Department of Anesthesia Techniques

Defibrillator

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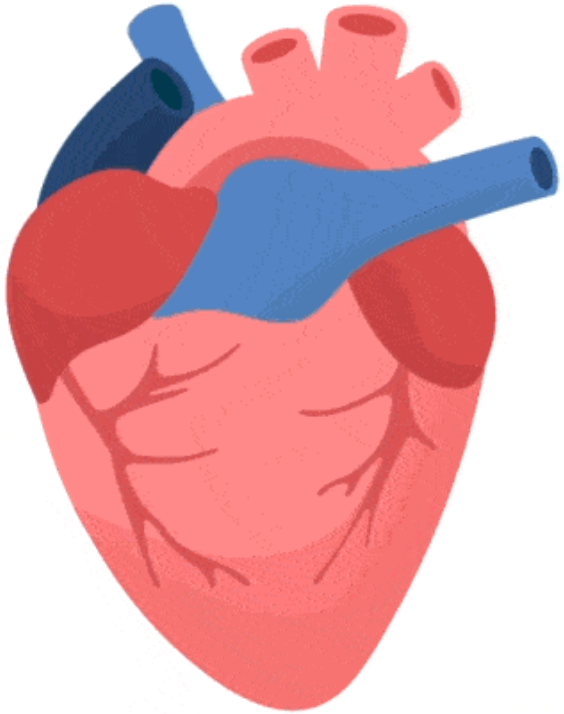
Defibrillation

- Is the passage of an electrical current across the myocardium in order to change the electrical activity of the heart from a chaotic to organized rhythm.
- It is a term usually used in relation to the treatment of ventricular fibrillation (VF) or ventricular tachycardia (VT); when used for the treatment of atrial fibrillation (AF) or atrial flutter, it is usually termed ‘cardioversion’.



What is Defibrillation?

- When combined with CPR and specialized medical care, rapid defibrillation can save lives.
- Defibrillation does not treat the arrhythmia's underlying cause.
- It does not always work, especially in cases of severe, untreated cardiac disease or some end-stage conditions.

Defibrillator Machine

- Devices that provide an electric pulse or shock to the heart to restore a regular heartbeat.
- They're used to prevent or treat arrhythmias, which are irregular heartbeats that are either too slow or too fast. If the heart abruptly stops beating, defibrillators can help restore it.

Defibrillator Machine

- automated external defibrillators (AEDs): are found public places for a sudden cardiac arrest.

In an emergency, inexperienced people can operate these devices.

- Implantable cardioverter defibrillators (ICDs) are **surgically** implanted inside the body .
- wearable cardioverter defibrillators (WCDs) are placed on the body

Types of Defibrillator Machines

1. Manual Defibrillator

A skill is required for manual external defibrillators.

