

# CARDIO PULMONARY RESUSCITATION

## CPR

### Definition of CPR according to WHO

Is an emergency life saving procedure performed when heart stops beating or impending stop. for the purpose of oxygenation of the heart, lungs & brain until restore the normal cardiopulmonary function

CPR IS EASY AS CAB C=Compression...A= Airway....B =Breathing

Compressions Push hard and fast on the center of the victim's chest

Airway Tilt the victim's head back and lift the chin to open the airway

Breathing Give mouth-to-mouth rescue breaths

### □ Types of C P R

1- B L S

2- A L S

### Definition of B L S according to WHO

Is an emergency life saving procedure performed when heart stops beating or impending stop. for the purpose of oxygenation of the heart, lungs & brain until restore the normal cardiopulmonary function WITHOUT EQUIPMENTS

It involves by giving strong, rapid punches to the chest to keep blood moving through the body and blows air into the mouth to help with breathing and send oxygen to the patient's lung

So its C A B C=Compression...A= Airway....B =Breathing

### Goals of BLS

1. Maintain oxygen and blood supply to vital organs during cardiac arrest

Restore spontaneous circulation) Cardiac output during CPR with effective, uninterrupted chest compression is at best GOALS OF BLS

Maintain oxygen and of the normal spontaneous circulation .

- 2- Minimize post resuscitation organ injury
- 3- Improve the patient's survival and neurologic outcome

#### **Newly concept for training**

1. CPR coach to help team leader .
2. CPR coach ensures high quality BLS, while team leader focuses on other aspects like ACLS .
3. Double sequential defibrillation (Two defibrillators set one anterolateral and other antero posterior electrodes
4. ,Biphasic 120: 200 J but monophasic 360 J
5. In Situ training (simulation and training in the clinical setting to improve professional skills ,team function & clinical care
6. Booster training to refresh participants knowledge ,skills & attitudes around the key of course components
7. Spaced learning approach (outside clinic ,hospital &classroom )

# CHAIN OF SURVIVAL

- Identifies a sequence of **SIX critical actions** that increase survival rates from sudden cardiac arrest (SCA)

## OUTSIDE HOSPITAL CARDIAC ARREST

OHCA



# INSIDE HOSPITAL CARDIAC ARREST

IHCA



**Recovery** (including additional treatment, observation, rehabilitation, and psychological support)

## CPR Components for BLS Providers

Component	Adults and Adolescents	Children (Age 1 Year to Puberty)	Infants (Age Less Than 1 Year, Excluding Newborns)
<b>1-Safety</b>	Make sure the environment is safe for rescuers and victim		
Scene			
Rescuer			
Victim			
Bystanders			



## A-CHECK RESPONSE



Shake shoulders gently

Ask “Are you all right?”

If he responds

- Leave as you find him.
- Find out what is wrong.
- Reassess regularly.

## Rapid neurological assesment of patient response (AVPU)

- **A**lert
- **V**oice
- **P**ain
- **U**nresponsive

## B-Check pulse Central not peripheral pulse Age & site of pulse check in CPR

CATEGORY	AGE	SITE FOR PULSE CHECK
<b>NEONATE</b>	1 <sup>ST</sup> 30 DAYS AFTER BIRTH	<u><i>PRECORDIAL AUSCULTATION</i></u>   <u><i>3 LEAD ECG</i></u>
<b>INFANT</b>	30DAYS TO 1YEAR AFTER BIRTH	<u><i>BRACHIAL ARTERY</i></u>
<b>CHILD</b>	1YEAR TO PUBERTY	<u><i>FEMORAL</i></u> <u><i>CAROTID ARTERY</i></u>
<b>ADULT \ADOLOCENT</b>	AFTER PUBERTY	<u><i>CAROTID ARTERY</i></u>

- PUBERTY: *FEMALE*: BREAST DEVELOPMENT  
*MALE*: AXILLARY HAIR

## C - CHECK BREATHING

- Look, listen and feel for NORMAL breathing
- Do not confuse agonal breathing with NORMAL breathing



No response  
No pulse  
No breathing  
**SHOUT FOR HELP**



Component	Adults and Adolescents	Children (Age 1 Year to Puberty)	Infants (Age Less Than 1 Year, Excluding Newborns)
<b>3 - Shout for help</b> <b>-Mobile phone technology</b> <b>-Activation of emergency response system</b>	-If you are alone with no mobile phone, leave the victim to activate the emergency response system and -Get the AED before beginning CPR - If you have other personell , send someone for activation And begin CPR immediately; -use the AED as soon as it is available <b>-Activation of emergency team</b>	<b>Witnessed collapse</b> <b>One was present at time of the patient collapsed</b> Follow steps for adults and adolescents on the left <b>Unwitnessed collapse</b> <b>the patient is found without pulse and no one was present at the time the patient collapsed</b> Give 2 minutes of CPR Leave the victim to activate the emergencyresp	



# Air way

## 4-Open airway

-head tilt

-chin lift or head tilt

-jaw thrust manoeuvre

-and mask bag ventilation is recommended for initial airway control in most circumstances. If not available do mouth to mouth breathing

- **Triple** manoeuvre: head tilt-chin lift, mouth open, jaw thrust



## Head Tilt-Chin Lift Maneuver

- **Indications:**

- Unresponsive
- No spinal injury
- Unable to protect airway

- **Contraindications:**

- Responsive
- Possible spinal injury



- **Advantages**

- No equipment
- Noninvasive

- **Disadvantages**

- Hazardous to spinal injury
- No protection from aspiration

## Jaw-Thrust Maneuver

- **Disadvantages**

- Cannot maintain if patient becomes responsive or combative
- Difficult to maintain for an extended time
- Difficult to use with bag-mask ventilation
- Thumb must remain in place
- Requires second rescuer
- No protection against aspiration



