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 the appropriate medical treatment can come and restore the normal cardiopulmonary function.

PURPOSE

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

INDICATION

Cardio vascular disorders

CAD, congenital heart diseases , coronary

embolism, cardiac rupture & dissection

Pulmonary causes

pulmonary embolism, pulmonary edema, asphyxia due to drowning or foreign body

Metabolic causes

hypoglycemia, electrolyte imbalances

Fluid imbalance

extensive hemorrhage, hypotension, shock

Neurological causes

brain injuries, massive cva

Poisons substance and drug overdose

co poisoning, propanolol over dose

Other causes

electrical shock, hypothermia, narcotic overdose

Diagnosis of cardiac arrest (TRIAD):

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

PHASES OF THE CARDIO PULMONARY RESUSCITATION:

Phase-1 *Basic life support*

C= circulation

A= Airway

B= Breathing

Phase-2 *Advance cardiac life support*

D= Drugs

E= ECG

F= fibrillation

Phase-3 *Prolonged life support*

Post resuscitation care

BLS

- 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).

1) EARLY RECOGNITION

1) Unresponsiveness

- Check the victim for a response.
- Shake shoulders gently
- Ask “Are you all right?” *If there is no response, shout for help*

2) No breathing or no normal breathing (i.e, only gasping) *Look, Listen ,Feel*

3) No pulse felt within 10 seconds.

2) CPR Sequence

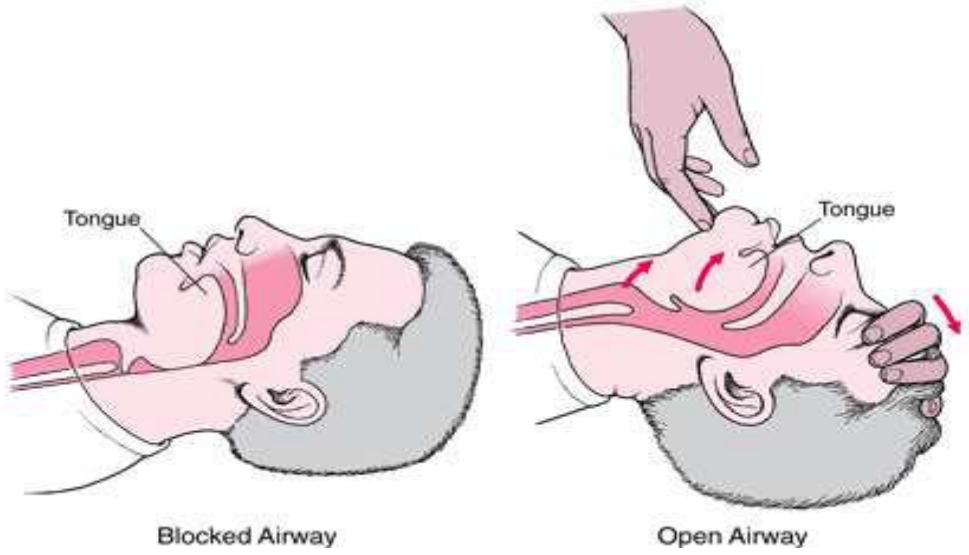
(A) = Airway

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.

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.

(B) = Breathing

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

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 he patients mouth. Blow steadily into the patients mouth watching the chest rise as if the patient was taking a deep breath.

2) Mouth to mask ventilation

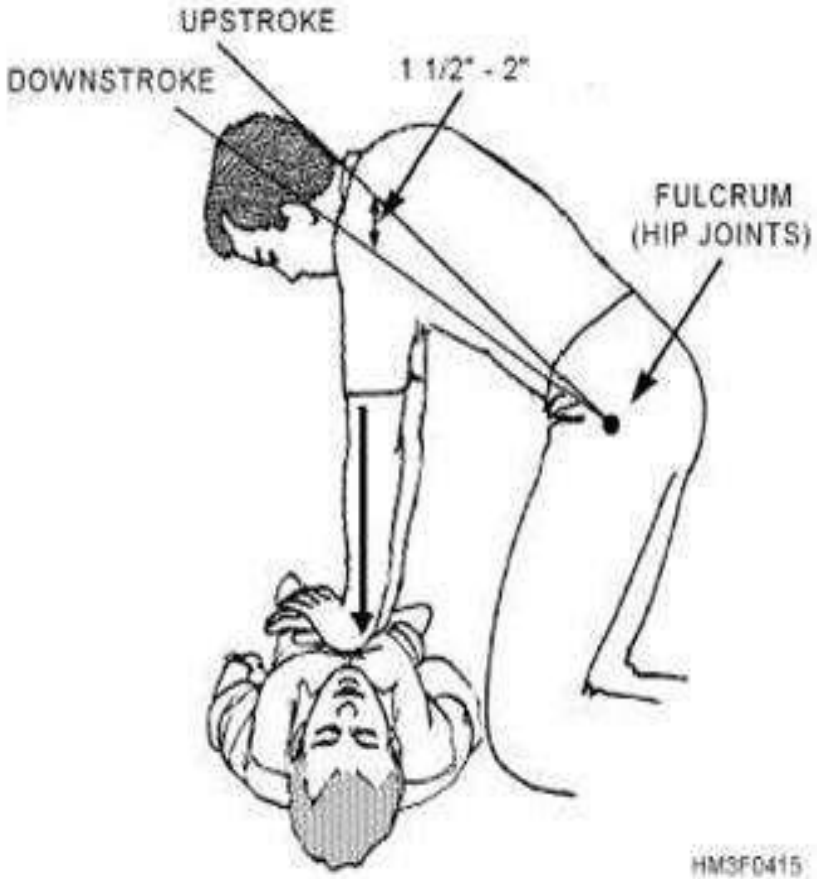
3) Bag mask ventilation

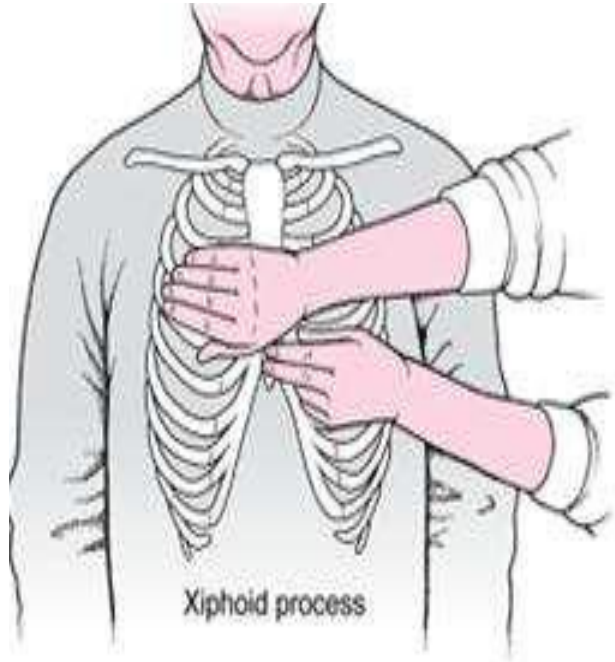
(C) Chest compressions (cardiac massage)

• 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 4-5 cm** in adults, and **2-4 cm** in children, **1-2 cm** in infants .


UPSTROKE
DOWNSTROKE
1 1/2" - 2"
FULCRUM
(HIP JOINTS)
HM3F0415


Xiphoid process

- Must be performed at a rate of **100/min**
- Equal compression : relaxation
- During CPR the ratio of chest compressions to ventilation should be as follows:

  Single rescuer = **30:2**

- Chest compressions must be continued for 2 minutes before reassessment of cardiac rhythm.
  - ► (2 minutes = equivalent to 5 cycles 30:2).
- When possible change CPR operator every 2 min.

Chest compressions in infants (0-12 months)

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. Vomiting , Aspiration

3) 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
- Return of or strong pulse

When to terminate BLS

- Pulse and respiration returns
- Emergency medical help arrive

ADULT
BASIC LIFE SUPPORT
(BLS)

OBJECTIVES

Students should be able to demonstrate:

- How to assess the collapsed victim
- How to perform chest compression and rescue breathing
- How to place an unconscious breathing victim in the recovery position.

BACKGROUND

- Approximately ***700,000*** cardiac arrests per year in Europe
- Survival to hospital discharge presently approximately ***5-10%***
- Bystander CPR vital intervention before arrival of emergency services – ***double or triple*** survival from SCA (sudden cardiac arrest)
- Early resuscitation and prompt defibrillation (within 1-2 minutes) can result in ***>60% survival***

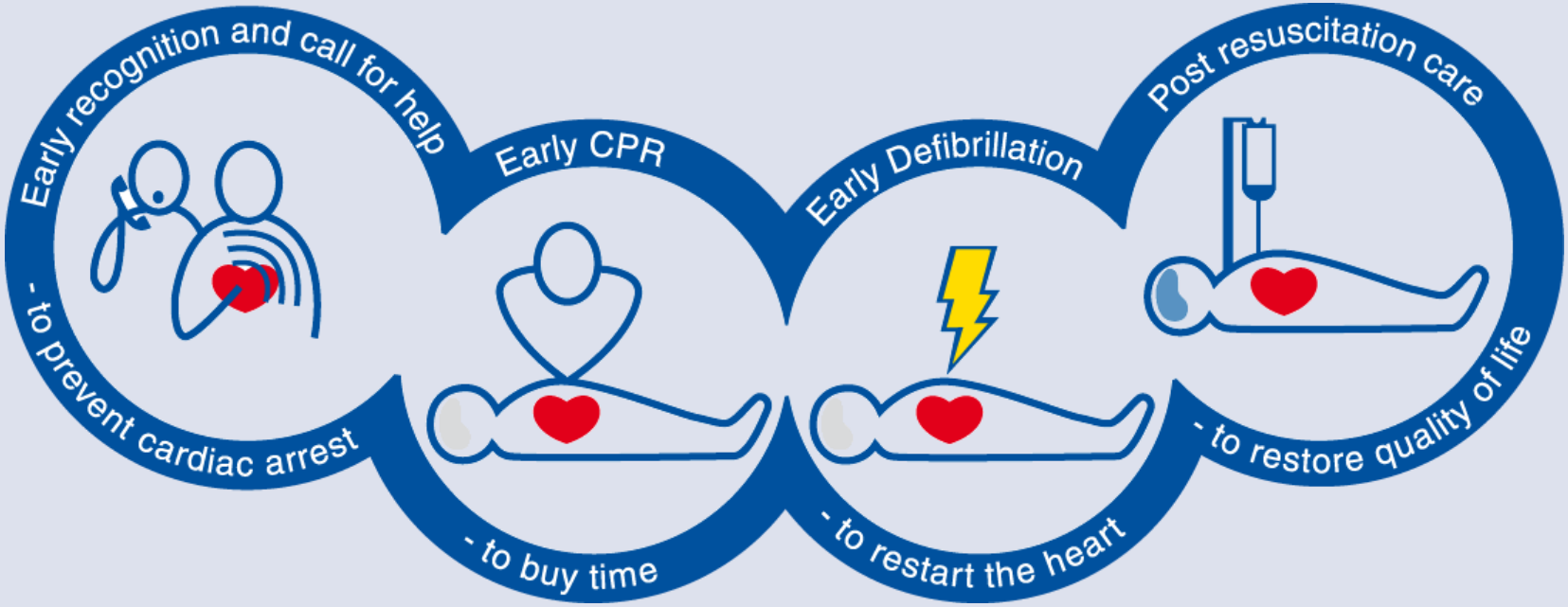
BASIC LIFE SUPPORT (BLS

Airway

Breathing

Circulation **(CAB)**

CHAIN OF SURVIVAL



BASIC LIFE SUPPORT

SEQUENCES OF PROCEDURES PERFORMED TO RESTORE THE CIRCULATION OF OXYGENATED BLOOD AFTER A SUDDEN PULMONARY AND/OR CARDIAC ARREST

CHEST COMPRESSIONS AND PULMONARY VENTILATION PERFORMED BY **ANYONE** WHO KNOWS HOW TO DO IT, **ANYWHERE, IMMEDIATELY, WITHOUT** ANY OTHER **EQUIPMENT**

Protective devices

Basic Life Support

- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- Call 997
- 30 chest compressions
- 2 rescue breaths

APPROACH SAFELY!

Scene

Rescuer

Victim

Bystanders

Approach safely
Check response
Shout for help
Open airway
Check breathing
Call 112
30 chest compressions
2 rescue breaths

CHECK RESPONSE

- Approach safely
- **Check response**
- Shout for help
- Open airway
- Check breathing
- Call 977
- 30 chest compressions
- 2 rescue breaths

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.