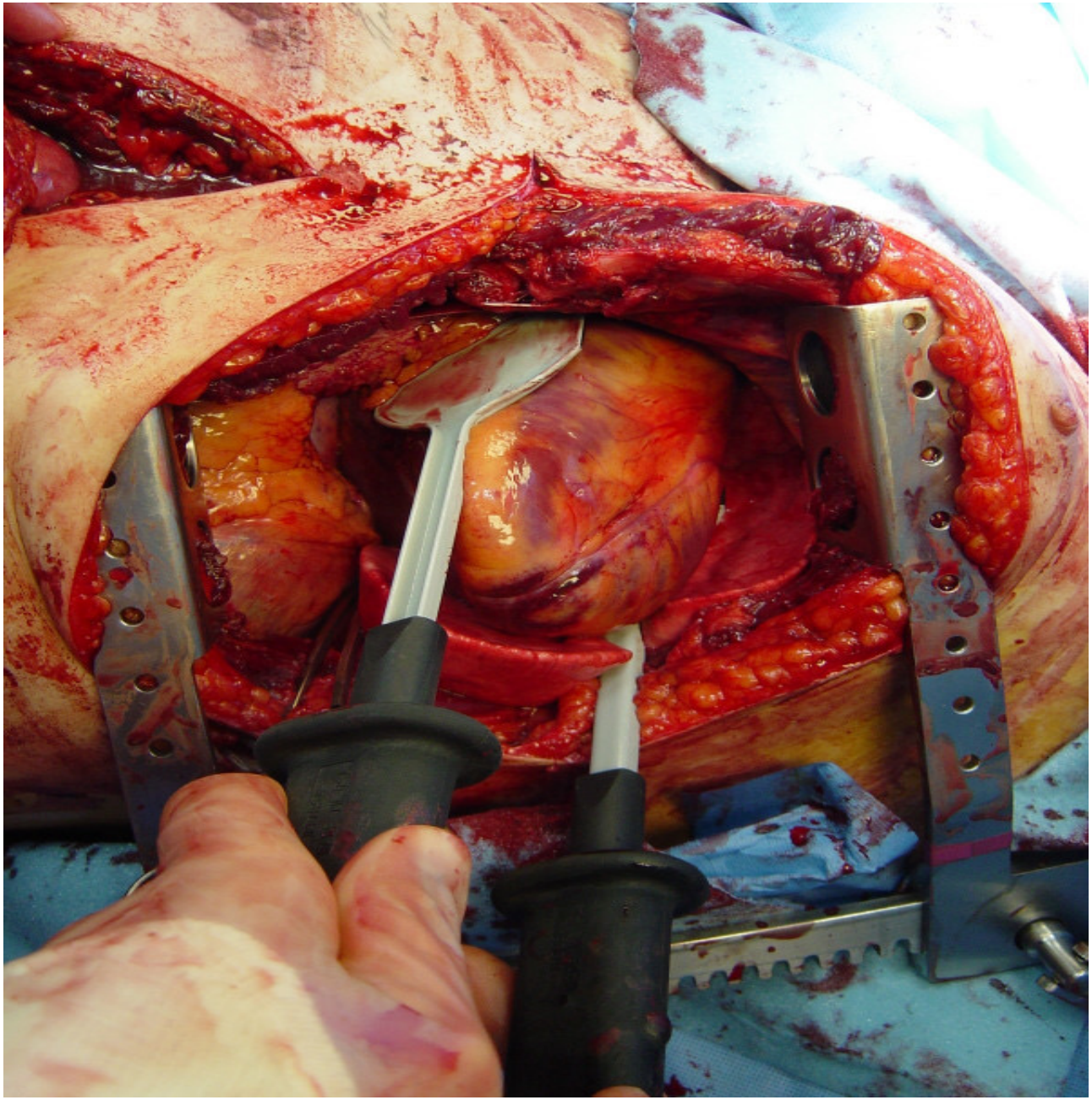
They're utilized in conjunction with an ECG, which might be standalone or integrated.

The voltage and timing for the electrical shock are manually determined after a healthcare provider assesses the heart rhythm. these units found in hospitals and ambulances.

Types of Defibrillator Machines

Internal defibrillator is frequently used to defibrillate the heart During or after cardiac surgery, such as a heart bypass, is Round metal plates are used as electrodes and come into direct touch with the myocardium. Paddles placed directly on the heart administer the shock in manual internal defibrillators.

They're mostly employed in the operating room and, in rare cases, the emergency department during an open-heart surgery.



2. Automated External Defibrillators (AED Defibrillator)

- Designed for use by **untrained persons.**
- AEDs can analyze cardiac rhythms determining whether or not a rhythm is shockable
- AEDs have improved outcomes for abrupt out-of-hospital cardiac arrests by making these units widely available.
- Trained health professionals will have more limited use of automatic defibrillators than manual external defibrillators.
- AEDs do not enhance outcomes in patients with in-hospital cardiac arrests
- AEDs have fixed voltages and do not allow the operator to adjust the voltage based on the situation.
- AEDs may also cause effective CPR to be delayed.


