CARDIOPULMONARY RESUSCITATION (CPR)
What does CPR stands for?

- C = Cardio (heart)
- P = Pulmonary (lungs)
- R = Resuscitation (recover)

DEFINITION

Cardio pulmonary resuscitation (CPR) is a technique of basic life support for the purpose of oxygenation to the heart, lungs and brain until and unless the appropriate medical treatment can come and restore the normal cardiopulmonary function.
PURPOSE

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

INDICATION

- Cardiac arrest
- Respiratory arrest
- Combination of both
Definition of Cardiac arrest:
It is loss of cardiac function, breathing and loss of consciousness.

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

1) Hypoxia.
2) Hypotension.
3) Hypothermia.
4) Hypoglycemia.
5) Acidosis ($\mathbf{H}^+$).
6) Hypokalemia (electrolyte disturbance).

1) Cardiac Tamponade.
2) Tension pneumothorax.
3) Thromboembolism (pulmonary, coronary).
4) Toxicity (eg. digoxin, local anesthetics, insecticides).
HOW CPR WORKS:

The air we breathe in, travels to our lungs where oxygen is picked up by our blood and then pumped by the heart to our tissue and organs.

When a person experiences cardiac arrest—whether due to heart failure in adults or the elderly or an injury such as near drowning, or severe trauma in a child—the heart goes from a normal arrhythmic pattern called ventricular fibrillation, and eventually ceases to beat altogether.

This prevents oxygen from circulating throughout the body, rapidly killing cells and tissue.
Inessence, cardio (heart) pulmonary (lung) resuscitation (revive, revitalize) serves as an artificial heartbeat and an artificial respirator.

CPR may not save the victim even when performed properly, but if started within 4 minutes of cardiac arrest and defibrillation is provided within 10 minutes, a person has a 40% chance of survival.

**EQUIPMENTS**

- A hard flat surface.

- No additional equipment is necessary but in hospital setting, an emergency (crash) cart with defibrillator and cardiac monitor should be brought to the bedside. A crash cart contains:

  - Airway equipment.
  - Suction equipment.
  - Intravenous equipment.
  - Laboratory tubes and syringes.
  - Pre packed medication for advanced life support.
**PHASES OF THE CARDIO PULMONARY RESUSCITATION:**

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• **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).
Diagnosis of cardiac arrest

Loss of time !!!

Blood pressure measurement
Taking the pulse on peripheral arteries
Auscultation of cardiac tones

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) 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 COMPRESSION

- 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. 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

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

PROBLEMS AND COMPLICATIONS OF CHEST COMPRESSIONS

1. RIB FRACTURES
2. FRACTURE STERNUM
3. RIB SEPARATION
4. PNEUMOTHORAX
5. HEMOTHORAX
6. LUNG CONTUSIONS
7. LIVER LACERATIONS
8. FAT EMBOLI
9. HIV, HEPATITIS
10. INFECTIONS

MANAGE ACCORDINGLY BUT CONTINUE CPR
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.

CLEAR THE AIRWAY

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).

4) **Heimlich manoeuvre**: if the pt is conscious or the foreign body cannot be removed by a finger sweep. 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 his can be done by a series of **blows on his back** and chest thrusts.
Breathing: Breathe for the person

Rescue breathing can be mouth-to-mouth breathing or mouth-to-nose breathing if the mouth is seriously injured or can't be opened.

- With the airway open (using the head-tilt, chin-lift maneuver), pinch the nostrils shut for mouth-to-mouth breathing and cover the person's mouth with yours, making a seal.
(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 though the nose.

3) **Mouth to mouth and nose**: is used in infants and small children.
Assessment of restoration of breathing and circulation

- Contraction of pupil
- Improved color of the skin
- Free movement of the chest wall
- Swallowing attempts
- Struggling movements

Signs of restored ventilation and circulation include:

- Struggling movements
- Improved color
- Return of or strong pulse
- Return of systemic blood pressure
When to terminate BLS

- Pulse and respiration returns
- Emergency medical help arrives
- Physician declared patient is deceased
- In a non health setting, another indication to stop BLS would be that the rescuer was exhausted and physically unable to continue to perform BLS.
ALS includes:

- Circulation by cardiac massage
- Airway management by equipments
- Breathing by advanced techniques
- Defibrillation by manual defibrillator
- Drugs.