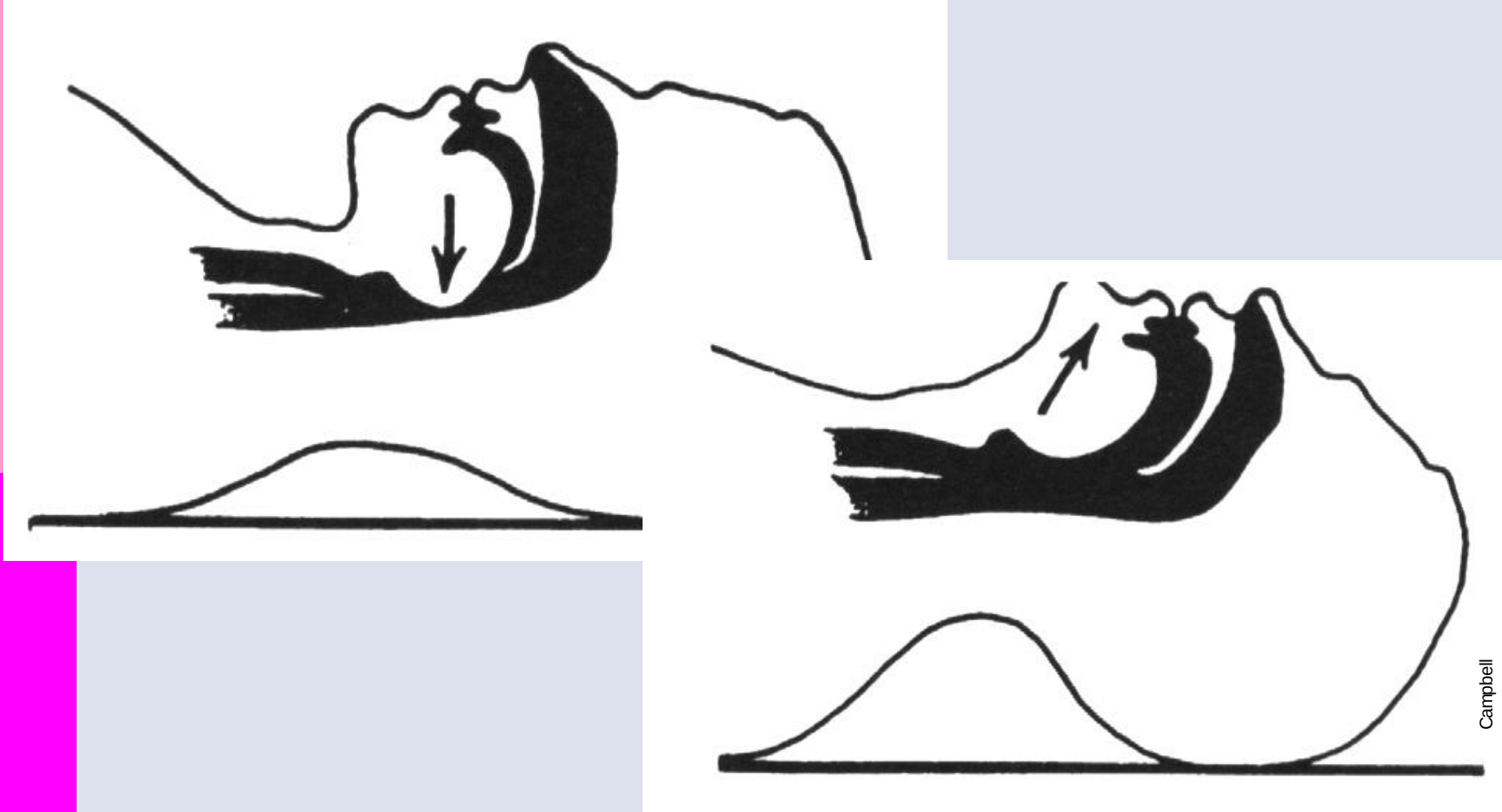
SHOUT FOR HELP

- Approach safely
- Check response
- **Shout for help**
- Open airway
- Check breathing
- Call 977
- 30 chest compressions
- 2 rescue breaths

OPEN AIRWAY

- Approach safely
- Check response
- Shout for help
- **Open airway**
- Check breathing
- Call 977
- 30 chest compressions
- 2 rescue breaths

AIRWAY OPENING BY NECK EXTENSION

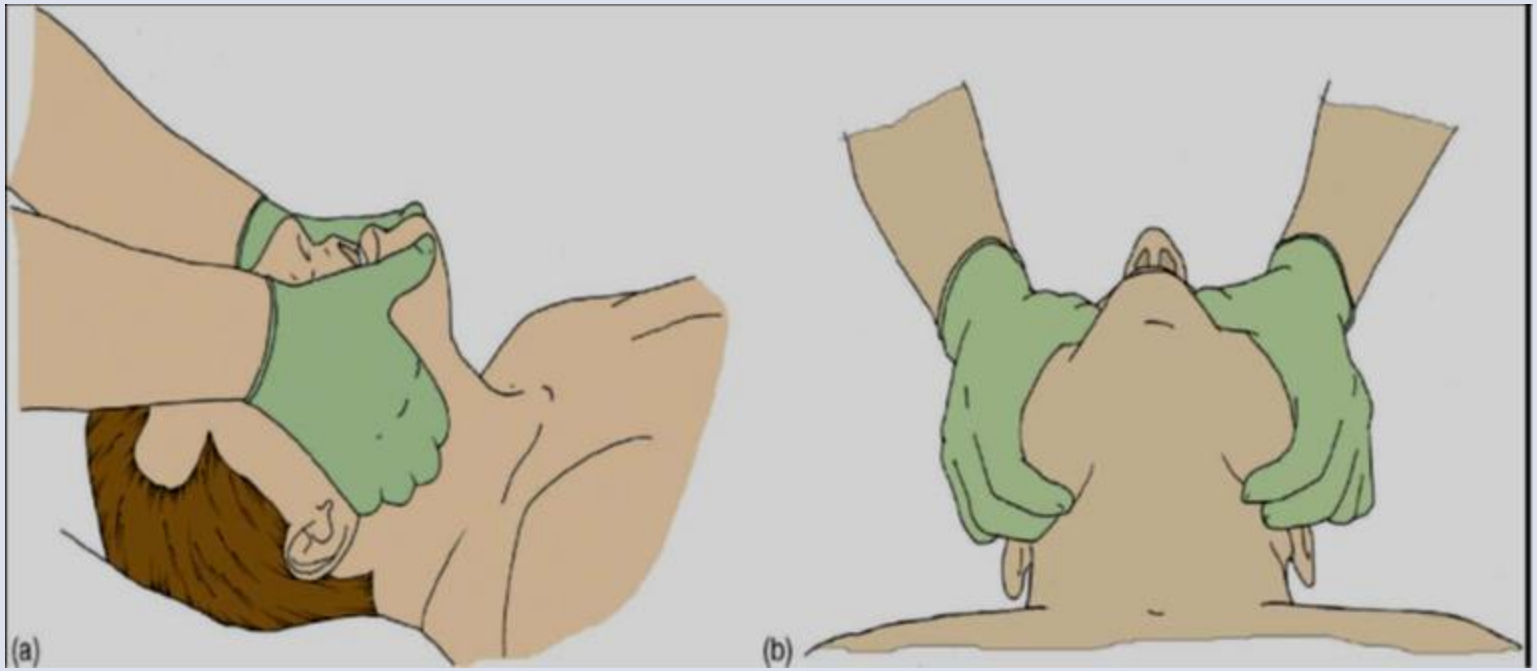


OPEN AIRWAY

Head tilt and chin lift
- lay rescuers
- non-healthcare rescuers

No need for finger sweep
unless solid material can be seen in the airway

OPEN AIRWAY



Head tilt, chin lift + jaw thrust
- healthcare professionals

CHECK BREATHING

- Approach safely
- Check response
- Shout for help
- Open airway
- **Check breathing**
- Call 977
- 30 chest compressions
- 2 rescue breaths

CHECK BREATHING

- Look, listen and 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

Erroneous information can result in withholding CPR from cardiac arrest victim

POTENTIALLY REVERSIBLE CAUSES
(5 H's & 5 T's):

- **H**ypoxia
- **H**ypovolemia
- **H**ypothermia
- **H**yper/hypoK+and metabolic disorders
- **H+** ions (acidosis)

- **T**ension pneumothorax
- **T**amponade
- **T**oxic/therap. disturbances
- **T**hrombosis coronary
- **T**hrombosis pulmonary

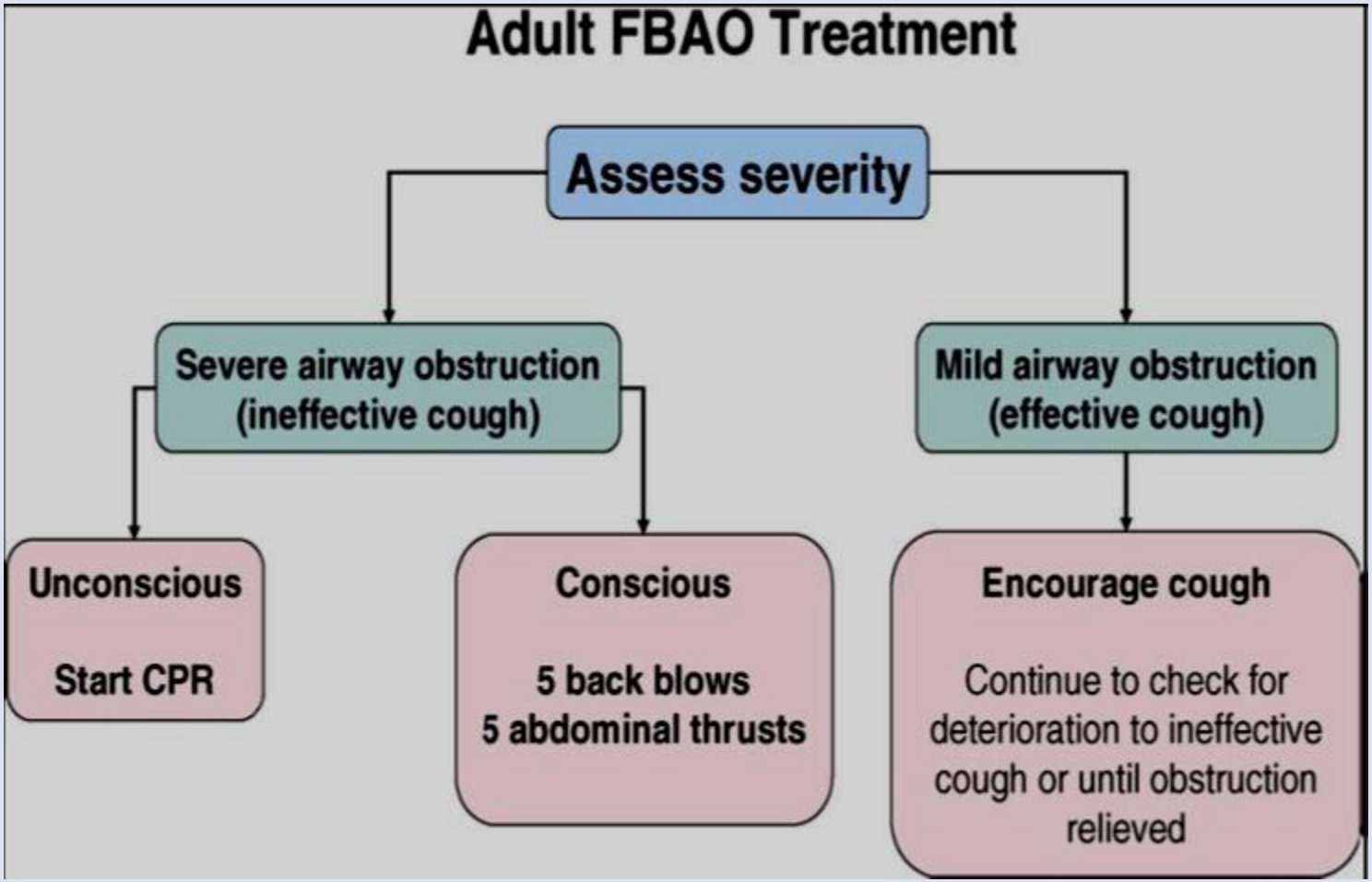
- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- **Call 977**
- 30 chest compressions
- 2 rescue breaths

FOREIGN-BODY AIRWAY OBSTRUCTION (FBAO)

Approximately 16 000 adults and children receive treatment for FBAO in the UK yearly

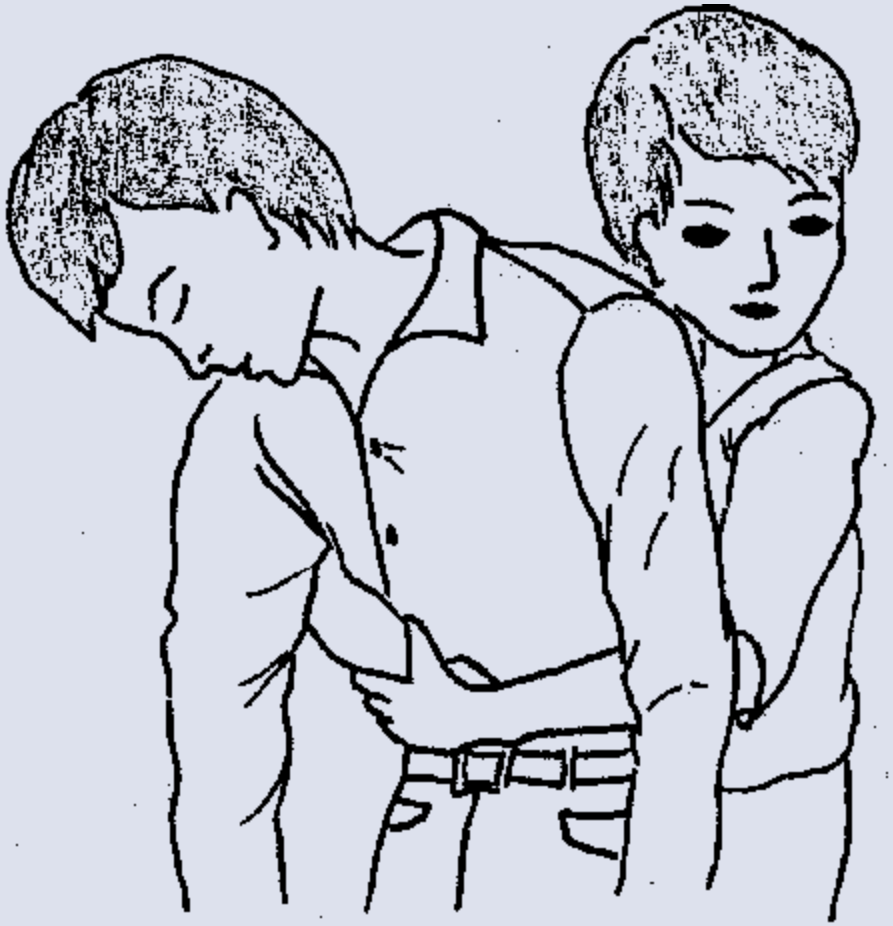
SIGNS	**MILD** obstruction	**SEVERE** obstruction
"Are you choking?"	"YES"	Unable to speak, may nod
Other signs	Can speak, cough, breathe	Can not breathe/wheezy breathing/silent attempts to cough/ unconsciousness