Lifeline VIEW
Give 30 Compressions
SHOCK


Appliquez les électrodes


ADULT ELECTRODE PADS
defibtech


Use of an AED by an untrained person

- AEDs frequently require the cessation of chest compressions and rescue breathing in order to diagnose rhythm.
- certain organizations advocate that if manual external defibrillators are readily available, they be used instead of AEDs.
- AEDs have been widely available in many easily accessible regions because early defibrillation can greatly improve VF outcomes.
- AEDs have been incorporated into the basic life support algorithm (BLS).
- They are carried by many first responders, including firefighters, police officers, and security guards.

AEDs are available in two types:

1- completely automatic
2- semi-automatic.

A semi-automatic AED diagnoses heart rhythms and determines whether or not a shock is required. If a shock is recommended, the user must press a button to deliver it.

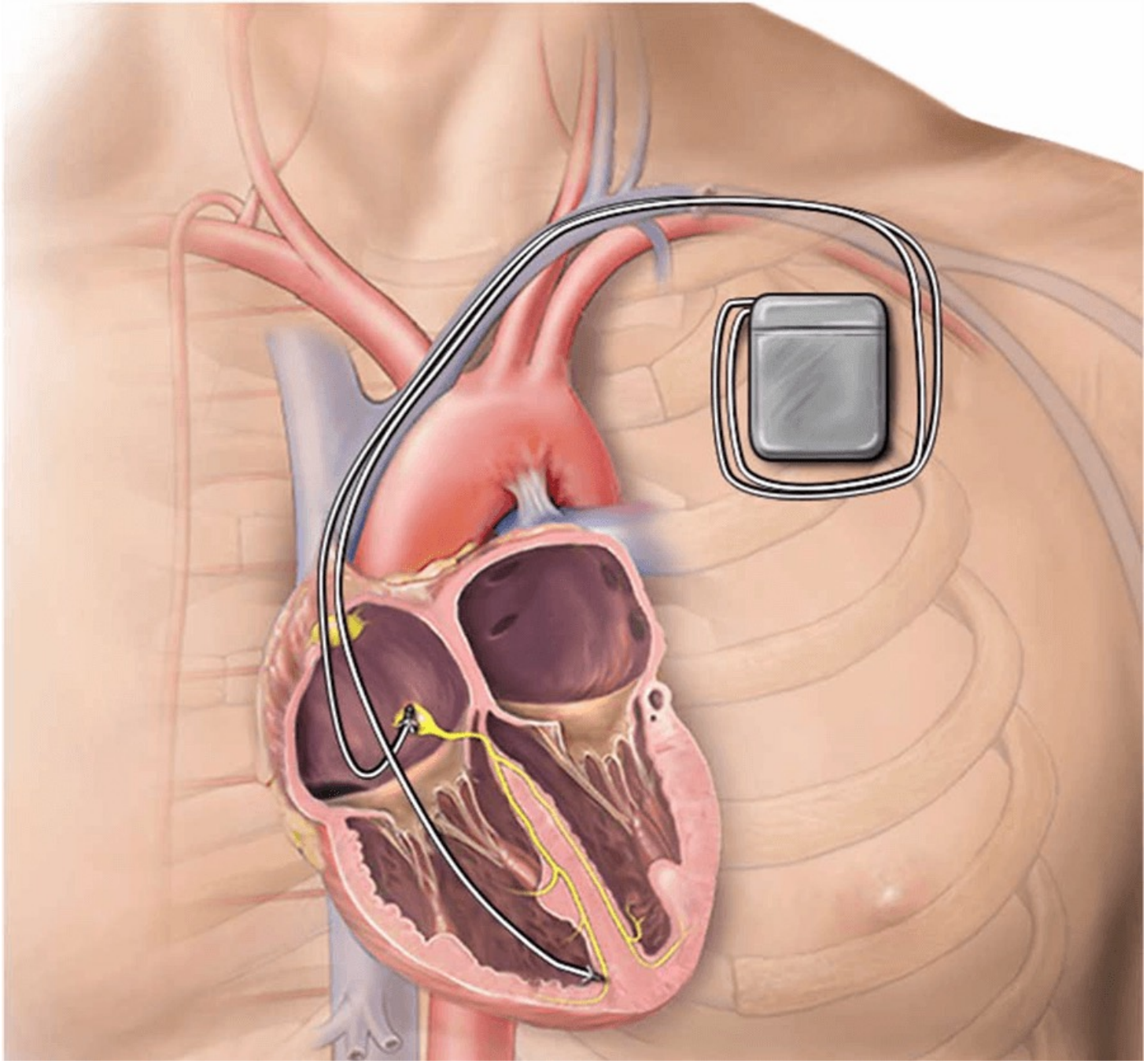
A fully automated AED detects the heart beat and instructs the user to stand back while the shock is delivered automatically.

