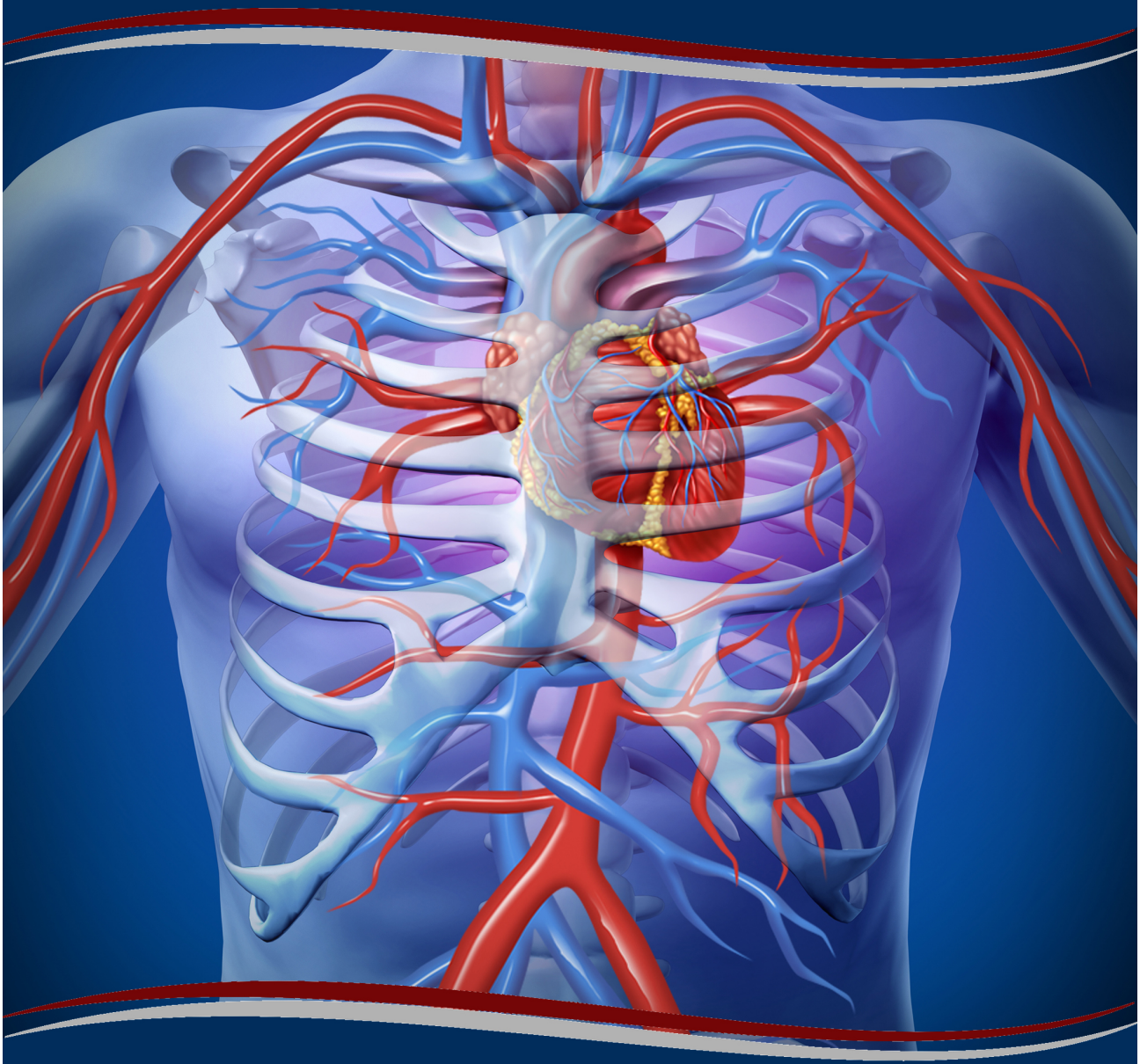
ADVANCED CARDIOVASCULAR LIFE SUPPORT

HANDBOOK



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Advanced Cardiovascular Life Support