ADULT FBAO TREATMENT



BACK BLOWS

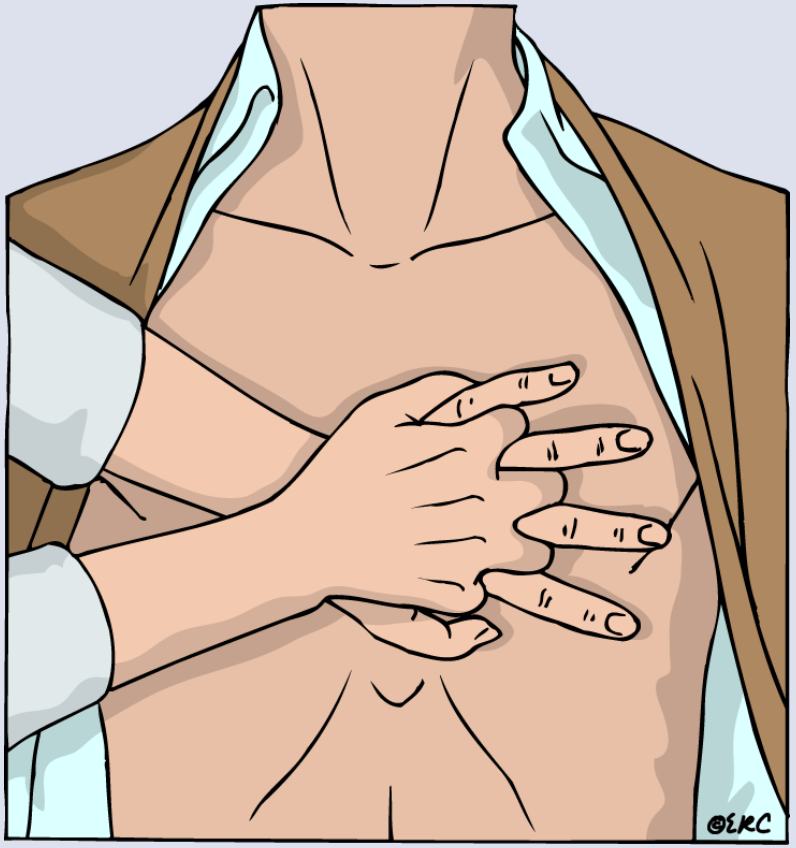
ABDOMINAL THRUSTS



30 CHEST COMPRESSIONS

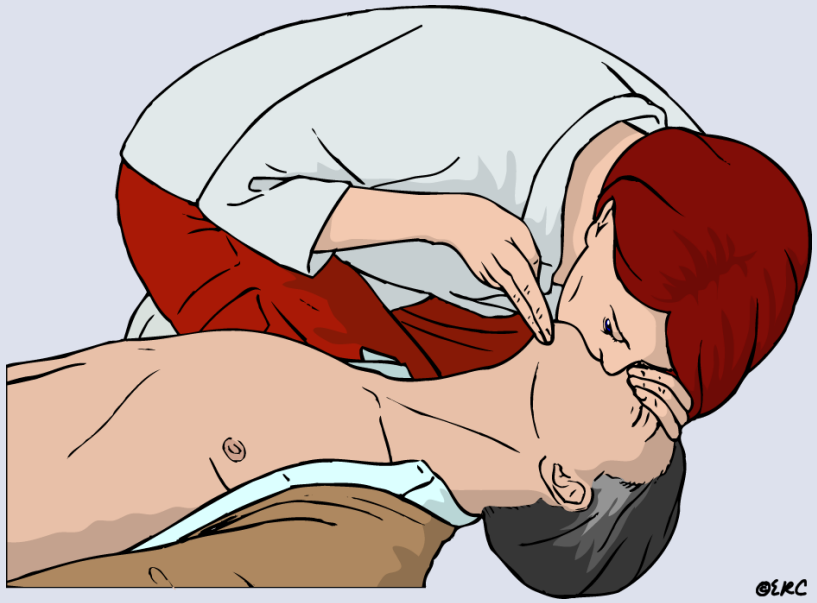
- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- Call 977
- **30 chest compressions**
- 2 rescue breaths

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^{-1}
  - Depth 4-5 cm
  - Equal compression : relaxation
- When possible change CPR operator every 2 min

RESCUE BREATHS



- Approach safely
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- Open airway
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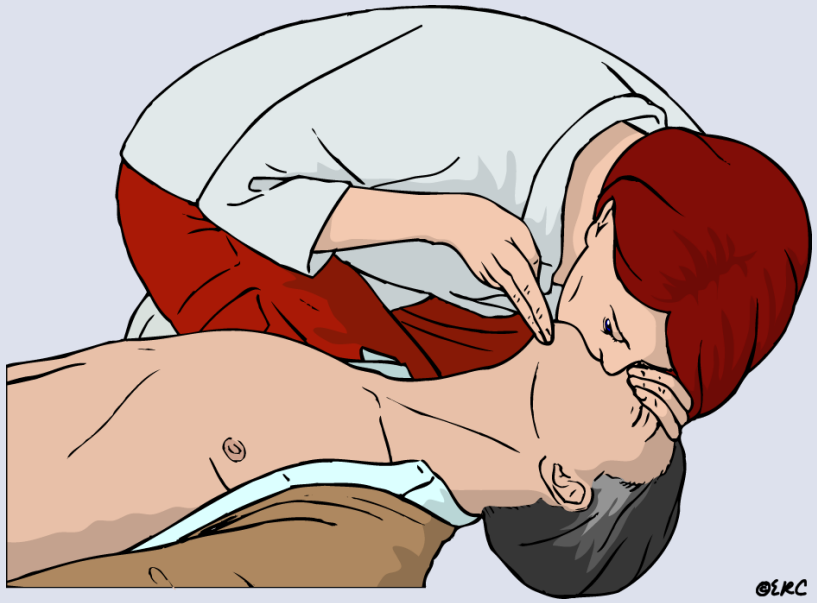
RESCUE BREATHS



- 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

Breathing: Mouth To Nose (when to use)

- Can't open mouth
- Can't make a good seal
- Severely injured mouth
- Stomach distension

- Mouth to stoma (tracheotomy)

RESCUE BREATHS

RECOMMENDATIONS:

- **Tidal volume**

  500 – 600 ml

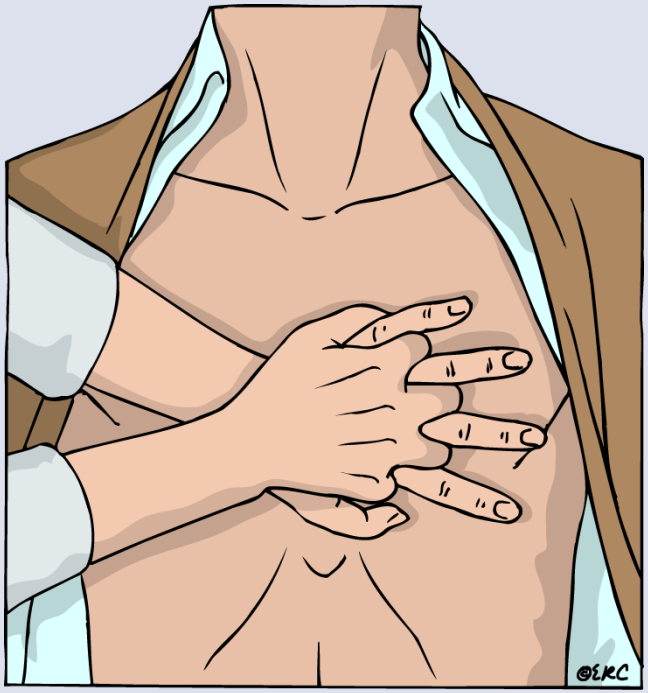
- **Respiratory rate**

  give each breaths over about 1s with enough volume to make the victim's chest rise

- **Chest-compression-only**

  continuously at a rate of 100 min

CONTINUE CPR



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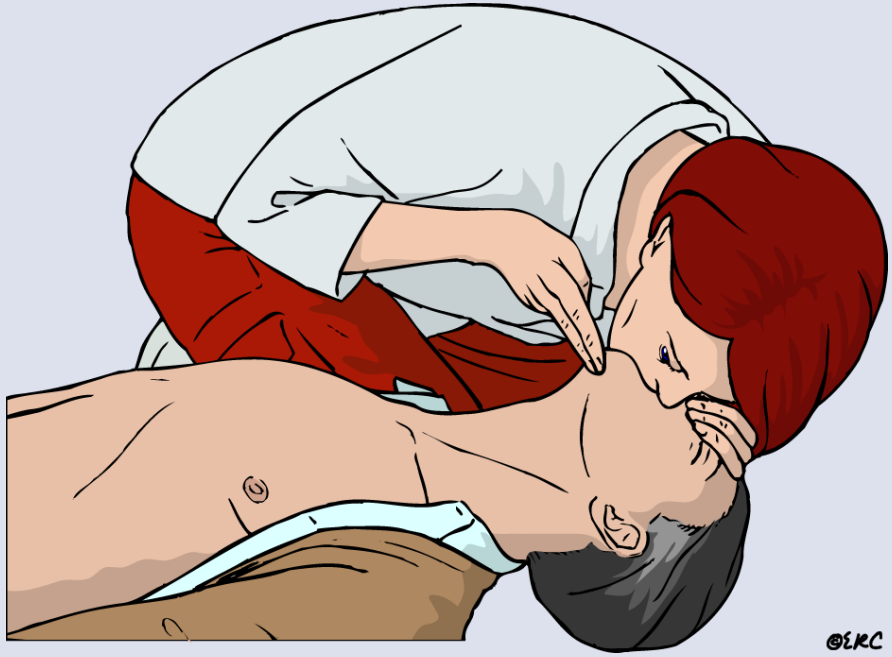

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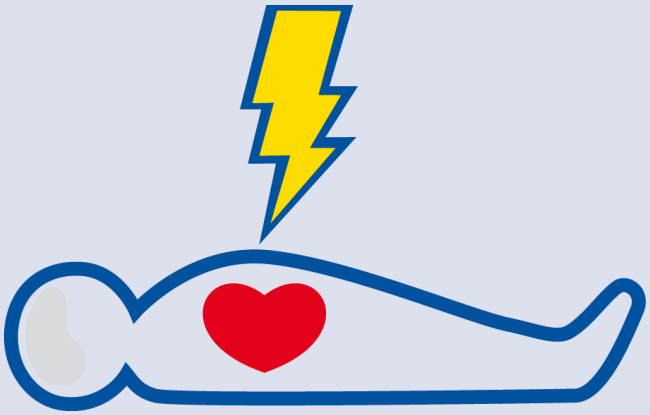
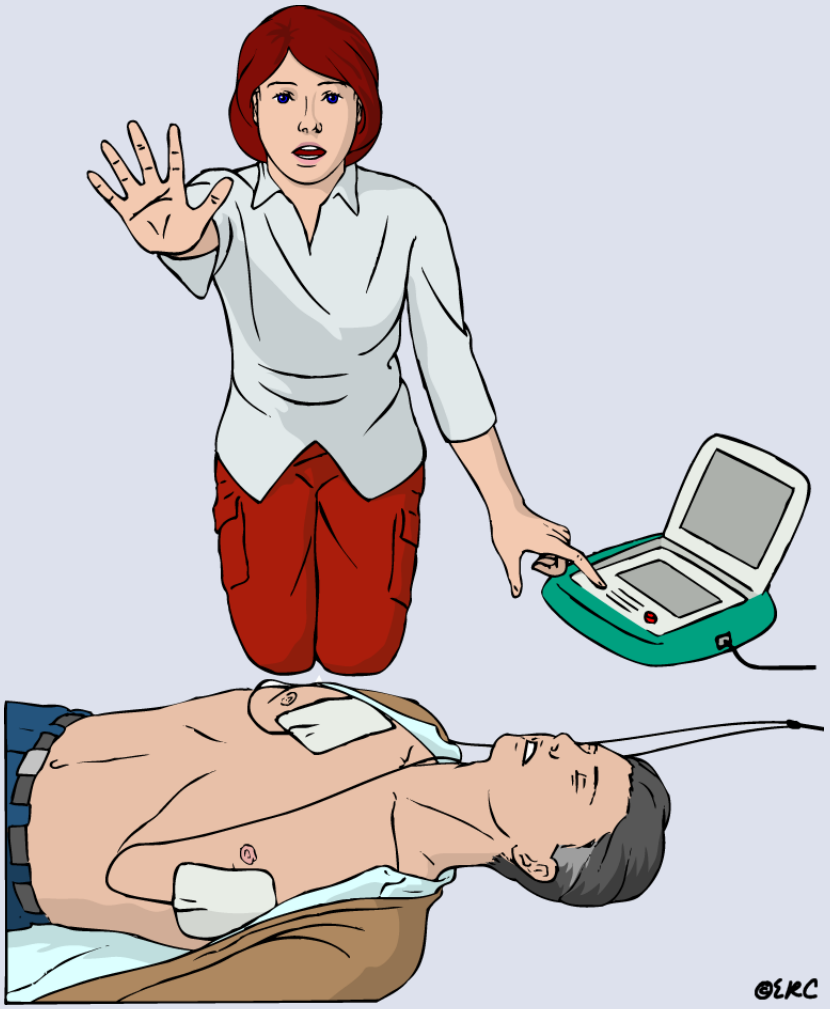
- Approach safely
- Check response
- Shout for help
- Open airway
- Check breathing
- Call 977
- 30 chest compressions
- 2 rescue breaths