Few types of AEDs have advanced features, like manual override or an ECG display.


IPAD
AED
1
2
ON/OFF
Automatic
Shock
iPAD
1
2
3
ON/OFF
PULL

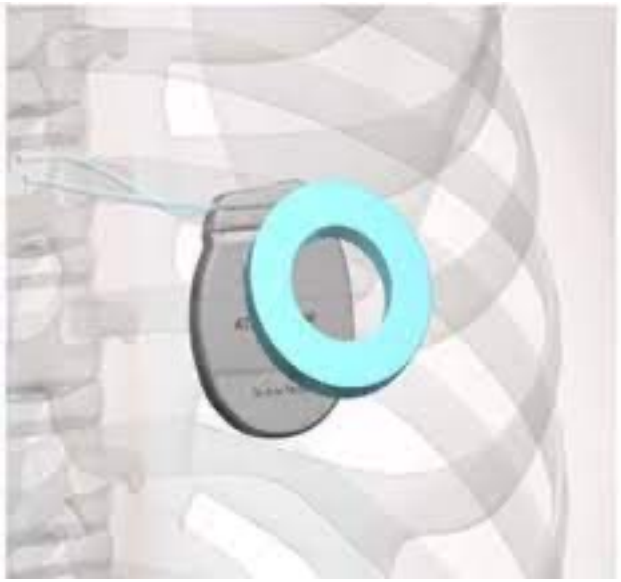
3. Cardioverter-Defibrillators

Automatic internal cardiac defibrillators (AICDs), also known as implantable cardioverter-defibrillators (ICDs), are pacemaker-like implants. According to the device's programming, they continuously monitor the patient's heart rhythm and automatically administer shocks for life-threatening arrhythmias.



- Many current equipment's can discriminate between VF, VT, and other arrhythmias that are more benign, such as SVT and atrial fibrillation.
- When ventricular fibrillation is life-threatening arrhythmia, the device is programmed to deliver an unsynchronized shock right away.

- the patient's ICD may fire frequently or incorrectly. This is a medical emergency since it depletes the device's battery life, gives the patient severe discomfort and worry, and in extreme situations, can even produce life- threatening arrhythmias.
- Some emergency medical personnel now have a ring magnet to place over the device, which essentially inhibits the device's shock function while still allowing the pacemaker to work (if the device is so equipped).
- EMS workers may deliver sedation if the gadget الأداة shocks regularly but adequately.



- A wearable defibrillator is a portable defibrillator which can be worn by risky patients. If VF or VT is identified, the equipment watches the patient 24 hours a day and can immediately deliver a biphasic shock. Patients who are not immediate candidates for ICDs should use this device.

Defibrillator Uses

- Cardiac resuscitation, defibrillation is frequently used (CPR).
- types of cardiac dysrhythmias: ventricular fibrillation (VF) and pulseless ventricular tachycardia, require defibrillation.
- Defibrillation is not recommended if the heart has fully stopped, as in:
- asystole
- or pulseless electrical activity (PEA).
- If the patient is conscious and has a pulse, defibrillation is not recommended

- Electrical shocks administered incorrectly can result in serious dysrhythmias such as ventricular fibrillation.
- Out-of-hospital cardiac arrest survival rates are low , often less than 10%.
- In- hospital cardiac arrests have a greater success rate of 20%.
- People with a shockable rhythm (such as VF or pulseless VT) had better survival rates of 21-50 % compared to people with a non-shockable rhythm (asystole or PEA).