Handbook

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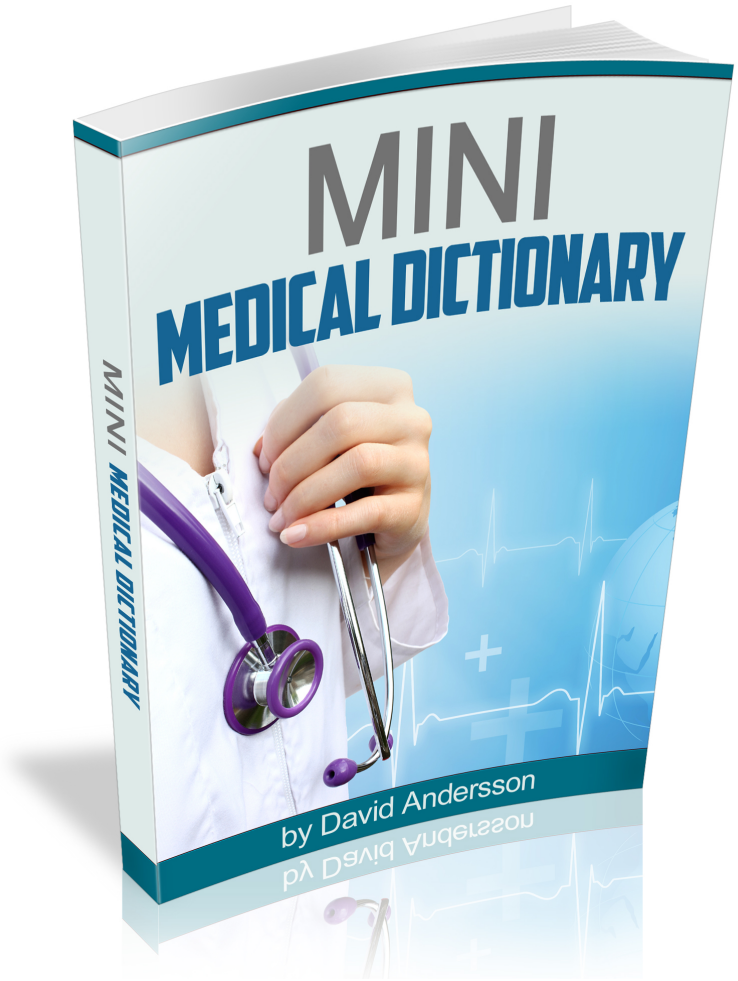

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Introduction

This is a book that will serve as reference when you need to verify something or if you are just learning the 2016 guidelines for ACLS (Advanced Cardiovascular Life Support).

This handbook contains helpful information about cardiac emergencies and other special resuscitation situations.

You will be given step-by-step guides on how to perform certain processes.

Provided also are useful information about medications, administration, and point of entry.

You'll learn basic ACLS techniques that will be helpful whether you are a professional responder or just starting up in training.

Chapter 1: Introduction to Emergency Cardiac Care

Coronary Artery Disease

Coronary Artery Disease (CAD) is the medical term for plaque buildup in the arteries of the heart. This result to a limited blood flow to the heart, a condition referred to as ischemia.

Risk Factors

Risk factors that cannot be changed:

- Age – Men over 45 years of age and women who are more than 50 years old are at risk.
- Family history of heart disease – Children who have parents with heart disease are highly likely to develop the condition themselves.
- Race – Mexican American, native Hawaiians, American Indians, and Asian Americans have been found out to be more at risk to developing heart disease than others.