## Clean airway

- Removes material from the mouth or throat quickly and efficiently
  - Ventilating with secretions in the mouth will result in upper airway obstruction or aspiration.
- Next priority after opening airway manually



## CHECK BREATHING

### 5-Check breathing

- Look
- listen
- Feel
- for NORMAL breathing
- Do not confuse agonal breathing with NORMAL breathing



### AGONAL BREATHING

- Occurs shortly after the heart stops in up to 40% of cardiac arrests
- Described as barely, heavy, noisy or gasping breathing
- Recognise as a sign of cardiac arrest

### Not breathing

- Call for help
- Start CPR and Rescue breaths

## Age & site of pulse check in CPR

CATEGORY	AGE	SITE FOR PULSE CHECK
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- PUBERTY: *FEMALE*: BREAST DEVELOPMENT  
*MALE*: AXILLARY HAIR

- No pulse
- Call for help
- Start CPR

No response  
 No breathing  
 No pulse  
 Shout for help  
**START C P R**



Component	Adults and Adolescents	Children (Age 1 Year to Puberty)	Infants (Age Less Than 1 Year, Excluding Newborns)
6-Compression-ventilation ratio without advanced airway	1 or 2 rescuers 30:2	One rescuer 30:2 Two or more rescuers 15:2	
-Compression-ventilation ratio with advanced airway	Continuous compressions at a rate of 100-120/min Give 1 breath every 6seconds(10 breaths/mm)	Continuous compressions at a rate of 100-120/min Give 1 breath every 2-3 seconds (20-30 breaths/mm)	

## Check circulation

- Check the pulse
- Check the bleeding

## Age & site of pulse check in CPR

CATEGORY	AGE	SITE FOR PULSE CHECK
NEONATE	1 <sup>ST</sup> 30 DAYS AFTER BIRTH	<u>PRECORDIAL</u> <u>AUSCULTATION</u> 3 <u>LEAD ECG</u>
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ADULT \ ADOLESCENT	AFTER PUBERTY	<u>CAROTID ARTERY</u>

- PUBERTY: FEMALE: BREAST DEVELOPMENT  
MALE: AXILLARY HAIR



- No pulse
- Call for help
- Start CPR

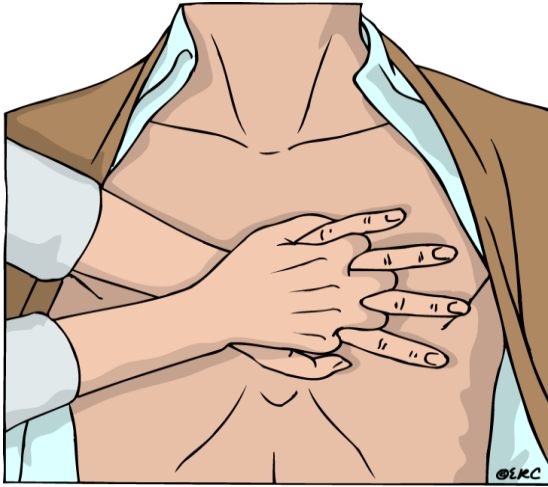
No response  
No breathing  
No pulse  
Shout for help  
START C P R



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6-Compression-ventilation ratio without advanced airway	1 or 2 rescuers 30:2	One rescuer 30:2 Two or more rescuers 15:2	
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<b>Compression rate</b>	100-120/min		
<b>Compression depth</b>	At least 2 inches (5 cm)*	At least one third AP diameter of chest About 2 inches (5 cm)	At least one third AP diameter of chest About 1 : 11/2 inches (4 cm)
<b>Hand placement</b>	2 hands on the lower half of the breastbone (sternum) <div data-bbox="417 512 807 842" data-label="Image"> </div>	2 hands or 1 hand (optional for very small child) on the lower half of the breastbone (sternum) <div data-bbox="831 688 1273 976" data-label="Image"> </div>	<b>1 rescuer</b> 2 fingers in the center of the chest, just below the nipple line <b>2 or more rescuers</b> 2 thumb-encircling hands in the center of the chest, just below the nipple line
<b>Chest recoil</b>	Allow full recoil of chest after each compression; do not lean on the chest after each compression		
<b>Minimizing interruptions</b>	Limit interruptions in chest compressions to less than 10 seconds		

## 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 min<sup>-1</sup>
  - Depth 4-5 cm
  - Equal compression : relaxation
- When possible change CPR operator every 2 min

# CHEST COMPRESSIONS

Table 1

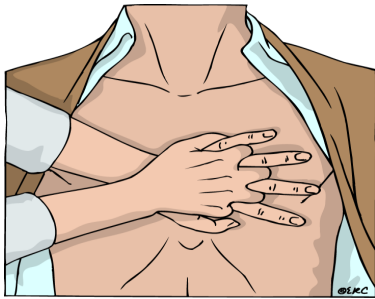
BLS Dos and Don'ts of Adult High-Quality CPR

Rescuers Should	Rescuers Should Not
Perform chest compressions at a rate of 100-120/min	Compress at a rate slower than 100/min or faster than 120/min
Compress to a depth of at least 2 inches (5 cm)	Not less than 4cm and not more than 7 cm
Allow full recoil after each compression	Lean on the chest between compressions
Minimize pauses in compressions	Interrupt compressions for greater than 10 seconds
Ventilate adequately (2 breaths after 30 compressions, each breath delivered over 1 second, each causing chest rise)	Provide excessive ventilation (ie, too many breaths or breaths with excessive force)





