mg epinephrine intravenously as equally effective for the treatment of adult patients in ventricular fibrillation; however, no recommendation for vasopressin was made to date for adult patients with asystole and pulseless electrical activity, and paediatrics due to lack of clinical data.

## Magnesium sulfate

(2 g IV/IO bolus, followed by a maintenance infusion) may be used to treat polymorphic ventricular tachycardia consistent with torsade de pointes, but is not recommended for routine use in adult cardiac arrest

## Calcium

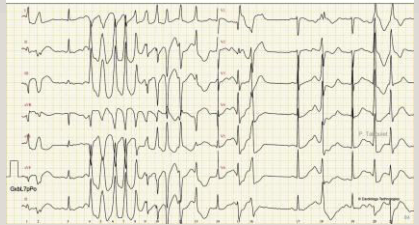
- Dose: 10 ml of 10% Calcium chloride IV.
- Indications: PEA caused by: hyperkalemia,
- Do NOT give calcium solutions and  $\text{NaHCO}_3$  simultaneously by the same route.

## Sodium bicarbonate:

- Used in:
  - 1- Severe metabolic acidosis ( $\text{pH} < 7.1$ )
  - 2- Life-threatening hyperkalemia.
  - 3- Tricyclic antidepressant overdose.
- Dose: (half correction)  
 $\frac{1}{2} \text{ Base Deficit} \times \frac{1}{3} \text{ Body weight.}$

## Torsade de pointes

Methadone et K 3.1



### 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).

### IV Fluids:

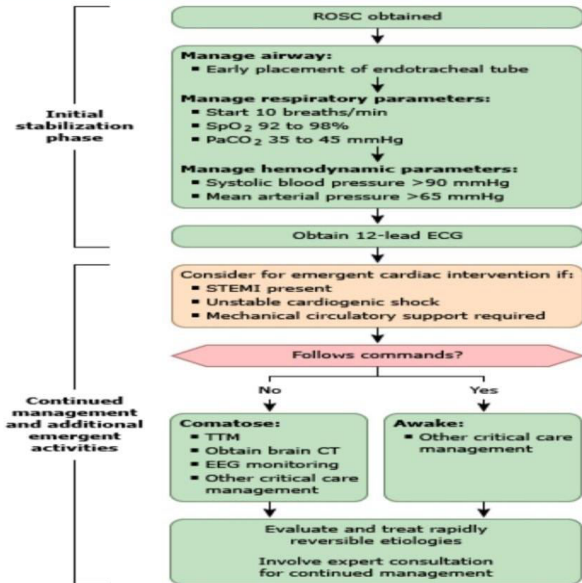
- Infuse fluids rapidly if hypovolemia is suspected.
- Use normal saline (0.9% NaCl) or Ringer's solution.
- Avoid dextrose which is redistributed away from the intravascular space rapidly and causes hyperglycemia which may worsen neurological outcome after cardiac arrest.
- Dextrose is indicated only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



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).

## Adult post-cardiac arrest care algorithm



### Initial stabilization phase

Resuscitation is ongoing during the post-ROSC phase, and many of these activities can occur concurrently. However, if prioritization is necessary follow these steps:

- Airway management: Waveform capnography or capnometry to confirm and monitor endotracheal tube placement
- Manage respiratory parameters: Titrate FIO<sub>2</sub> for SpO<sub>2</sub> 92 to 98%; start at 10 breaths/min; titrate to PaCO<sub>2</sub> of 35 to 45 mmHg
- Manage hemodynamic parameters: Administer crystalloid and/or vasopressor or inotrope for goal systolic blood pressure >90 mmHg or mean arterial pressure >65 mmHg

### Continued management and additional emergent activities

These evaluations should be done concurrently so that decisions on targeted temperature management (TTM) receive high priority as cardiac interventions.

- Emergent cardiac intervention: Early evaluation of 12-lead electrocardiogram (ECG); consider hemodynamics for decision on cardiac intervention
- TTM: If patient is not following commands, start TTM as soon as possible; begin at 32 to 36°C for 24 hours by using a cooling device with feedback loop
- Other critical care management:
  - Continuously monitor core temperature (esophageal, rectal, bladder)
  - Maintain normoxia, normocapnia, euglycemia
  - Provide continuous or intermittent electroencephalogram (EEG) monitoring
  - Provide lung-protective ventilation

## 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.