Risk factors that can be addressed, controlled, or treated:

- Cigarette smoking – Smokers and secondhand smokers are at high risk.
- Increased levels of blood cholesterol – High levels of blood cholesterol may lead to coronary artery disease and other heart conditions.
- High blood pressure – The heart works double time when one is suffering from high blood pressure. When this happens, the muscles of the heart thicken and stiffen. This increases the likelihood of heart attack, stroke, congestive heart failure, and kidney failure.
- Physical inactivity – Being physically active helps control blood cholesterol levels, diabetes, prevents obesity, and helps control blood pressure.
- Obesity and diet and nutrition
- Diabetes mellitus

- Stress and depression – How an individual respond when stressed and depressed, may contribute to developing a coronary artery disease and other heart ailments.
- Alcohol – Increased alcohol levels may result in increased high blood pressure.

Sudden Cardiac Death (SCD)

SCD, the most common cause of natural death in the U.S., is an unexpected death resulting from a loss of heart function. It occurs more frequently in adults who are in their mid-30s to mid-40s. It affects men two times more than it does with women. It is rare in children.

Sudden cardiac arrest is not a heart attack. With heart attack, there is a blockage in one or more coronary arteries, limiting blood supply to the heart. If oxygen-rich blood does not reach the heart muscle, the heart won't function.

On the other hand, with sudden cardiac arrest the electrical system to the heart does not function the way it is expected to, resulting to irregular heartbeats. Blood may not be delivered to the body because of ventricular fibrillation. If blood does not reach the brain, it may lead to loss of consciousness and death follows immediately, if not given medical attention right away.

Chain of Survival

The American Heart Association, in a publication in 1991, identified early defibrillation and basic CPR as two important tools in saving the life of an emergency patient.

AHA's Chain of Survival states that critical actions are needed in dealing with life-threatening emergencies, such as cardiac arrest, heart attack, stroke, and foreign body airway obstruction.

The links include:

- Immediate access to emergency response system.

  It includes early recognition of the emergency and early notification of emergency rescue team via 911 calls.

- Early administration of CPR to support circulation to the heart and brain until the normal activity is restored.

  A set of actions performed in sequence to assess and support the patient's airway, breathing, and circulation.

- Early defibrillation.

  This is the delivery of electric shock to the heart to restore its normal rhythm.

- Early advanced cardiovascular support.

  This refers to the response of highly trained paramedics who can efficiently attend to the patient's needs, administer drugs accordingly, perform advanced airway procedures, and other protocols, prior to the patient's arrival at the hospital.

BLS – Basic Life Support

Providers of BLS should be able to intervene early, in order to prevent possible death.

- Chain of survival should be initiated as soon as condition is established.
- Initiate immediate chest compression on the patient.
- Give early defibrillation using an Automated External Defibrillator or AED, when available.
- Initiate rescue breathing.
- Perform BLS.
- Relieve choking episode.

Initiating a Chain of Survival (Adults)

For adult patients, it is critical that the Chain of Survival for cardiac arrest is quickly initiated and performed.

In-hospital Chain of Survival:

1. Surveillance and prevention

2. Recognizing the occurrence of cardiac arrest. Activating the Emergency Response System.
3. Immediate administration of high quality CPR.
4. Rapid defibrillation.
5. Advanced life support and post cardiac care.

Outside of hospital Chain of Survival

1. Recognizing cardiac arrest and activating Emergency Response System.
2. Immediate administration of CPR.
3. Rapid defibrillation.
4. Giving of basic and advanced EMS.
5. Advanced life support and after hospital care.

BLS Guidelines

EMS Activation	Call for help right away, at the same time, assess the patient's condition – pulse and breathing. If alone, without a mobile phone: Leave the patient to activate EMS and get AED before administering CPR. Alone with mobile phone: Activate EMS first. With co-rescuers: Split duties, 1 or 2 people should start CPR, while the other 1 or 2 people activate EMS, then get AED.
Sequence	CAB sequence – Compressions, Airway, Breathing The first 30 chest compressions should not be delayed.
Compression Depth	Infants to children (before puberty): Compress the chest up to just 1/3 of the chest diameter. Puberty/adolescence/adult: Compression depth is between 2 and 2.4 inches, or 5 to 6 cm.
Compression Frequency	Not less than 100, but not over 120