CONTINUE CPR

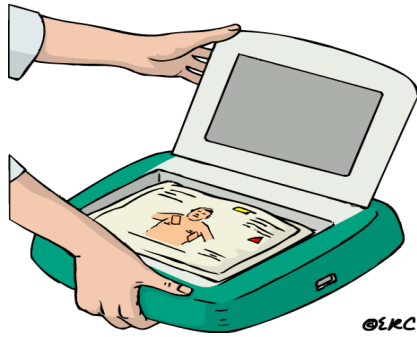


## DIFFERENCE IN ADULT AND PEDIATRIC CPR

POINT OF DIFFERENCE	ADULTS	CHILDREN\INFANT
1: activation of emergency response system	1 <sup>st</sup> : Activate ERS & get AED 2 <sup>nd</sup> : Start CPR	<b><u>Witnessed collapse:</u></b> same as adult  <b><u>Unwitnessed collapse:</u></b> 1 <sup>st</sup> : 2mins of CPR 2 <sup>nd</sup> : leave the victim to active ERS
2:compression to ventilation ratio <b>without advanced airway</b>	One or more rescuer. Always 30:2	1 rescuer: 30:2 2 rescuer: 15:2
3:compression to ventilation ratio <b>with advanced airway</b>	1breath every 6secs (10 breaths\min(	1breath every 2-3 secs 30-20)breaths \mins(
4: depth of compression	2to 2.4inches	Children: about 2inches Infants: about 1.5inches
5: hand placement	Lower half of sternum	Infants: 1 rescuer: 1finger technique