DEFIBRILLATION





Approach safely

Check response

Shout for help

Open airway

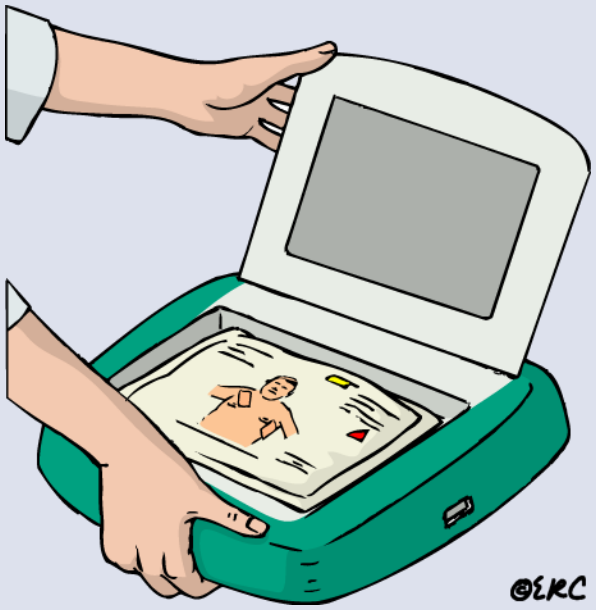
Check breathing

Call 977

Attach AED

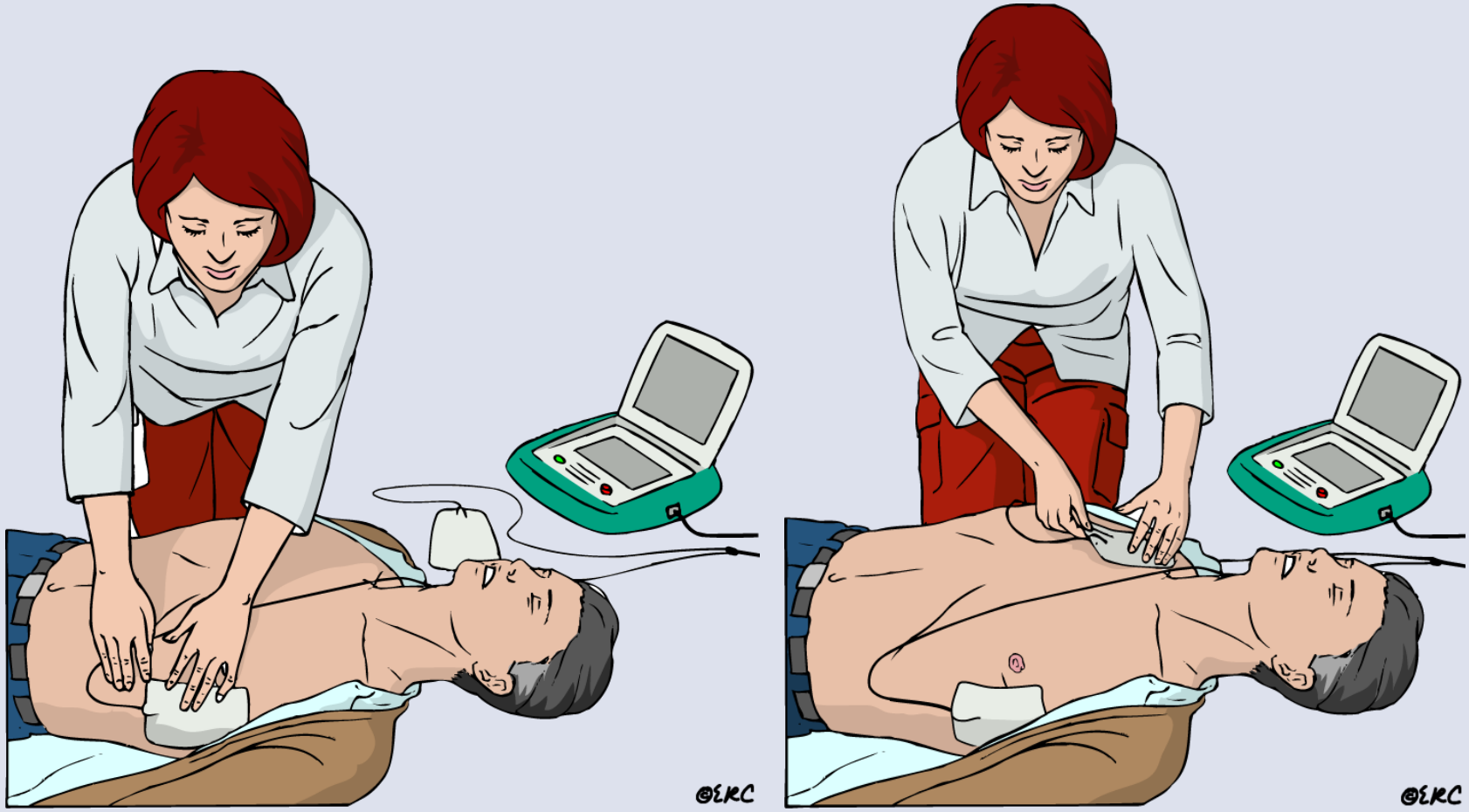
Follow voice prompts

AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

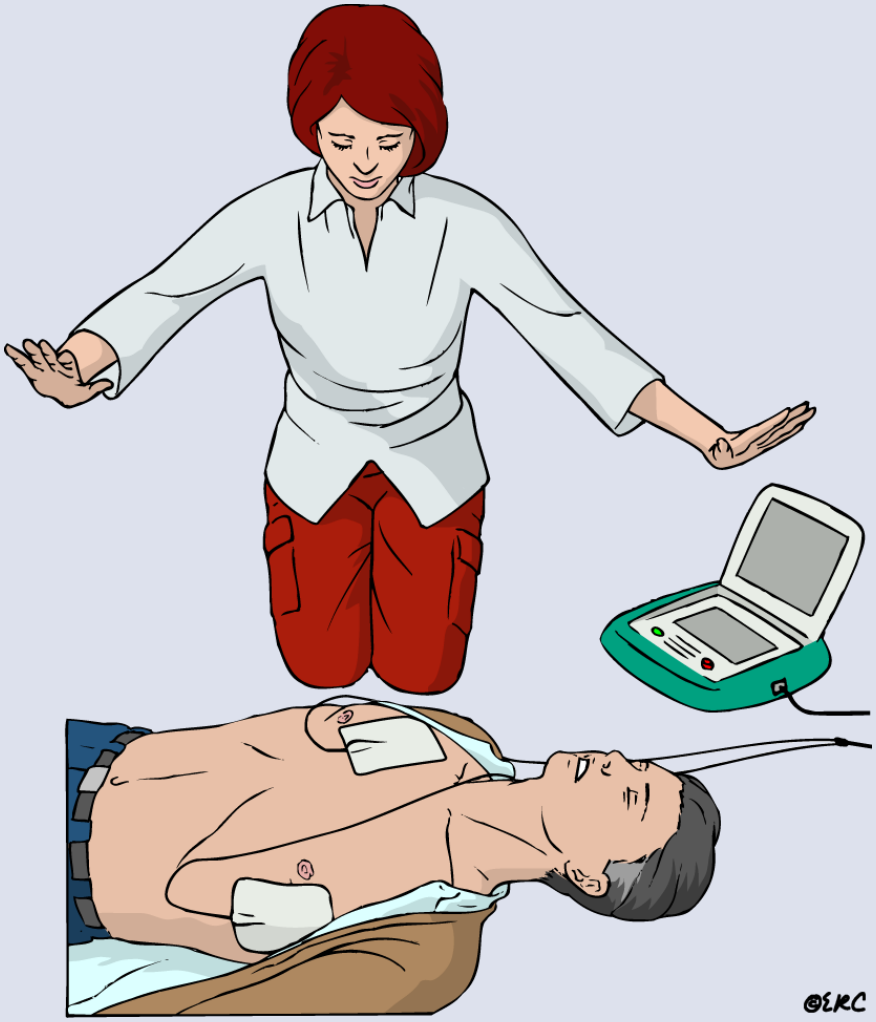


- Some AEDs will automatically switch themselves on when the lid is opened

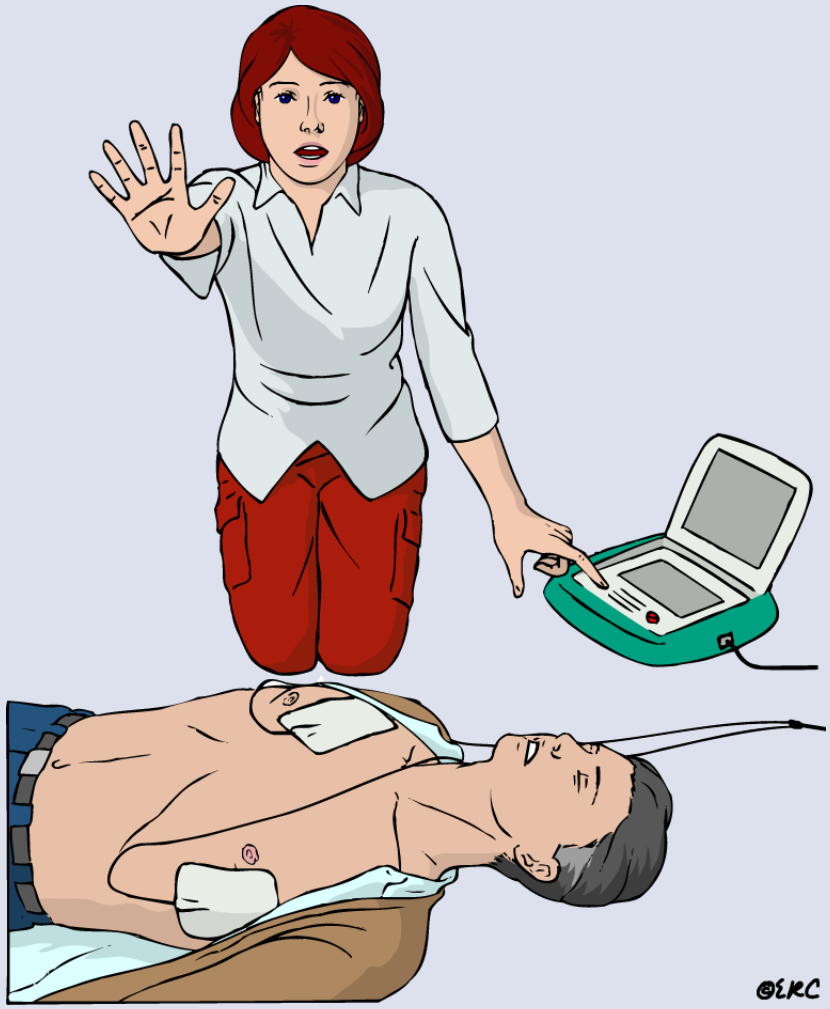
ATTACH PADS TO CASUALTY'S BARE CHEST



ANALYSING RHYTHM
DO NOT TOUCH VICTIM

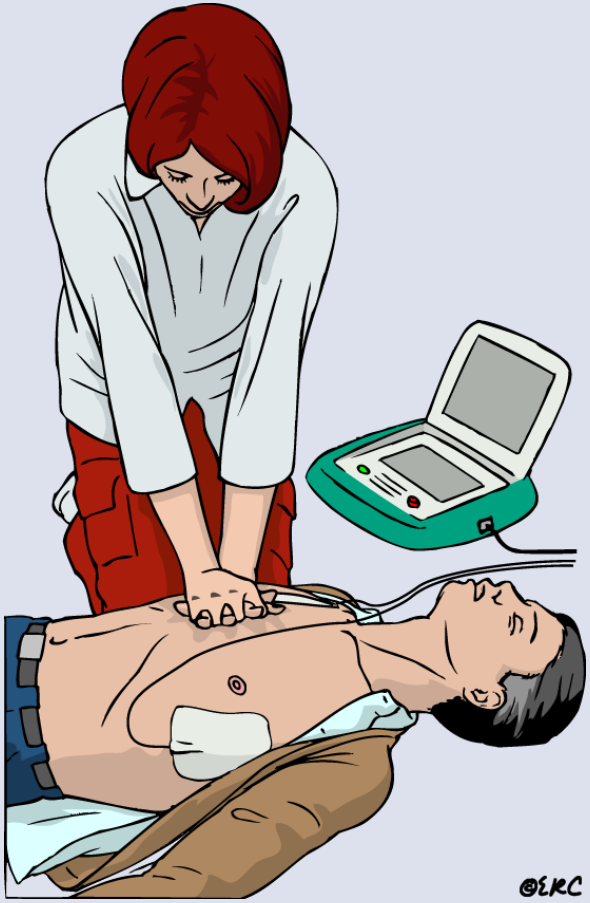


SHOCK INDICATED



- Stand clear
- Deliver shock

SHOCK DELIVERED
FOLLOW AED INSTRUCTIONS



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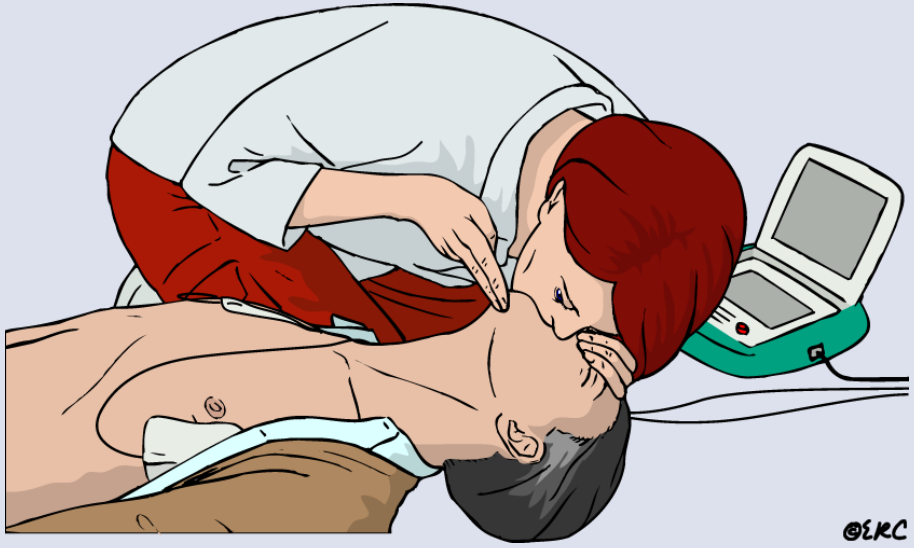

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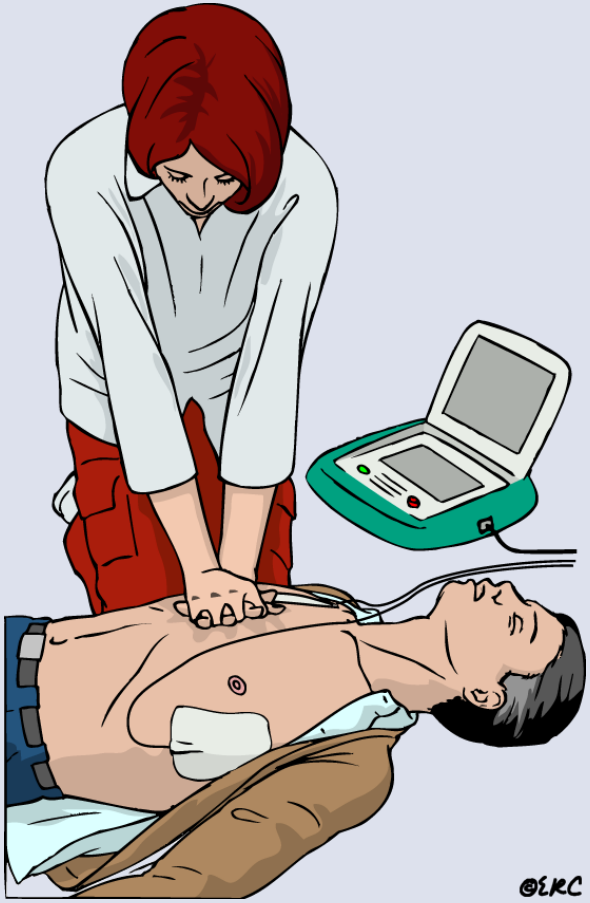
NO SHOCK ADVISED
FOLLOW AED INSTRUCTIONS



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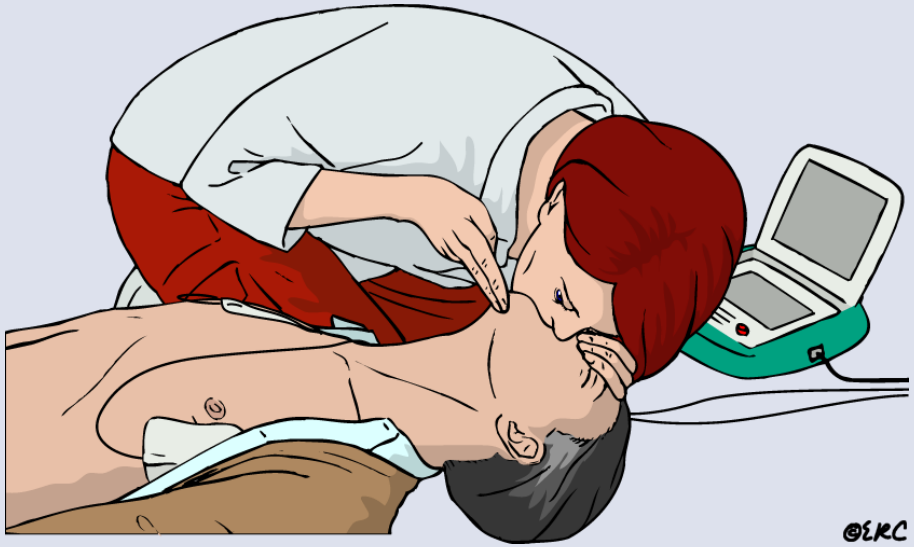

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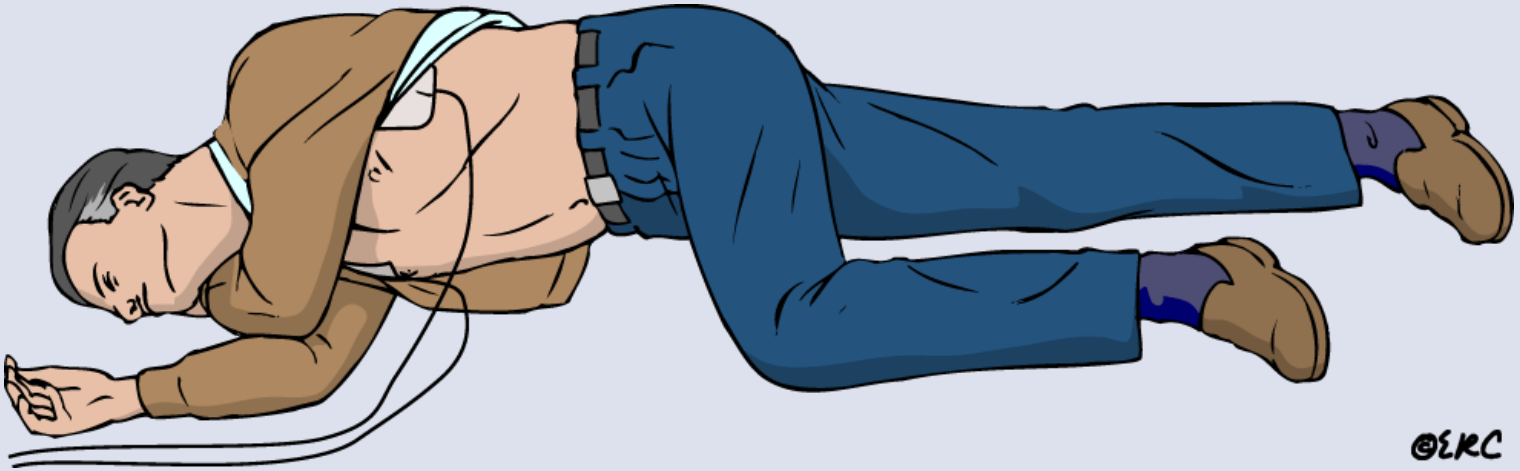
IF VICTIM STARTS TO BREATHE NORMALLY PLACE IN RECOVERY POSITION

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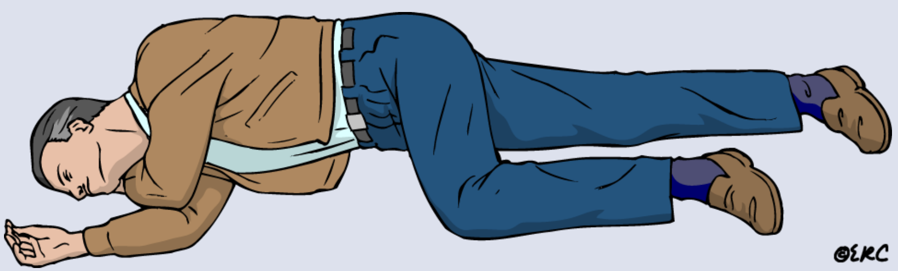
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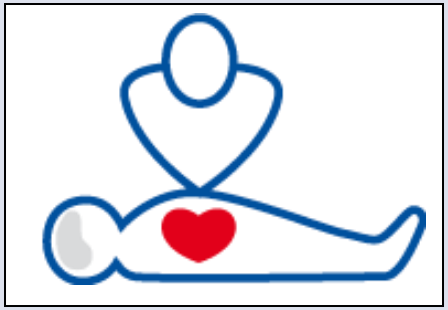
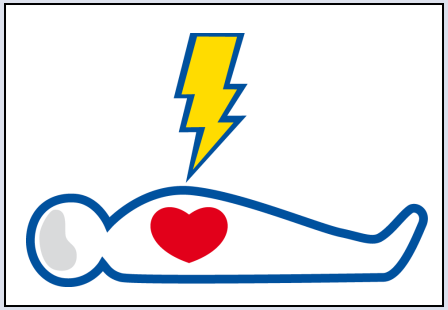
Basic Life Support



Approach safely
Check response
Shout for help
Open airway
Check breathing
Call Emergency System
30 chest compressions
2 rescue breaths



Approach safely
Check response
Shout for help
Open airway
Check breathing
Call Emergency System
Attach AED
Follow voice prompts

CONTINUE RESUSCITATION UNTIL

- Qualified help arrives and takes over
- The victim starts breathing normally
- Rescuer becomes exhausted

When Can I Stop CPR?

- Victim revives
- Trained help arrives
- Too exhausted to continue
- Unsafe scene
- Physician directed (do not resuscitate orders)
- Cardiac arrest of longer than 30 minutes
  - (controversial)

Why CPR May Fail

- **Delay in starting**