Chest Recoil	Let the chest to fully recoil between compressions. Make sure not to lean on the chest in between compressions. Let the heart to be fully filled with blood.
Compression-Only CPR	Untrained rescuers can provide chest compressions until the EMS or a trained provider arrives (or until the patient begins to move).
Naloxone	Trained providers and EMS will provide intramuscular or intranasal naloxone to the patient, in the case of known or suspected opioid overdose. Observe if there is abnormal or no breathing at all, no response, but with pulse.
Shock or CPR?	Immediately use an AED in case of a cardiac arrest, if available. If not readily available, give chest compressions until AED becomes available.
Chain of Survival	In-hospital and out-of-hospital Chain of Survival for Adult Cardiac Arrest differ. The initial providers and lay rescuers should provide immediate care, then transfer to the code team or EMS team, respectively.

Table 1: BLS Guidelines

Important Notes:

- Beginning compressions immediately increase the chance of survival, hence, the "CAB" sequence should still be done.
- Immediate and high quality CPR is of extreme importance.
- CPR basics:
    - Compressions should be between 100 and 120 per minute.
    - Never interrupt compressions, except when it's time to use AED or changing providers.
    - Interruptions should not exceed 10 seconds at a time.
    - Chest compressions should be at least 60% of the rescue time.
    - Deliver each breath over 1 second.
    - Avoid rapid ventilations to prevent over-inflation.
    - CPR should be performed as a team, to make it more efficient.

    - When advanced airway is being done, ventilate at 1 breath per 6 seconds or 10 breaths per minute.
- Feel for the patient's pulse no longer than 10 seconds:
    - For adults and adolescents, use the carotid artery in the neck.
    - For children, the femoral artery in the inner thigh is preferred.
    - For infants, use the brachial artery found in the upper arm.

Post-Cardiac Arrest Care

The treatment of the patient should continue after resuscitation, to ensure complete recovery. Post-cardiac arrest care includes:

1. Verification of the ROSC (Return of Spontaneous Circulation).
2. Manage the airway. If there is an advanced airway, provide breath every 5 seconds. With the use of quantitative waveform capnography, titrate the oxygen. This helps maintain a PETCO2 of 35-40mm Hg. If you have no access to a waveform capnography machine, titrate oxygen in order to keep the patient's oxygen saturation to between 94% and 99%.
3. Insert IV medication. Blood pressure should be above 90mm Hg and/or a mean arterial pressure of 65 mm Hg. Prevent hypotension. If there is low blood pressure, consider any of these:
    - Administer 1-2 liters saline or Ringer's lactate IV fluid.
    - Begin with epinephrine IV infusion to maintain systolic pressure of >90 mm Hg.
    - Begin with dopamine IV infusion.
    - Give norepinephrine for extremely low blood pressure.
4. Perform evaluation of the H's and T's for treatable causes. (See Table 2).
5. Track the patient's mental status. If there is a decrease of consciousness after resuscitation, consider hypothermia.
6. TTM (targeted temperature management) should be done in all comatose patients (adults) who have ROSC after a cardiac arrest episode. The target is

between 32°C and 36°C for 24 hours, the least. Onset of fever should be prevented after patients in TTM return to normal temperature. For patients of outside-of-hospital cardiac arrest, they should not be cooled before reading the ED.

7. Get a 12-lead ECG to see if the patient suffered an ST segment elevation myocardial infarction or STEMI or non-ST segment elevation myocardial infarction (NESTMI).
8. For suspected STEMI or AMI, consider giving percutaneous coronary intervention (PCI) to open up the coronary arteries.