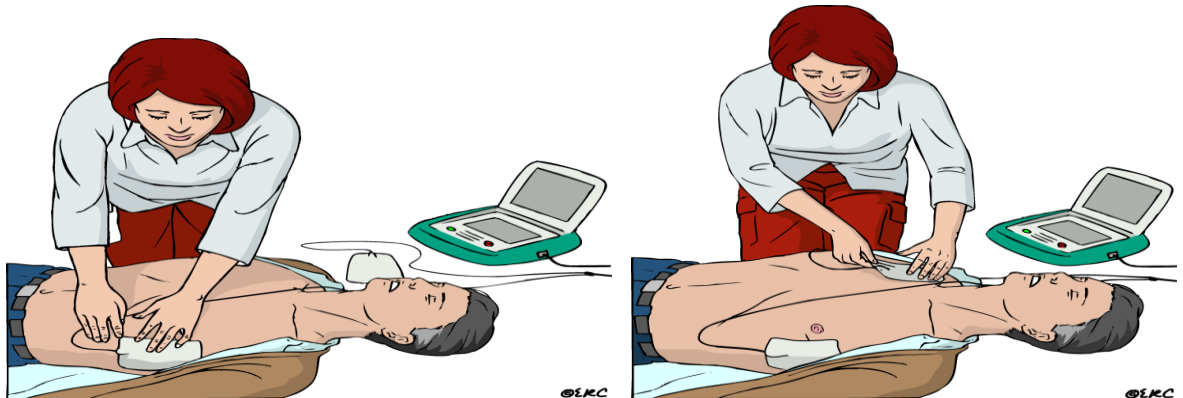


## AUtomated Electrical Defirillator AED



Some AEDs will automatically switch •  
themselves on when the lid is opened

## ATTACH PADS TO CASUALTY'S BARE CHEST



**ANALYSING RHYTHM  
DO NOT TOUCH VICTIM**



**SHOCK INDICATED**



Stand clear  
Deliver shock

SHOCK DELIVERED  
FOLLOW AED INSTRUCTIONS



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30



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2



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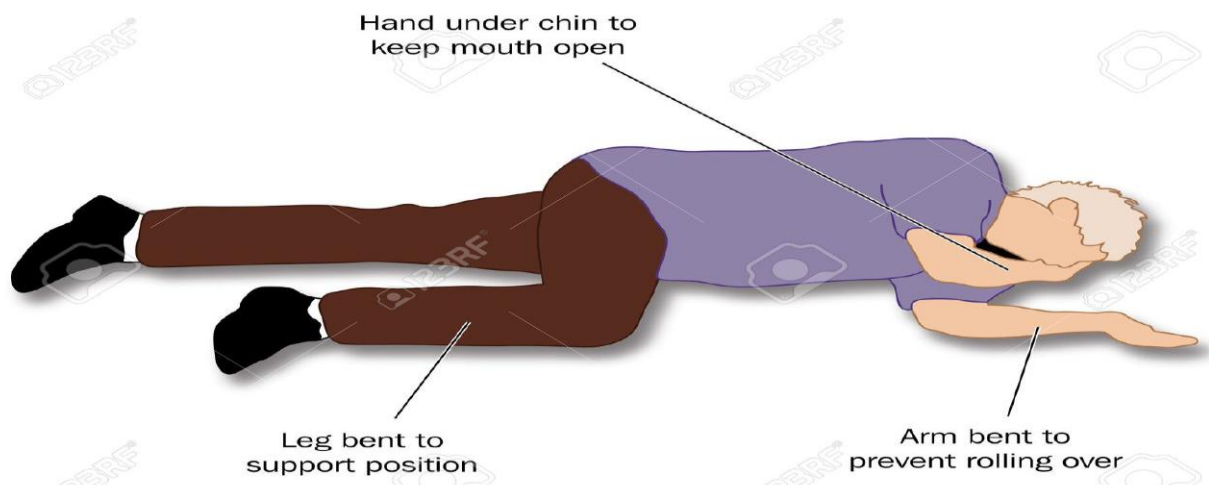
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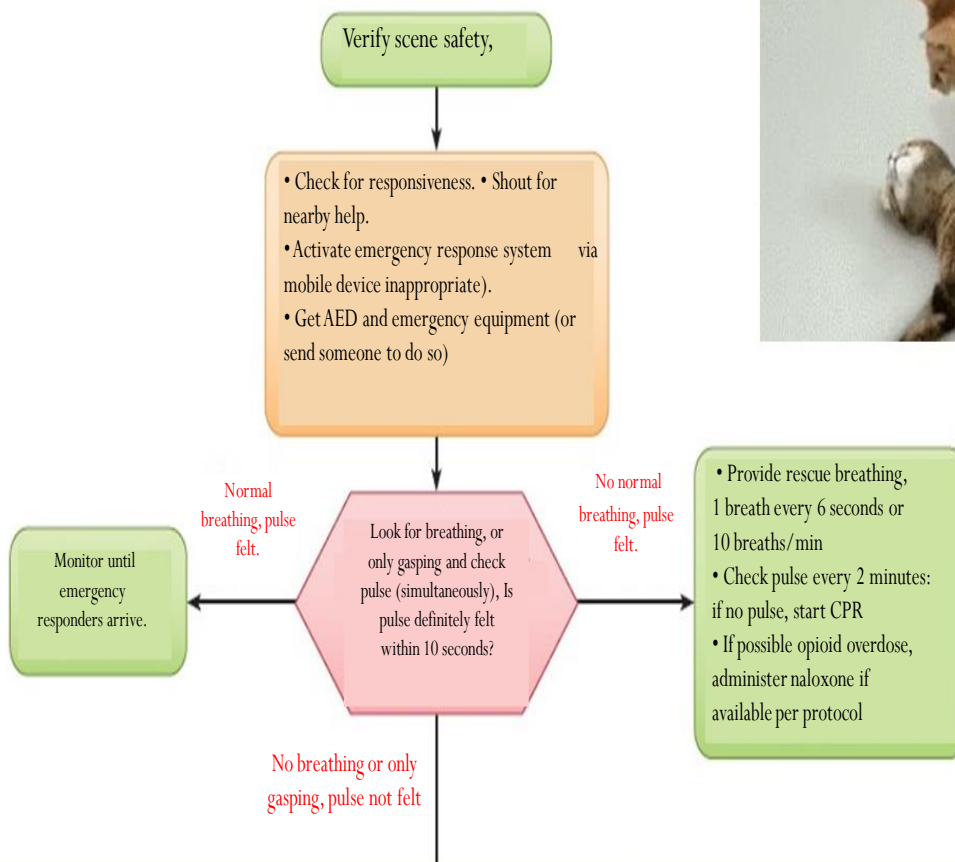
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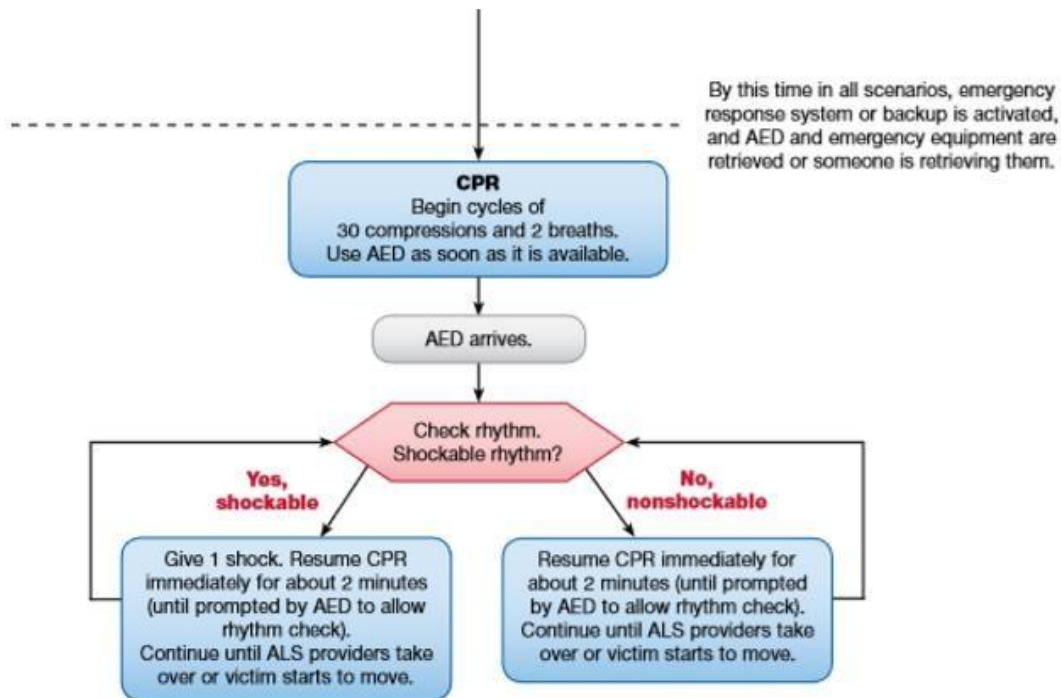


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## Adult Basic Life Support Algorithm for Healthcare Providers





## ADVANCED LIFE SUPPORT

## Definition of A L S according to WHO

Is an emergency life saving procedure performed when heart stops beating or impending stop. for the purpose of oxygenation of the heart, lungs & brain until restore the normal cardiopulmonary function with EQUIPMENTS