- **Improper procedures (ex. Forget to pinch nose)**
- **No ACLS follow-up and delay in defibrillation**
  - Only 15% who receive CPR live to go home
  - Improper techniques
- **Terminal disease or unmanageable disease (massive heart attack)**

Injuries Related to CPR

- **Rib fractures**
- **Laceration related to the tip of the sternum**
  - **Liver, lung, spleen**

Complications of CPR

- Vomiting
- Aspiration
- Place victim on left side
- Wipe vomit from mouth with fingers wrapped in a cloth
- Reposition and resume CPR

REPETITION

1. Name adult basic life support sequences of actions.
2. What is the manoeuvre for keeping the airway open called?
3. What is the numeral combination of chest compression and rescue breaths in adult basic life support?
4. Where do you place your hands while performing chest compressions?
5. How would you describe „agonal breathing“?
6. What is the telephone number of emergency response system?
7. Name 2 techniques applied in severe airway obstruction?

THANK YOU

Any question

ARTERIAL BLOOD GAS

Acid-Base Balance

- Cells need steady balance between acids and bases
- Normal acid base balance: [1:20] One part acid (CO_2): 20 parts base (HCO_3^-) = perfect pH of (7.35 – 7.45)
- Consider CO_2 an acid b/c it results in an acid when dissolved in blood:

  $CO_2 + H_2O \leftrightarrow H_2CO_3 \leftrightarrow HCO_3^- + H^+$
- Acid gain or base loss => Acidosis (pH < 7.35)
- Gain base or lose acids => Alkalosis (ph > 7.45)

Regulation of Acid-Base Balance

- Regulatory mechanisms are very sensitive to small changes in pH:

1. Buffers
2. Respiratory System
3. Renal System

Buffers

- Immediately combine with excess acid to form substances that do not greatly affect pH.
- Bicarbonate (HCO_3^-) Most important buffer ,
  Absorption, excretion,production regulated by kidney.
- Other buffers: Phosphate, Ammonium, Protein

Respiratory System

- If acidotic :

Hyperventilation => CO2 eliminated => improvement in acidotic state .

- If alkalotic :

hypoventilation => CO2 retained => improvement in alkalotic state.