Treatable Causes of Cardiac Emergencies

Potential Cause	Identification	Treatments
Hypovolemia	Rapid heart rate Narrow QRS from ECG	Infuse normal saline or Ringer's lactate.
Hypoxia	Slow heart rate	Airway management and oxygenation.
Acidosis (Hydrogen ion excess)	Low amplitude from QRS	Hyperventilation May consider sodium bicarbonate bolus
Hypoglycemia	Glucose testing	IV bolus of dextrose
Hypokalemia	Flat T waves and a U wave from ECG	IV magnesium infusion
Hyperkalemia	Peaked T waves and wide QRS complex from ECG	May consider calcium chloride, sodium bicarbonate, and insulin and glucose protocol
Tension pneumothorax	Slow heart rate Narrow QRS complexes from ECG Difficulty breathing	Thoracostomy or needle decompression

Tamponadep-cardiac	Rapid heart rate Narrow QRS complexes from ECG	Pericardiocentesis
Toxins	Prolonged QT interval from ECG Look for neurological symptoms	Treatment depends on the toxin found
Pulmonary embolus (Thrombosis)	Rapid heart rate QRS complexes from ECG	Surgical embolectomy Administer fibrinolytics
Myocardial infarction (Thrombosis)	Shows abnormal results in ECG, depending on where the infarction is	Treatment will be based on the extent of condition and the age

Table 2: Treatable Causes of Cardiac Emergencies

Chapter 2 Airway Management and Ventilation

Airway Management is a set of medical procedures done on patients to prevent obstruction of the airway, to create or maintain an open spot between the patient's lungs and the atmosphere. It is important to establish and maintain a clear airway, while ensuring immediate oxygenation and ventilation. Oxygen supply is vital to the human body. If the normal process of the Respiratory System (bringing in oxygen and eliminating carbon dioxide) is interrupted, it will result in vital organs failure.

Major considerations:

- Early detection
- Immediate and effective intervention
- Continuous assessment

Here are the basic things that you need to know to ensure efficient airway management:

- Open and maintain a clear airway
- Immediately identify and treat obstructions
- Assess oxygenation status and ventilation
- Administer oxygen
- Give proper ventilator assistance

Common Obstructions

In the upper airway:

- Tongue – The tongue could fall backwards, closing off the patient's airway.

  Partial obstruction: snoring respirations

  Complete obstruction: no respirations

- Foreign material – Typically, the middle-aged and older people are affected, particularly those who have dentures.

  Signs: gagging, choking, dyspnea, aphonia/dysphonia, and stridor

- Soft tissue edema
- Vomit
- Blood

In the larynx:

- Laryngospasm – Spasmodic closure of the patient's vocal cords, causing complete closure of the airway. Possible causes could be intubation trauma and extubation.
- Foreign material
- Edema – The opening to the glottis becomes limited or totally closes.

In the lower airway:

- Edema
- Blood
- Secretions
- Aspiration – Aside from blocking the airway, it can also cause damage to the bronchiolar tissue, bringing pathogens to the lungs, and minimizing the ability to ventilate.
- Bronchospasms

How to identify:

- Look for movements on the chest or abdominal areas.
- Listen through the mouth and nose for sign of breathing, like snoring or gurgling.
- Feel for expired air through the mouth and nose.

How to open the airway:

- Tilt the head
- Lift the chin
- Thrust the jaw

Oxygen Administration

Oxygen should be given when you have the following scenarios:

- Gas exchange impairment
- Heart failure
- Interruption ventilation in the lungs

The following are the needed specifications:

- Concentration
- Delivery method
- Amount, in liter per minute

Oxygen Delivery System

Device	Characteristic	Concentration	LPM (Liters Per Minute)
Nasal Cannula	Low flow rates	24 – 50%	2 – 6 LPM
Basic Face Mask		40 – 60%	5 – 8 LPM
Air-entrainment Mask (Venturi Mask)	Color-coded jet adapters	Blue: 24% Green: 35% At trachea: 24 – 50%	4 – 10 LPM 8 LPM 6 – 10 LPM
Partial Re-breathing Mask	Comes with reservoir bag	60 – 90%	6 – 10 LPM
Non-rebreather Mask (Reservoir Mask)	Provides the highest oxygen concentration	Almost 100%	8 – 10 LPM (can be higher)
Face Tent		30 – 50%	4 – 8 LPM or higher

Table 3: Oxygen Delivery System

Manual Airway Maneuvers

The lungs receive air through the trachea. In cases where airway is compromised, any obstruction has to be removed.