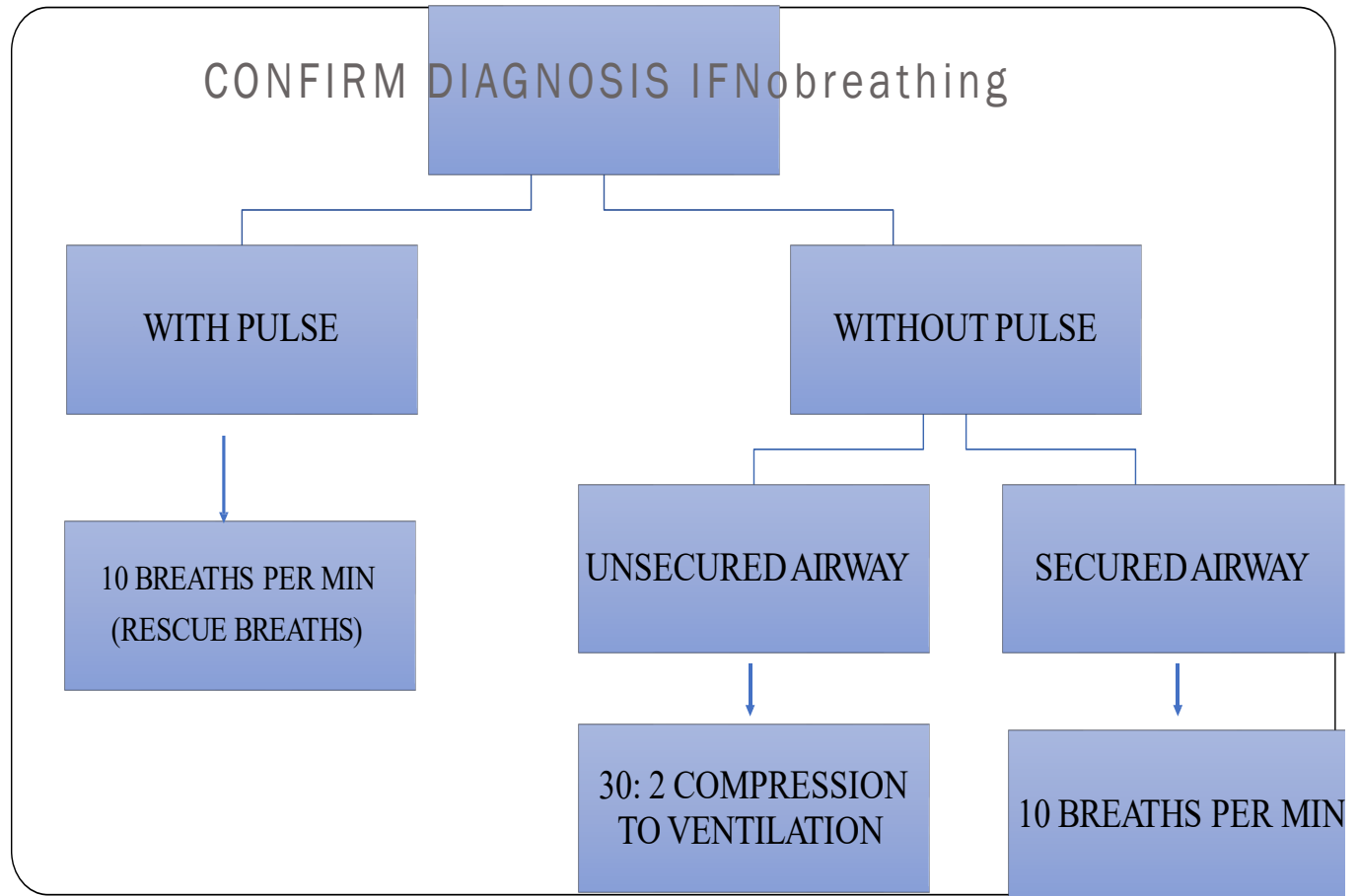
So its A B C..... A= Airway....B =Breathing....C =Circulation

## ADVANCED CARDIAC LIFE SUPPORT

- TEAM OF TRAINED PROFESSIONALS
- COMPRISES OF DOCTORS, TRAINED PARAMEDICAL STAFF, NURSES
- **MEMBERS:** MINIMUM 6 AND MAXIMUM 10
- 6 rescuer role distribution
  - ✓ 1TEAM LEADER
  - ✓ 1COMPRESSOR & 1VENTILATOR ( CHANGE ROLES EVERY 2MINS(
  - ✓ 1DEFIBRILLATOR
  - ✓ 1INTRAVENOUS DRUG DELIVERY
  - ✓ 1TIME KEEPER

## Comparison between BLS & ACLS

BASIC LIFE SUPPORT	ADVANCED CARDIAC LIFE SUPPORT
CAN BE PERFORMED BY ANYONE	TRAINED MEDICAL \PARAMEDICAL STAFF
RHYTHM IDENTIFICATION BY <b>AED</b>	RHYTHM IDENTIFICATION BY <b>RESUSICATOR</b>
AED FOR DEFIBRILLATION	MANUAL DEFIBRILLATOR
NO IV LINE \DRUG USE	IV LINE AND DRUG MANAGEMENT
NO ADVANCED AIRWAY	ADVANCED AIRWAY USE
NO OXYGEN SUPPORT	OXYGEN SUPPORT





## ADVANCED AIRWAY

- DEPENDING ON THE LEVEL OF EXPERTISE OF THE CPR PROVIDER
- ENDOTRACHEAL TUBE
- LARYNGEAL MASK AIRWAY
- COMBITUBE
- *“UNDER NO CIRCUMSTANCES SHOULD THE INSERTION OF ADVANCED AIRWAY COMPROMISE THE CHEST COMPRESSIONS” due to consumed long time.*