- Quick response: within 1-2 min of pH imbalance.

Renal System

- Kidneys conserve or eliminate H+ and HCO3- in response to abnormal pH.
- If acidotic =>

Eliminate H+ (acid) and retain HCO3- (base) in effort to normalize pH.

- If alkalotic =>

Eliminate HCO3- (base) in effort to normalize pH.

- Response to abnormal pH is slow (hours to days).

Acid Base Imbalances

Respiratory Acidosis

- Acidosis is due to hypoventilation
- Causes:
  - COPD (Emphysema, bronchitis)
  - failure of respiratory muscles (ALS, Guillain-Barre)
  - airway obstruction (e.g., post-op)
- Metabolic compensation: Kidneys excrete H+/retain HCO3- .

Respiratory Alkalosis

- Alkalosis is due to hyperventilation.

- Causes
  - anxiety (Rx with paper bag)
  - pneumonia
  - pulmonary edema

- Metabolic compensation: Kidneys excrete HCO_3^- (if problem lasts hours/days)

Metabolic Acidosis

- Acidosis is due increase in metabolic acids and/or loss of HCO_3^-
- Increased acids due to
  - diabetic ketoacidosis
  - renal failure (kidneys cannot excrete H+)
  - poisoning .
- Lost alkali (base) due to:
  - severe diarrhea
  - intestinal malabsorption
- Respiratory compensation: hyperventilation to blow off CO_2.

Metabolic Alkalosis

- Alkalosis is due to loss of acid/H+ or excess alkali intake.
  - Vomiting
  - gastric suction
  - diuretics

- Respiratory compensation: hypoventilation to retain CO2.

ABG Parameters

- ***PaO_2***
  - Partial pressure of O_2
  - Normal: 80 - 100 mmHg
  - Measures the effectiveness of the lungs in oxygenating the blood. Reflects ability of lungs to diffuse inspired oxygen across the alveolar membrane into the circulating blood

- ***SaO2***
  - Oxygen saturation
  - % of hgb that is saturated with oxygen.
  - Normal: > 95%

- ***$PaCO_2$***
  - Partial Pressure of CO_2
  - Normal: 35 - 45 mmHg
  - Reflects effectiveness of ventilation (movement of air into and out of lungs).

- ***HCO_3^-***
  - Bicarbonate ion; metabolic parameter.
  - Part of buffer system.
  - **Normal: 22 - 26 mEq/l**

- ***pH –***

Measures acidity.

Determined by relative concentrations of CO_2 and HCO_3 .

Normal (7.35 - 7.45)

DEFINITION of ABG

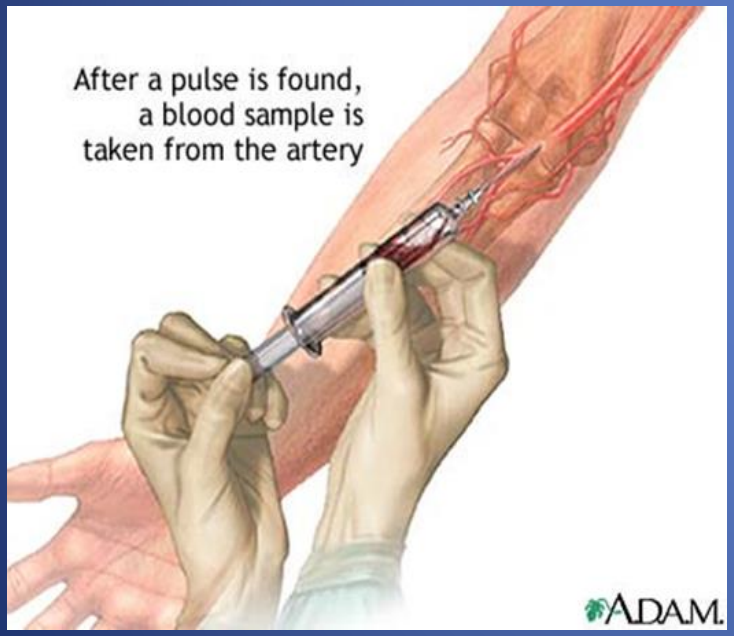
- It is a diagnostic procedure in which a blood is obtained from an artery directly by an arterial puncture or by arterial catheter.

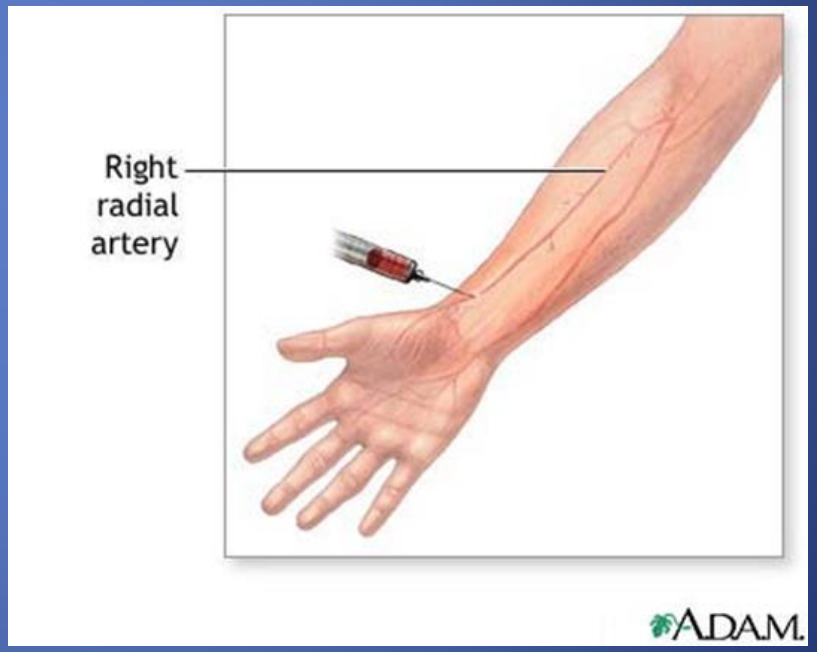
Sites for obtaining ABG

1. Radial artery (most common)
2. Brachial artery
3. Femoral artery

Radial is the most preferable site used because:

- It is easy to access
- It is not a deep artery which facilitate palpation, stabilization and puncturing
- The artery has a collateral blood circulation


After a pulse is found,
a blood sample is
taken from the artery
A.D.A.M.


Right
radial
artery
A.D.A.M.

indication

1. To obtain information about patient ventilation (PCO2) , oxygenation (PO2) and acid base balance.
2. Monitor gas exchange and acid base abnormalities for patient on mechanical ventilator.
3. To evaluate response to clinical intervention and diagnostic evaluation (oxygen therapy)

Contraindications

1. Bleeding diathesis
2. AV fistula
3. Severe peripheral vascular disease, absence of an arterial pulse
4. Infection over site

Normal values:

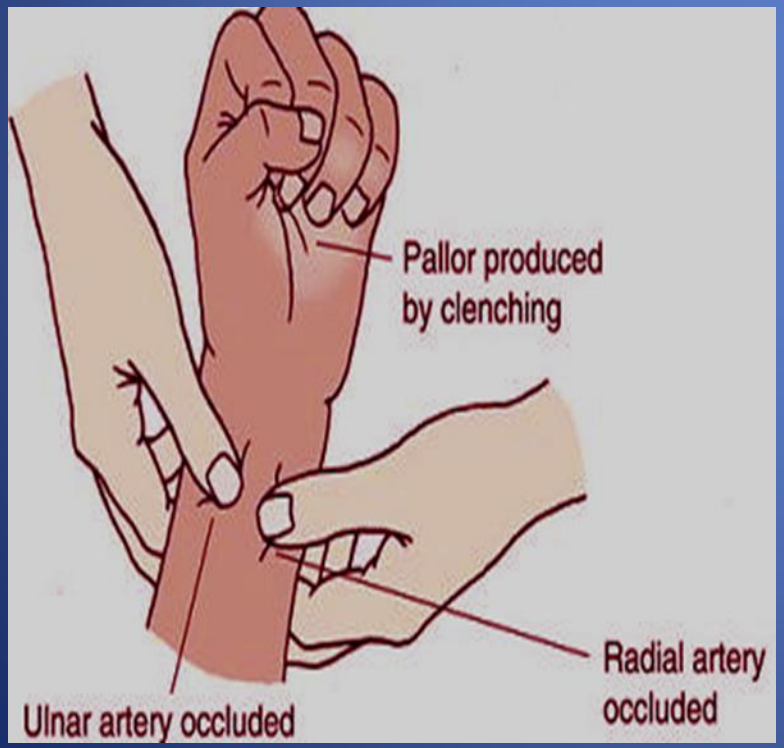
- ***PH*** = 7.35 – 7.45
- ***PCO2*** = 35 – 45 mmhg
- ***PO2*** = 80 – 100 mmhg
- ***HCO3*** = 22 – 28 meq/L

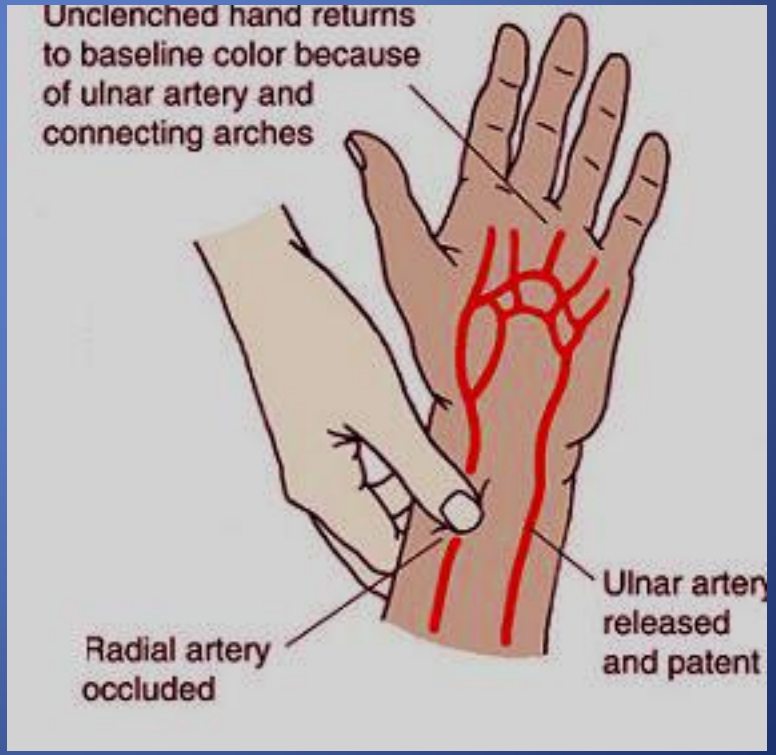
Preparatory phase:

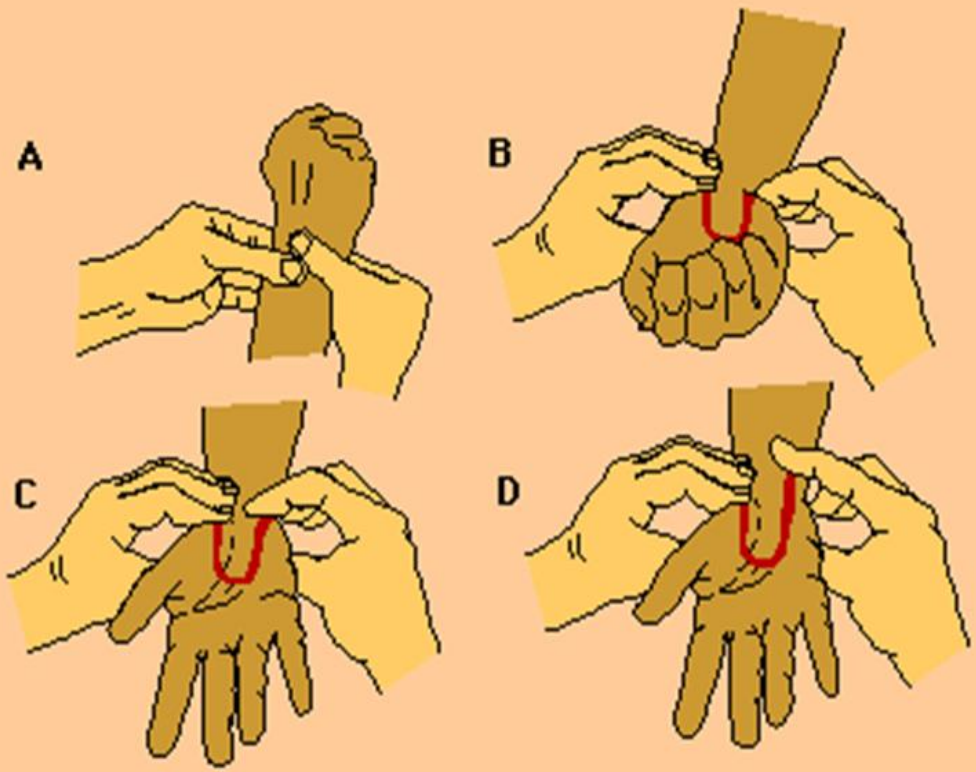
- Record patient inspired oxygen concentration.
- Check patient temperature
- Explain the procedure to the patient .
- If not using hepranized syringe , hepranize the needle.
- Perform Allen's test.