- Defibrillation is used to treat ventricular arrhythmias that are immediately life- threatening, such as:
- Ventricular fibrillation

- Pulseless ventricular tachycardia

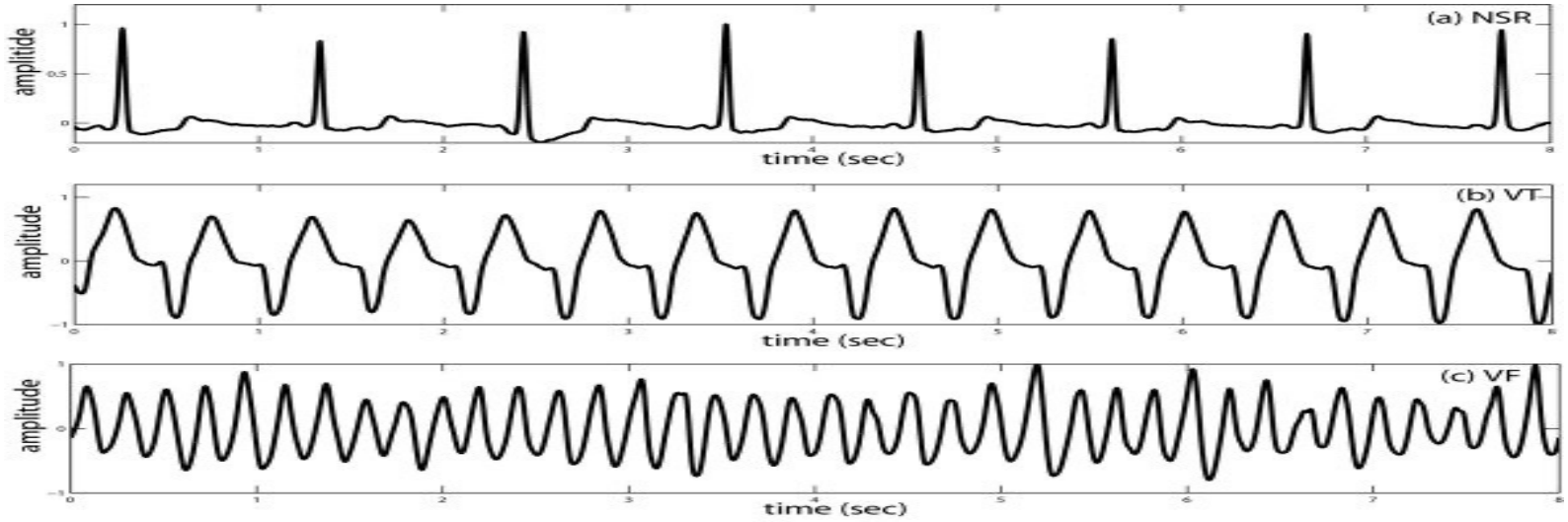
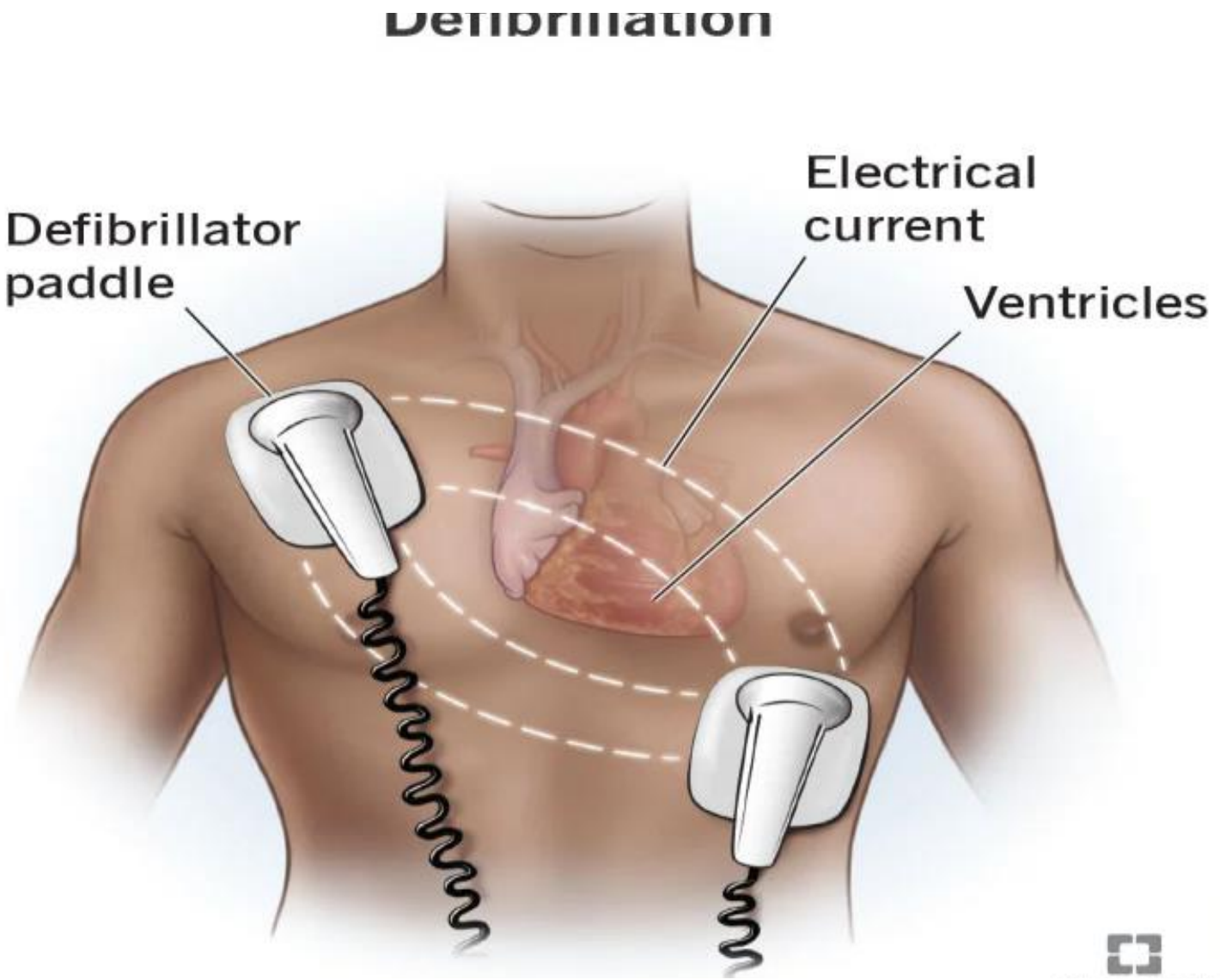