# DEFIBRILLATION

- Delivery of an **electrical current** through the myocardium to interrupt disorganized cardiac activity and restore an organized cardiac rhythm
- **Monophasic** defibrillator :a **single 360joule (J)** shock is delivered. ( old –not used anymore(
- **Biphasic** defibrillator **200-120):J**) is usually sufficient to terminate the arrhythmia )new & better(
- If the rescuer is unfamiliar :**maximal available energy** should be used as the default energy
- **Pediatric patients:** 1<sup>st</sup> shock : 4-2J/kg--- subsequent shocks 4 J/kg )MAX 10J/kg(



# DEFIBRILLATOR



**AUTOMATED  
EXTERNAL  
DEFIBRILLATOR**

**( BASIC LIFE SUPPORT)**



**MANUAL  
DEFIBRILLATOR**

**( ADVANCED  
CARDIAC LIFE  
SUPPORT)**

**PLACEMENT OF ELECTRODES:**  
**ADULT:**

- **Upper right sternal border**, just below the clavicle
- Lateral to the **left nipple**.

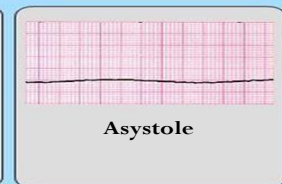
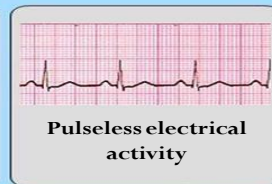
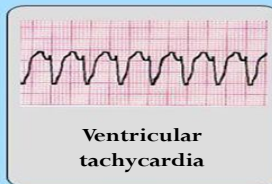
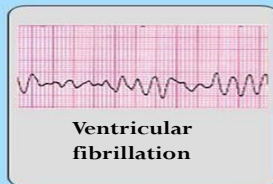


**CHILD OR INFANT:**

- Anterior and Posterior.



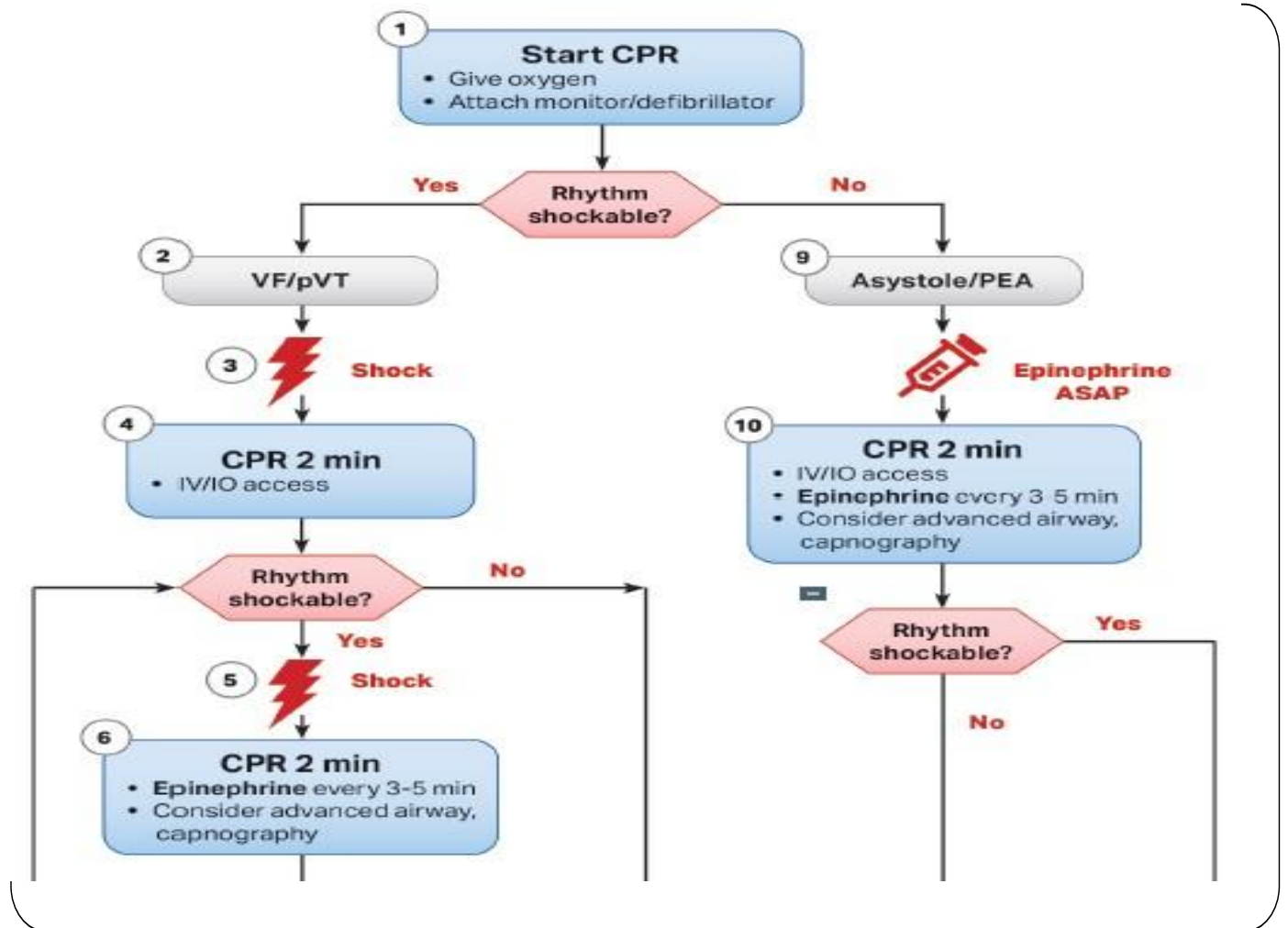
**Cardiac arrest heart rhythms summary**