- *<u>Allen's test</u>*

It is a test done to determine that collateral circulation is present from the ulnar artery in case thrombosis occur in the radial







Modified Allen's test The patient's hand is initially held high while the fist is clenched and both radial and ulnar arteries are compressed (A); this allows the blood to drain from the hand. The hand is then lowered (B) and the fist is opened (C). After pressure is released over the ulnar artery (D), color should return to the hand within six seconds, indicating a patent ulnar artery and an intact superficial palmar arch. (Redrawn from American Heart Association. Textbook of Advanced Cardiac Life Support, 1994.)

Performance phase:

- Wash hands
- Put on gloves
- Clean with alcohol swab
- Palpate the artery for maximum pulsation
- If radial, perform Allen's test
- Skin and subcutaneous tissue may be infiltrated with local anesthetic agent if needed

- Insert needle at 45 radial ,60 brachial and 90 femoral.
- Withdraw the needle.
- Check bubbles in syringe.
- Place the capped syringe in the container of ice immediately .
- Maintain firm pressure on the puncture site for 5 minutes, if patient has coagulation abnormalities apply pressure for 10 – 15 minutes.

Follow up phase:

- Palpate the pulse distal to the puncture site.
- Assess for cold hands, numbness, tingling or discoloration.
- Documentation include:

results of Allen's test, time the sample was drawn, temperature, puncture site, time pressure was applied and if O2 therapy is there.

complication

1. Arteriospasm
2. Distal ischemia

3. Hematoma
4. Hemorrhag

5. Infection
6. Numbness

ABG Interpretation:

Step 1 (Assess Oxgenation)

- Look at PaO_2 and SaO_2
  - Normal
  - Hypoxemic

Step 2 (Assess Acid-Base Balance)

- Look at pH
  - Acidotic, alkalotic, or normal?
  - If normal
    - High normal?
    - Low normal?

Step 3

- Look at $PaCO_2$
  - Is it altered (i.e. increased or decreased)?
  - If altered, consider the direction of the alteration:
    - Could it have ***caused*** the alteration in pH?
    - Could it be compensation?

Step 4

- Look at HCO_3^-
  - Is it altered (i.e. increased or decreased)?
  - If altered, consider the direction of the alteration:
    - Could it have ***caused*** the alteration in pH?
    - Could it be compensation?

Step 5

- Decide if the abnormal pH is caused by the pCO2 (respiratory causes) or the HCO3 (metabolic causes) or mixed.

Mechanical ventilation

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objectives

- **To define what is the mechanical ventilator.**
- **To know what are the indications for M.V .**
- **To determine modes of mechanical ventilation .**
- **To know how to adjust M.V .**
- **To know how to deal with complications of M.V .**
- **To determine what is the nursing management of ventilated patient .**

- **Is a machine that generates a controlled flow of gas into a patient's airways. Oxygen and air are received from cylinders or wall outlets, the gas is pressure reduced and blended according to the prescribed inspired oxygen tension (FiO2), accumulated and delivered to the patient using one of many available modes of ventilations.**


MAQUET
MAQUET
SERVO-s


A/C
PC
12
20
1.00
3.0
50
50
PEEP
5.0

Spontaneous respiration vs. Mechanical ventilation

- **Natural Breathing**
  - **Negative inspiratory force**
  - **Air pulled into lungs**
- **Mechanical Ventilation**
  - **Positive inspiratory pressure**
  - **Air pushed into lungs**

INDICATIONS

Respiratory Failure :

Hypoxemic Respiratory Failure

Hypercapnic Respiratory Failure

Need for sedation/ neuromuscular blockage.

Need to decrease systemic or myocardial oxygen consumption.

Indications

- **Respiratory Failure**
  - **CNS Disorders**
    - ***Reduced Drive To Breathe:*** **depressant drugs, brain or brainstem lesions (stroke, trauma, tumors), hypothyroidism**
    - ***Increased Drive to Breathe:*** **increased metabolic rate (↑CO2 production), metabolic acidosis, anxiety associated with dyspnea**

indications

- **Neuromuscular Disorders**
  - ***Paralytic Disorders:*** **Myasthenia Gravis, Guillain-Barre, poliomyelitis, etc.**
  - ***Paralytic Drugs:*** **Curare, nerve gas, succinylcholine, insecticides**
  - ***Drugs that affect neuromuscular transmission;*** **calcium channel blockers, long-term adenocorticosteroids, etc.**
  - ***Impaired Muscle Function:*** **electrolyte imbalance, malnutrition, chronic pulmonary disease, etc.**

Indications

- **Increased Work of Breathing**
  - » ***Pleural Occupying Lesions:*** **pleural effusions, hemothorax, empyema, pneumothorax**
  - » ***Chest Wall Deformities:*** **flail chest, kyphoscoliosis, obesity**
  - » ***Increased Airway Resistance:*** **secretions, mucosal edema, bronchoconstriction, foreign body**
  - » ***Lung Tissue Involvement:*** **interstitial pulmonary fibrotic diseases**

indications

- **Increased Work of Breathing (cont.)**
  - ***Lung Tissue Involvement:*** **interstitial pulmonary fibrotic diseases, aspiration, ARDS, cardiogenic PE, drug induced PE**
  - ***Pulmonary Vascular Problems:*** **pulmonary thromboembolism, pulmonary vascular damage**
  - ***Dynamic Hyperinflation*** **(air trapping)**
  - ***Postoperative Pulmonary Complications***

MODES OF VENTILATION:

MODES OF VENTILATION:

➢ Spontaneous:

- The Pt. breath spontaneously.
- The Pt. needs only specific FIO2 to maintain its normal blood gases.

➢ Controlled:

The machine controls the patient ventilation according to set tidal volume and respiratory rate . spontaneous respiratory effort of Pt. is locked out , (patient who receives sedation and paralyzing drugs he will on controlled Mode).

➢ SIMV:

Machine allows the Pt to breath spontaneously while providing preset FIO2 , and a number of ventilator breaths to ensure adequate ventilation without fatigue.

➢ ASSIST / CONTROL:

The Pt. triggers the machine with negative inspiratory effort. If the Pt. fails to breath the machine will deliver a controlled breath at a minimum rate and volume already set.

1- Volume-cycled ventilator

- **Inspiration is terminated after a preset tidal volume has been delivered by the ventilator.**

- **The ventilator delivers a preset tidal volume (VT), and inspiration stops when the preset tidal volume is achieved.**

2- Pressure-cycled ventilator

- **In which inspiration is terminated when a specific airway pressure has been reached.**

- **The ventilator delivers a preset pressure; once this pressure is achieved, end inspiration occurs.**

3- Time-cycled ventilator

- **In which inspiration is terminated when a preset inspiratory time, has elapsed.**

ADJUSTMENT ON THE VENTILATOR:

- The ventilator is adjusted so that the pt. is comfortable and "in sync " with the machine.
- Minimal alteration of the normal cardiovascular
- and pulmonary dynamics is desired.

If the volume of ventilator is adjusted appropriately , the pt. arterial blood level will be satisfactory and there will be no or little cardiovascular compromise.

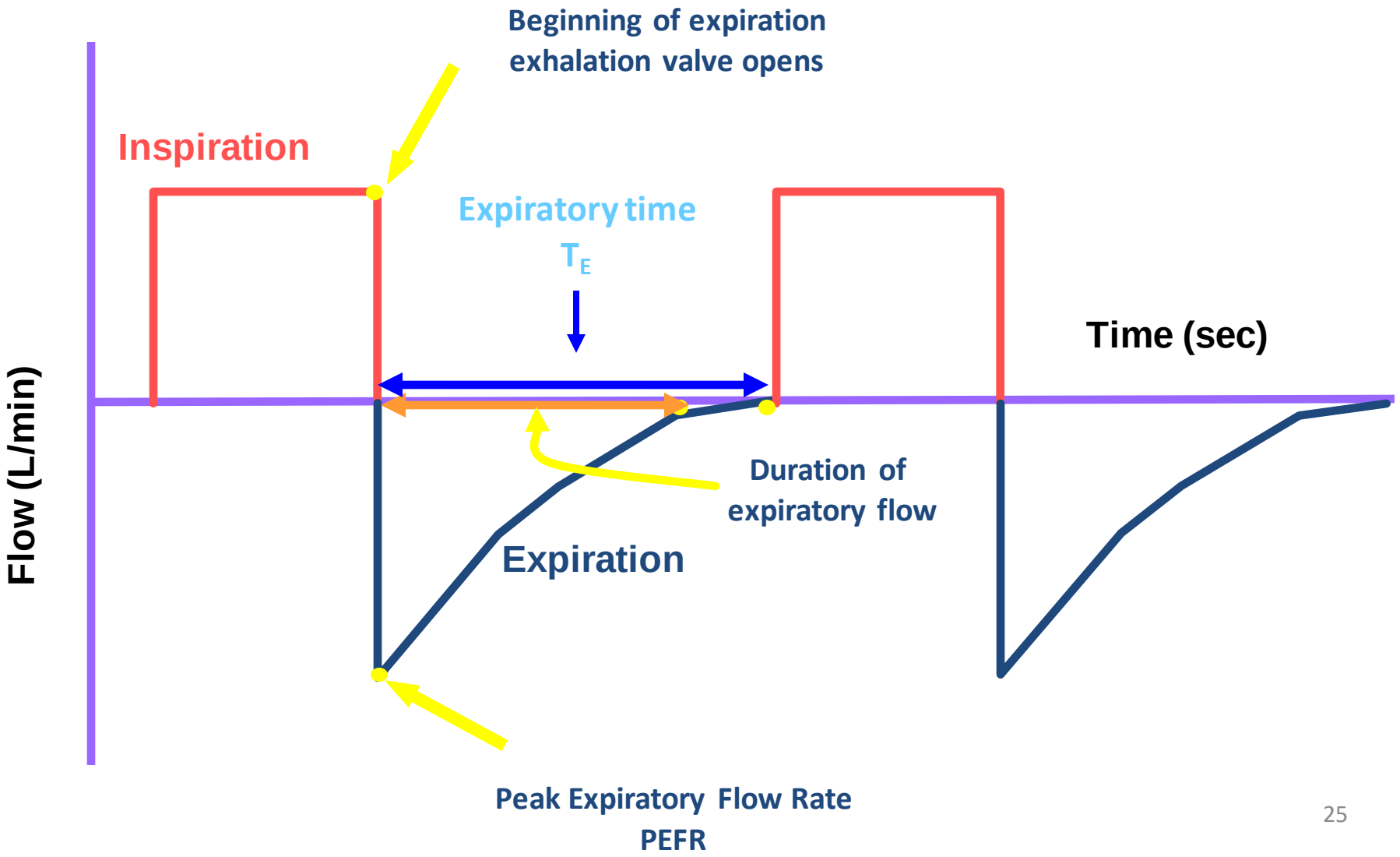
INITIAL SETTINGS

- Select your mode of ventilation
- Set sensitivity at Flow trigger mode
- Set Tidal Volume
- Set Rate
- Set Inspiratory Flow (if necessary)
- Set PEEP
- Set Pressure Limit
- Inspiratory time
- Fraction of inspired oxygen

Trigger

- There are two ways to initiate a ventilator-delivered breath: pressure triggering or flow-by triggering
  - When pressure triggering is used, a ventilator-delivered breath is initiated if the demand valve senses a negative airway pressure deflection (generated by the patient trying to initiate a breath) greater than the trigger sensitivity.
  - When flow-by triggering is used, a continuous flow of gas through the ventilator circuit is monitored. A ventilator-delivered breath is initiated when the return flow is less than the delivered flow, a consequence of the patient's effort to initiate a breath

Expiratory Flow Pattern



Initiation of Mechanical Ventilation

- Ventilator Alarm Settings
  - Apnea Alarm
    - Set with a 15 – 20 second time delay
    - In some ventilators, this triggers an apnea ventilation mode
  - Apnea Ventilation Settings
    - Provide full ventilatory support if the patient become apneic
    - VT 4-6 mL/kg ideal body weight
    - Rate 10 – 20 breaths/min
    - FiO2 100%

Initiation of Mechanical Ventilation

- Ventilator Alarm Settings
  - High/Low FiO2 Alarm
    - High: 5% over the analyzed FiO2
    - Low: 5% below the analyzed FiO2
  - High/Low Temperature Alarm
    - Heated humidification
      - High: No higher than 37° C
      - Low: No lower than 30° C