Figure 1

- 
Defibrillation
Defibrillator paddle
Electrical current
Ventricles

How is Defibrillation Performed?

The technique for defibrillation differs based on the type of device. following steps:

- begin CPR Until a defibrillator is available
- Two sticky defibrillator electrodes or paddles lubricated with special jelly will be applied upper right chest and lower left rib cage

The upper right chest and lower left back are two possible positions

Complications of Defibrillation

- Defibrillation comes with dangers and potential problems. Defibrillation's life- saving benefits significantly exceed the hazards.
- **Risks and potential complications:**
  - Burns on the skin
  - Myocardial necrosis (death of heart muscle tissue)
  - cardiac arrhythmias include
    - asystole
    - ventricular fibrillation following pulseless VT
    - other less dangerous arrhythmias.

Safety

- Oxygen concentrations as high as 60% have been measured in enclosed environments using oxygen-powered medical devices
- 24% oxygen X2 the rate of combustion احتراق
- 30% oxygen increases X10
- In an oxygen-enriched atmosphere, sparking from poorly applied defibrillator paddles in an oxygen-enriched environment can cause a fire.

How to decrease risk of fire

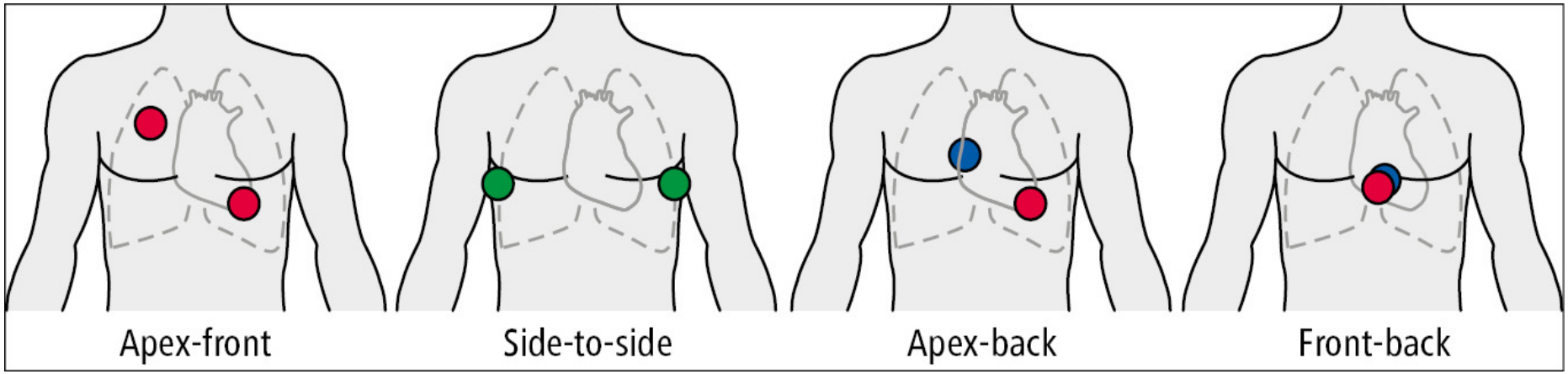
- Remove any oxygen mask or nasal cannula and place ≥ 1 m away from the patient's chest
- Disconnect any bag-valve device from the tracheal tube (or other airway adjunct), and remove it ≥ 1 m from the patient's chest during defibrillation.
- If the patient is connected to a ventilator, leave the ventilator tubing (breathing circuit) connected to the tracheal tube during defibrillation.

Application of defibrillation electrodes

- Self-adhesive defibrillation pads are generally replacing defibrillation paddles.
- They improve safety
  - avoiding the need to lean over the patient during defibrillation
  - provide better electrical contact with the skin compared with the flat metal plates of defibrillation paddles
  - minimizing the risk of electrical arcing and fire
  - Optimal electrode position is one that results in greatest current flow across the myocardium.
  - The standard position to achieve this is the sternal electrode placed to the right of the sternum, immediately below the clavicle and the apical paddle placed in the mid-axillary line level with the V6 ECG electrode position.

Acceptable alternative positions include:

- Bi-axillary.
- Anterior (left sternal edge): posterior (between the left clavicle and spine).
- Posterior (behind the right clavicle): apical



Clinical aspects of defibrillation

- successful defibrillation and neurologically-intact survival to hospital discharge is time critical,
- with every minute that passes between collapse and defibrillation resulting in an increase in mortality of 7–10%, this increase is slowed marginally in patients receiving bystander resuscitation.
- In order to reduce delays in defibrillation, the introduction of public access defibrillators in areas of high population density (e.g., airports, shopping centers, railways stations, etc.) has resulted in significantly improved survival rates, particularly in some urban areas. In more rural areas rapid activation of trained community responders is also contributing to early defibrillation.

CPR versus defibrillation

- as the initial treatment.
- early studies suggested that a period of (CPR) for 1–3 minutes prior to defibrillation increased the defibrillation success rate, subsequent larger studies failed to repeat these observations.

- It is now recommended that when treating both in- and out-of-hospital cardiac arrest, rescuers should provide good-quality CPR, while a defibrillator is quickly applied and charged, but routine Preshock CPR (e.g. 2 or 3 minutes) is no longer recommended.