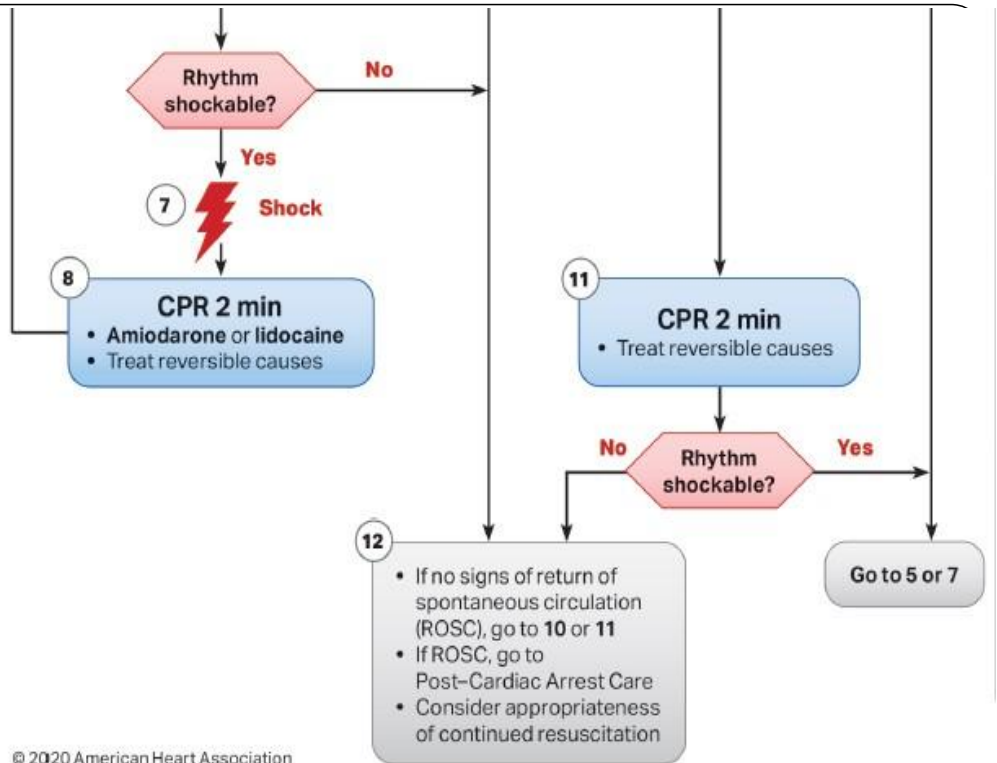


Shockable rhythms ; need to defibrillate

Non shockable

*VF and VT are very common for cardiac arrest in the home or in public places*





### 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.
- Change 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> is low or decreasing, reassess 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

### 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

### 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

### 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.  
or  
**Lidocaine IV/IO dose:** First dose: 1-1.5 mg/kg. Second dose: 0.5-0.75 mg/kg.

## ROUTES OF ACCESS

Intravenous	Interosseous	Endotracheal
Intravenously push bolus injection	<b>Most common:</b> lower end of femur or upper end of tibia	least preferred
Flush with 20mL of fluid or saline		Dose is 2-2.5 times the iv dose
Raise extremity for 10 to 20 seconds to enhance delivery of drug to circulation		5 drugs:( NAVAL) Naloxone Adrenaline Vasopressin Atropine Lignocaine



DRUG	ADULT	PEDIATRIC
ADRENALINE\EPINEPHRINE	1mg (1:10000) bolus every 5-3mins 0Endotracheal: 2.5-2times dose (1:1000) diluted in 10ml normal saline	0.01Mg\kg or 0.1 ml\kg of 1:10000 concentration( Max dose:1 mg Repeat every 3-5mins. <u>Endotracheal</u> : 0.1mg\kg or 0.1 ml\kg of 1:1000concentration
AMIODARONE	1 <sup>st</sup> dose: 300mg 2 <sup>nd</sup> dose: 150mg	5mg\kg bolus during cardiac arrest. May repeat 3 doses for refractory VF\pulseless VT
LIGNOCAINE	1 <sup>st</sup> dose: 1-1.5mg\kg 2 <sup>nd</sup> dose: 0.75-0.5mg\kg	1mg\kg bolus dose



### 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

- |                                   |                                 |
|-----------------------------------|---------------------------------|
| • <b>H</b> ypovolemia             | • <b>T</b> ension pneumothorax  |
| • <b>H</b> ypoxia                 | • <b>T</b> amponade, cardiac    |
| • <b>H</b> ydrogen ion (acidosis) | • <b>T</b> oxins                |
| • <b>H</b> ypo-/hyperkalemia      | • <b>T</b> hrombosis, pulmonary |
| • <b>H</b> ypothermia             | • <b>T</b> hrombosis, coronary  |

# POST CARDIAC ARREST CARE

## *THERAPEUTIC HYPOTHERMIA*

- Recommended for comatose individuals with return of spontaneous circulation after a cardiac arrest event.
- Individuals should be cooled to 89.6 to 93.2 degrees F (32 to 36 degrees C) for at least 24 hours.