Initiation of Mechanical Ventilation

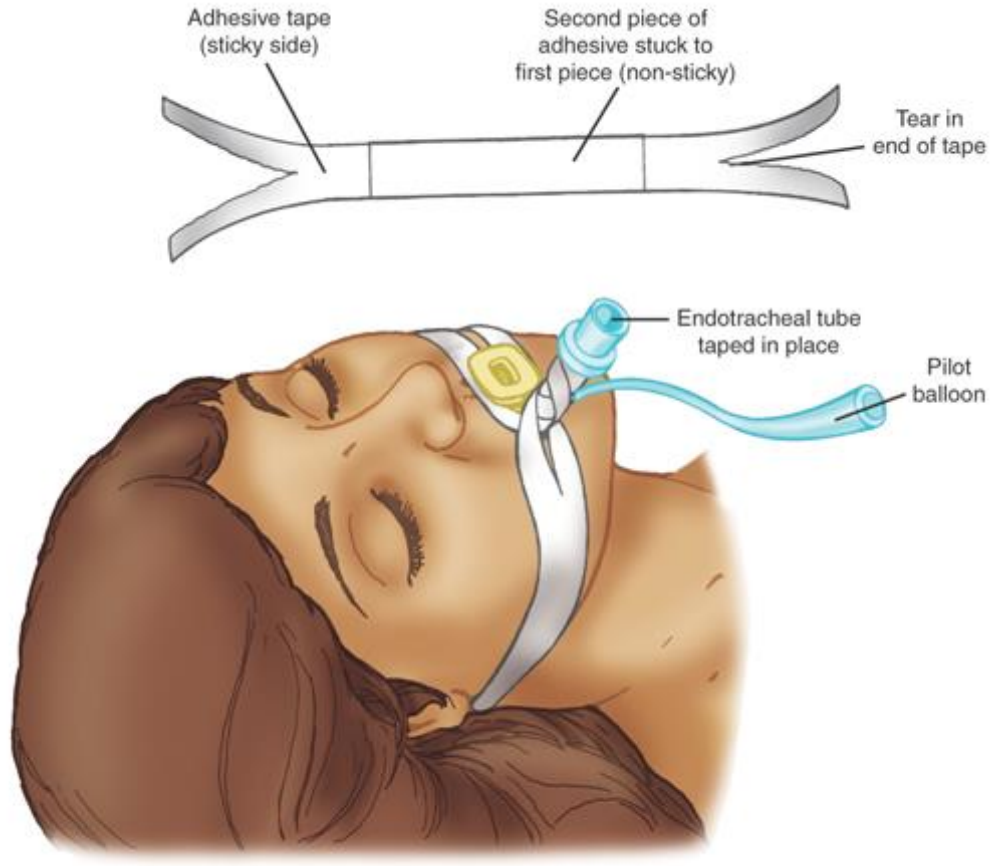
- Ventilator Alarm Settings
  - Apnea Alarm
    - Set with a 15 – 20 second time delay
    - In some ventilators, this triggers an apnea ventilation mode
  - Apnea Ventilation Settings
    - Provide full ventilatory support if the patient become apneic
    - VT 8 – 12 mL/kg ideal body weight
    - Rate 10 – 12 breaths/min
    - FiO2 100%

Intubation Procedure

Check and Assemble Equipment:

- ✓Oxygen flowmeter and O2 tubing
- ✓Suction apparatus and tubing
- ✓Suction catheter
- ✓Ambu bag and mask
- ✓Laryngoscope with assorted blades
- ✓3 sizes of ET tubes
- ✓Stillet
- ✓Stethoscope
- ✓Tape
- ✓Syringe
- ✓Sterile gloves

- The depth of the tube for a male patient on average is 21-23 cm at teeth
- The depth of the tube on average for a female patient is 19-21 at teeth.



Post Initial Settings

- Obtain an ABG (arterial blood gas) about 30 minutes after you set your patient up on the ventilator.
- An ABG will give you information about any changes that may need to be made to keep the patient's oxygenation and ventilation status within a physiological range.

ABG

- Goal:
- Keep patient's acid/base balance within normal range:

  - pH 7.35 – 7.45
  - PCO_2 35-45 mmHg
  - PO2 80-100 mmHg

THE FOLLOWING GUIDELINES ARE RECOMMENDED:

1. **set the machine to deliver the required tidal volume (4 to 6 ml/kg)**

2. **adjust the machine to deliver the lowest concentration of the oxygen to maintain normal PaO2 (80 to 100mmhg).The setting may be set high and gradually reduced based on ABGs result.**

3. Record peak inspiratory pressure.

4. Set mode (assist/control or SIMV)and rate according to physician order.

5. If Pt. is on assist/control mode , adjust sensitivity so that the Pt. can trigger the ventilator with the minimum effort(usually 3mmHg negative inspiratory force)

6. **Record minute volume and measure carbon dioxide partial pressure PaCO2, PH after 20 minutes of mechanical ventilation.**

7. **Adjust FIO2 and rate according to results of ABG to provide normal values or those set by the physician.**

COMPLICATIONS OF M.V

Complications of Endotracheal Intubation

- **Cuff problems**
  - **Ineffective seal leads to aspiration**
  - **Too much pressure leads to tracheal necrosis**
  - **Use minimal occluding volume (keep pressure <20 mm Hg)**
  - **Suction throat before deflation**

Complications

- Pulmonary
  - Alveolar hypoventilation
    - Cuff leak
    - Ventilator settings
    - Secretions
    - Atelectasis

Complications

- Pulmonary
  - Alveolar hyperventilation
    - Due to hypoxemia, fear, pain, anxiety → alkalosis
      - RX: sedate, analgesia, communication, correct hypoxemia
    - Due to inappropriate ventilator settings
      - high tidal volume
      - High rate
  - Pulmonary Infection
    - Upper airway defenses bypassed

Complications

- Neurological complications
  - Positive pressure ventilation → increased intrathoracic pressure
  - interferes with venous drainage; increased ICP
- GI
  - Stess ulcers and GI bleeds; Rx with H_2 receptor blockers
  - MV → Gastric and bowel dilation

Complications

- Musculoskeltal
  - Muscle atrophy d/t immobilization
    - Mobilize

- Psychologic
  - Stress
  - Communication very important
  - Sedate, explain, family visits, pain management
  - Facilitate expression of needs

Decreased Cardiac Output

- **Cause** - venous return to the right atrium impeded by the dramatically increased intrathoracic pressures during inspiration from positive pressure ventilation.
- **Symptoms** – increased heart rate,
- decreased blood pressure and perfusion to vital organs, decreased CVP,
- and cold extremities.
- **Treatment** – aimed at increasing preload (e.g. fluid administration) and decreasing the airway pressures exerted during mechanical ventilation by decreasing inspiratory flow rates and TV, or using other methods to decrease airway pressures (e.g. different modes of ventilation).

Barotrauma

- **Cause** – damage to pulmonary system due to alveolar rupture from excessive airway pressure.
- **Symptoms** – may result in pneumothorax, pneumomediastinum and subcutaneous emphysema.
- **Treatment** - cautious use of PEEP, and avoidance of high airway pressures resulting in development of auto-PEEP in high risk patients (patients with obstructive lung diseases (asthma, bronchospasm), unevenly distributed lung diseases (lobar pneumonia), or hyperinflated lungs (emphysema).

Nosocomial Pneumonia

- **Cause** – invasive device in critically ill patients becomes colonized with pathological bacteria within 24 hours in almost all patients. 20-60% of these, develop nosocomial pneumonia.
- **Treatment** – aimed at prevention by the following:
- Avoid cross-contamination by frequent handwashing
- Decrease risk of aspiration (cuff occlusion of trachea, positioning, use of small-bore NG tubes)
- Suction only when clinically indicated, using sterile technique
- Maintain closed system setup on ventilator circuitry and avoid pooling of condensation in the tubing
- Ensure adequate nutrition
- Avoid neutralization of gastric contents with antacids and H2 blockers

Decreased Renal Perfusion – can be treated with low dose dopamine therapy.

Increased Intracranial Pressure (ICP) – reduce PEEP

Hepatic congestion – reduce PEEP

Worsening of intracardiac shunts –reduce PEEP

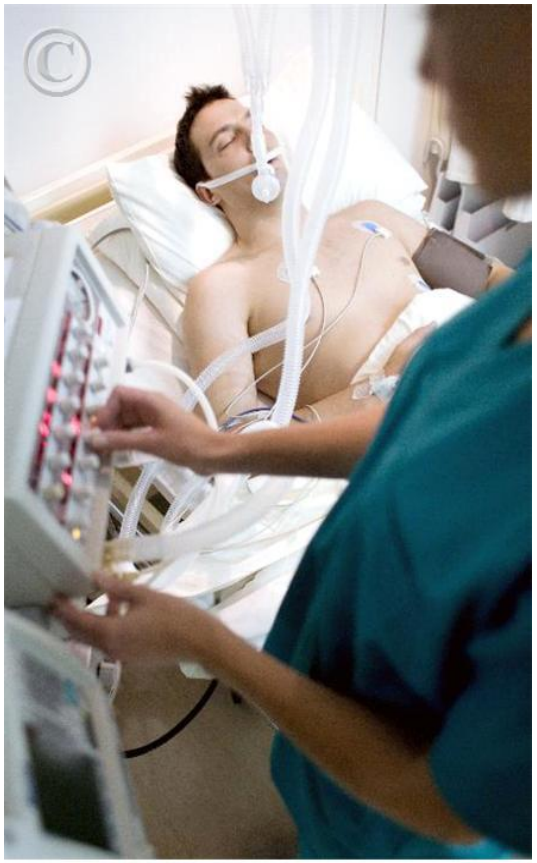
NURSING MANAGEMENT OF VENTILATED PATIENT

Nursing Management:

1. Promote respiratory function.
2. Monitor for complications
3. Prevent infections.
4. Provide adequate nutrition.
5. Monitor GI bleeding.

PROMOTE RESPIRATORY FUNCTION

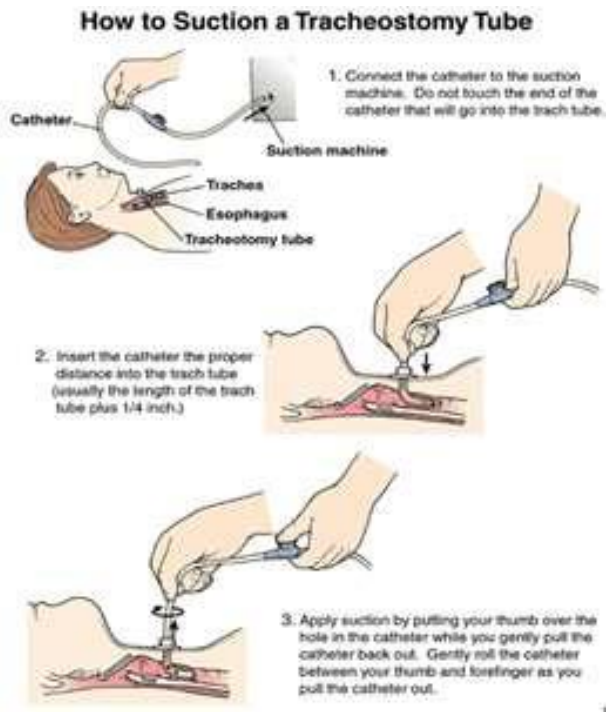
1. Auscultate lungs frequently to assess for abnormal sounds.
2. Suction as needed.
3. Turn and reposition every 2 hours.
4. Secure ETT properly.
5. Monitor ABG value and pulse oximetry.



SUCTION OF AN ARTIFICIAL AIRWAY

1. To maintain a patent airway
2. To improve gas exchange.
3. To obtain tracheal aspirate specimen.
4. To prevent effect of retained secretions.

(Its important to OXYGENATE before and after suctioning)



MONITOR FOR COMPLICATIONS

1. Assess for possible early complications
   Rapid electrolyte changes.
   Severe alkalosis.
   Hypotension secondary to change in
   Cardiac output.

2. Monitor for signs of respiratory distress
   Restlessness
   Apprehension
   Irritability and increase HR.

3. Assess for signs and symptoms of barotrauma(rupture of the lungs)
   - Increasing dyspnea
   - Agitation
   - Decrease or absent breath sounds.
   - Decreasing PaO2 level .

4. Assess for cardiovascular depression:
   - Hypotension
   - Tachy. and Bradycardia
   - Dysrhythmias.

- **PREVENT INFECTION**

1. Maintain sterile technique when suctioning.
2. Monitor color, amount and consistency of sputum.

- **PROVIDE ADEQUATE NUTRITION**

1. Begin tube feeding as soon as it is evident the patient will remain on the ventilator for a long time.
2. Weigh daily.
3. Monitor I&O .

- **MONITOR FOR GI BLEEDING**

Monitor bowel sounds.

TROUBLESHOOTING

- Anxious Patient
  - Can be due to a malfunction of the ventilator
  - Patient may need to be suctioned
  - Frequently the patient needs medication for anxiety or sedation to help them relax
    - Attempt to fix the problem

Low Pressure Alarm

- Usually due to a leak in the circuit.
  - Attempt to quickly find the problem
  - Bag the patient and call your RT.

High Pressure Alarm

- Usually caused by:
  - A blockage in the circuit (water condensation)
  - Patient biting his ETT
  - Mucus plug in the ETT

  - You can attempt to quickly fix the problem

Low Minute Volume Alarm

- Usually caused by:
  - Apnea of your patient (CPAP)
  - Disconnection of the patient from the ventilator
  - You can attempt to quickly fix the problem

Accidental Extubation

- **Role of the Nurse**:
  - Ensure the Ambu bag is attached to the oxygen flowmeter and it is on!
  - Attach the face mask to the Ambu bag and after ensuring a good seal on the patient's face; supply the patient with ventilation.

Weaning

- Monitor closely
  - resp rate
  - accessory muscle use
  - shallow respirations
  - paradoxical breathing
  - ABGs
    - rising PCO_2 → acidosis
    - falling PO2
    - BP (↓ or ↑)
    - LOC (restless, tiring, somnolence, anxiety)
    - Pulse oximeter

QUESTIONS!!!


Thank You

Ventilator circuit

Breathing system plain

Ventilator Breathing System (1.6m)

Ventilator Breathing System (1.6m)

heat & moisture exchanger HME filter


Aerogen