One shock versus three shock sequence

- With first shock efficacy of biphasic waveforms exceeding 90%, failure to successfully defibrillate is more likely to suggest the need for a period of CPR, rather than a further shock.

- The previous recommendations for up to three shocks before resuming CPR have now been superseded by a single shock sequence.
- Only on the rare occasion of a monitored VF/non-pulsatile VT arrest, it is acceptable to deliver three stacked shocks using a manual defibrillator before commencing 2 minutes of external chest compression and ventilation if necessary.
- AEDs are all programmed to deliver a single shocks before recommencing the 2-minute CPR cycle.

Energy levels

- First shock efficacy of the BIPHASIC SHOCK using 150–200 J has been reported as 86–98%.
- the initial biphasic shock energy should be at least 150 J for all waveforms when defibrillating ventricular arrhythmias.
- Increase the dose reduces the number of shocks required to restore an organized rhythm compared with fixed-dose biphasic defibrillation.
- Both fixed or escalating strategies are acceptable, but when using a manual defibrillator, it is reasonable to increase the energy for subsequent shocks.
- The lower efficacy of the monophasic waveform means the initial and all subsequent monophasic shocks should be delivered at 360 J

- continue chest compressions whilst the defibrillator is charged.
- Immediate resumption of chest compressions following defibrillation is also emphasized, without pausing for a pulse check, which should only then take place after 2 minutes of CPR.
- Defibrillation should be achievable with an interruption in chest compressions of no more than 5 seconds.
- Survival rates decrease 7–10% with each minute that passes without defibrillation and an initial shockable rhythm of ventricular fibrillation (VF) will then deteriorate into pulseless electrical activity (PEA) and asystole.

Defibrillation in children

- Shockable rhythms occur in only 7–15% of pediatric and adolescent arrests with a much lower % than in adult cardiac arrest.
- Common causes of VF in these children include:
  - **Trauma**
  - **congenital heart disease**
  - **drug overdose**
  - **hypothermia.**
- pediatric self-adhesive pads with electrical attenuators should be used for children aged less than 8 years,
- but when these are not available, adult pads are acceptable, as long as there is no direct contact between the two electrodes.
- The recommended energy levels for both monophasic and biphasic defibrillation are **4 J/kg** for the initial and all subsequent shocks.


PAD

1- **The recommended energy levels for both monophasic and biphasic defibrillation in pediatric are**

a) 2jouls/kg

b) 4 joules/kg c) 6jouls/kg

d) 8jouls/kg

e) 10 joules/kg

2- The level of biphasic shock for defibrillating ventricular arrhythmias are

a) 150-200J

b) 200-300 J

c) 360 J

d) More than 360 J e) Less than 150 J

3- All the following are types of defibrillators except one

a) Automatic internal cardiac defibrillators

b) Automated external defibrillator

c) Implantablecardioverterdefibrator

d) Wearable defibrillator

e) Ventricular defibrillator

4- the precautions during defibrillation

a) Remove any oxygen mask or nasal cannula

b) Leave any bag-valve device connected to a tracheal tube

c) Leave any bag-valve device connected to laryngeal mask airway

d) If the patient is connected to a ventilator, leave the ventilator tubing

(breathing circuit) connected to the tracheal tube during defibrillation

e) All the above

5- Optimal electrode position during defibrillation is

a) the apical electrode placed to the right of the sternum, immediately below the clavicle and the apical paddle placed in the mid-axillary line.

b) the sternal electrode placed to the right of the sternum, immediately below the clavicle and the apical paddle placed in the mid-axillary line

c) the sternal electrode placed to the right of the sternum, immediately below the clavicle and the apical paddle placed in the mid-clavicular line

d) the sternal electrode placed to the left of the sternum, immediately below the clavicle and the apical paddle placed in the mid-axillary line

e) the sternal electrode placed to the right of the sternum, immediately above the clavicle and the apical paddle placed in the mid-axillary line