## *OPTIMIZATION OF HEMODYNAMICS AND VENTILATION*

- 100% oxygen is acceptable for early intervention but not for extended periods of time.
- Oxygen should be titrated, so that individual's pulse oximetry is greater than 94% to avoid oxygen toxicity.
- Do not over ventilate to avoid potential adverse hemodynamic effects.
- Ventilation rates of 10 to 12 breaths per minute to achieve ETCO<sub>2</sub> at 35 to 40 mmHg.
- IV fluids and vasoactive medications should be titrated for hemodynamic stability.

## CARDIAC ARREST MEDICATIONS

- Epinephrine
- Amiodarone
- Atropine
- Sodium Bicarbonate
- Calcium (Chloride or Gluconate)
- Lidocaine

## EPINEPHRINE

- Both an alpha- and beta-adrenergic agent
- During a cardiac arrest, most think it has the greatest benefit by alpha-adrenergic actions, increasing afterload and thus diastolic blood pressure, leading to improved coronary artery perfusion.

# EPINEPHRINE

- Indications:

- Cardiac arrest
- Severe bronchospasm
- Anaphylactic reactions

- Route of Administration

- IV or IO
- SQ or IM (for bronchospasm)

ET (cardiac arrest without IV or IO access) •

# EPINEPHRINE

- Dosage:

- initial (low) dose: 0.01 mg/kg  
= 0.1 cc/kg of 1:10,000

- subsequent (high) doses: 0.1 mg/kg  
= (0.1 cc/kg of 1:1,000)

PALS recommendations for high dose under review - please check for updates

## Amiodarone

- Class 3 antiarrhythmic drug as well as alpha & beta receptors blockers
- Given 300 mg bolus then 150 mg loading dose
- Used for ventricular arrhythmias and atrial fibrillation or flutter

# ATROPINE

- Parasympathetic (not an alpha- or beta-adrenergic) agent--acts by blocking cholinergic stimulation of the muscarinic receptors of the heart.
- Results in an increase in the sinus rate of the heart.
- Little effect on systemic vascular resistance or myocardial contractility.

# ATROPINE

- Indications:
  - Bradycardia
  - Second or third degree heart block
  - Asystole
  - Pulseless electrical activity (electrical mechanical dissociation)
- Route of Administration
  - IV, IO, ET, SQ, IM, nebulization



# ATROPINE

- Dosage:
  - 10 to 20 mcg/kg
  - minimum dose is 0.1 mg--smaller doses may cause reflex bradycardia (central stimulatory effect on the medullary vagal nuclei)
  - maximum (adult) dose is 2 mg

## SODIUM BICARBONATE

- Use during CPR remains a controversial issue due to lack of evidence showing benefit from receiving bicarbonate.
- Elevates blood pH by binding with hydrogen to form water and CO<sub>2</sub>
- $\text{HCO}_3^- + \text{H}^+ \Rightarrow \text{H}_2\text{CO}_3 \Rightarrow \text{H}_2\text{O} + \text{CO}_2$
- Must have adequate ventilation to remove CO<sub>2</sub> or respiratory acidosis will worsen

# SODIUM BICARBONATE

- Adverse effects of acidosis:
  - Cardiac
    - Decrease contractility
    - Lower threshold for ventricular fibrillation
    - Decrease responsiveness to catecholamines
  - Vascular
    - Decrease systemic vascular resistance
    - Decrease systemic vascular responsiveness to catecholamines
    - Increase pulmonary vascular resistance

# SODIUM BICARBONATE

- Indications:
  - Pre-existing acidosis
  - Prolonged CPR (after 10 minutes)
  - Pulmonary hypertensive crisis
  - Hyperkalemia
- Route of administration:
  - IV, IO
- Dosage
  - 1-2 meq/kg/dose (1 meq/cc or 0.5 meq/cc)

## CALCIUM

- Current recommendations for the use of calcium during CPR are restricted to a few specific situations.
- Intracellular calcium plays an important role in the process of cell death, but no studies have shown that transient hypercalcemia worsens outcome after cardiac arrest.

# CALCIUM

- Adverse Effects of Hypocalcemia
  - Decreased myocardial contractility
  - Decreased systemic vascular resistance
  - Decreased catecholamine release
  - Decreased cardiovascular response to catecholamines

# CALCIUM

- Indications:
  - Hypocalcemia
    - Ionized hypocalcemia may result from severe alkalosis or after large transfusions of citrated blood products.
  - Hyperkalemia
  - Hypermagnesemia
  - Calcium channel blocker overdose

# LIDOCAINE

- Indications:
  - Ventricular Tachycardia
  - Ventricular Fibrillation
  - Frequent PVCs
- Route of Administration:
  - IV, IO, ET
- Dosage:
  - 1 mg/kg/dose (may need up to 2.5 mg/kg ET)



# ENDOTRACHEAL MEDICATIONS

- **LEAN**
  - Lidocaine
  - Epinephrine
  - Atropine
  - Naloxone (Narcan)

# CALCIUM

- Route of administration:
  - IV, IO only
  - Calcium chloride--central venous line
  - Calcium gluconate--peripheral venous line
- Dosage:
  - Calcium chloride = 10-20 mg/kg
  - Calcium gluconate = 100-200 mg/kg

# LIDOCAINE

- Class 1B antiarrhythmic
- Decreases automaticity threshold and ventricular fibrillation threshold.
- Effective in terminating PVCs.
- Rarely used in pediatric arrests as ventricular tachycardia and ventricular fibrillation are not commonplace.

## Defibrillation and Cardioversion

### Objectives

- Defibrillator & Cardio version in your hands
- Definitions &Types
- Difference between defibrillator & Cardio version
- Different sites of plades
- Clinical application
- When don't process

### What is Defibriallator?

DC shock = AC shock = defibrallator