CHEST COMPRESSION
ACLS: Cardiac Arrest, Arrhythmias, and Their Treatment

Cardiac Arrest Circular Algorithm

1. Shout for Help/Activate Emergency Response
   - Start CPR
     - Give oxygen
     - Attach monitor/defibrillator
   - 2 minutes
   - Check Rhythm
   - If VF/VT Shock
   - Drug Therapy
     - IV/IO access
     - Epinephrine every 3-5 minutes
     - Amiodarone for refractory VF/VT
   - Consider Advanced Airway
   - Quantitative waveform capnography
   - Treat Reversible Causes
   - Continuous CPR
   - Monitor CPR Quality
   - Return of Spontaneous Circulation (ROSC)
   - Post-Cardiac Arrest Care
(B) Advanced techniques for airway patency:

1) Face Mask

2) Oropharyngeal airway

3) Nasopharyngeal airway

4) Laryngeal mask (LMA)

5) Endotracheal tube

6) Combitube
expired air contains 16% $O_2$ so supplemental 100% $O_2$ 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% O₂

• **Ambu Bag** (room air)
  = 21% O₂

• Ambu bag + O₂ (10-15L)
  = 45% O₂

• Ambu Bag + O₂ + Reservoir bag = 85% O₂
3) DEFIBRILLATION

- 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 Algorithm

Shout for Help/Activate Emergency Response

1. Start CPR
   - Give oxygen
   - Attach monitor/defibrillator

2. VF/VT
   - Shock

3. Rhythm shockable?
   - Yes
     - CPR 2 min
     - IV/IO access
   - No

4. CPR 2 min
   - IV/IO access
   - Epinephrine every 3-5 min
   - Consider advanced airway, capnography

5. Rhythm shockable?
   - Yes
     - Shock
   - No

6. CPR 2 min
   - Epinephrine every 3-5 min
   - Consider advanced airway, capnography

7. Rhythm shockable?
   - Yes
     - Shock
   - No

8. CPR 2 min
   - Amiodarone
   - Treat reversible causes

9. Asystole/PEA

10. CPR 2 min
    - IV/IO access
    - Epinephrine every 3-5 min
    - Consider advanced airway, capnography

11. CPR 2 min
    - Treat reversible causes

12. If no signs of return of spontaneous circulation (ROSC), go to 10 or 11
    - If ROSC, go to Post–Cardiac Arrest Care

Go to 5 or 7
(C) Defibrillation

**Position of Paddles:**

- One paddle is placed in the **right infraclavicular** region, while the other is placed in the **left 5th-6th 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 5th-6th intercostal space anterior axillary line**.
Drugs used in CPR

- **Adrenaline:**
  - Given as a *vasopressor α-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 3rd shock.
  - **Repeated:** in alternate cycles (every 4 minutes).
  - **Once adrenaline → ALWAYS adrenaline.**

- **Action:** Completely depolarize all myocardial cells so SA node can re-establish as pacemaker
- **Voltage of electricity discharge:**
  - High from 150 J to 360J (biphasic)
  - 360 J (monophasic)
**Amiodarone:**
- **Dose:** 300 mg IV bolus (5 mg/kg).
- **Given:** in shockable rhythm after the 3rd shock.
- If unavailable give **lidocaine** 100 mg IV (1-1.5 mg/kg).

**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 NaHCO3 simultaneously by the same route.

**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.

**Sodium bicarbonate:**
- **Used in:**
  1- Severe metabolic acidosis (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.

**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).
POST-CPR RECOVERY POSITION

1. Bend one arm and keep legs straight.
2. Place back of victim’s hand against cheek and hold there.
3. Hold victim’s hand against cheek to support head.
   Pull bent leg and roll victim toward you.
   Front view of recovery position
Post resuscitation care

- Maintain Airway and Breathing
- Check for Circulation
- Disability optimising neurological recovery
- Sedation

- Control of seizure
- Temperature control
- Treatment of hyperpyrexia
- Treatment of hypothermia
- Blood glucose level
ANY QUESTION