Putting the Patient in the Right Position

If you found an unresponsive patient in a prone position, move him to a supine position. Assess the patient's breathing. If he is breathing adequately and does not have any injury, put him to recovery position.

If you get a pulse on an unresponsive patient, but not breathing, open the airway. Move the patient's head to propel the tongue forward to help you open the airway.

Head Tilt-Chin Life Maneuver

Indications:

- Patient is unresponsive
- Unable to protect the airway
- No injury to the spine

Contraindications:

- Patient is responsive
- Possible injury to the spine

Jaw-Thrust Maneuver

Indications:

- Patient is unresponsive
- Possible injury to the spine
- Cannot protect the airway

Contraindications:

- Resistance when opening the mouth

Tongue-Jaw Lift Maneuver

The method of choice for:

- Suctioning
- Inserting an oropharyngeal airway

Ventilatory Support

A patient who is not breathing will need artificial ventilation and supplemental oxygen. Look for these signs:

- Insufficient minute volume
- Altered mental status

Normal Ventilation and Positive-Pressure Ventilation

	Normal Ventilation	**Positive-Pressure Ventilation**
Air Movement	As the diaphragm contracts, there is negative intrathoracic pressure, allowing the lungs to receive air.	Through mechanical ventilation, air is forced into the lungs.
Blood Movement	Allows for normal breathing, while initiating blood flow into the heart.	As the intrathoracic pressure heightens, blood is not adequately pulled back into the heart. As a result, there is a marked decrease in the amount of blood that the heart pumps.
Airway Wall Pressure	No effect	Volume should be increased to get the same effects as with normal breathing. When this happens, the walls are forced out of the normal anatomic shape.

Esophageal Opening Pressure	No effect	Air goes into the stomach, resulting in gastric distention, that may lead to aspiration and vomiting.
Over Ventilation	Not typical of normal breathing	This forces volume and rates, leading to increasing intrathoracic pressure, decreased cardiac input or hypertension, and gastric distention.

Table 4: Normal Ventilation Vs. Positive-Pressure Ventilation

Mouth-to-Mask Ventilation

If there is no sign of breathing, artificial ventilation has to be administered right away. Artificial methods include mouth-to-mask ventilation, bag-mask device ventilation, and manually triggered ventilation device.

If you are performing one-rescuer CPR, the patient should be given rescue breaths with the use of a mask.

How to do it:

1. Perform 30 counts of chest compressions, about 2 – 2.4 inches (or 5 – 6 cm) deep, at 100 – 120 per minute.
2. Form a "C-E" shape with your hand, while pressing down on the top and bottom edges of the mask, this will seal the mask against the patient's face. *Note: Your thumb and index finger should form the "C" while the remaining fingers will form the "E".*
3. If you have established that the patient has no neck injury, open the airway by using the head tilt/chin lift technique. If there is a suspected neck injury, use the jaw thrust technique to open the airway.
4. Give the patient 2 slow, deep breaths, over 1 second each.
5. Observe for movements on the victim's chest.

Bag-Mask Ventilation

The bag-mask device can supply nearly 100% oxygen to the patient. The total amount of gas in every adult bag-mask device is at 1,200 to 1,600 ml. The amount of oxygen that will be provided will be based on the visible movements on the patient's chest.

Components:

- A self-inflating, disposable bag
- No pop-off (capability to disable) valve
- Non-breathing outlet valve
- Oxygen reservoir
- One-way inlet valve system
- A transparent face mask

How to do it:

1. Position yourself just above the patient's head, kneeling.
2. Carefully position the neck in a hyperextended position. If there is injury on the neck, find another position.
3. Place the bag-mask on the face of the patient.
4. Bring the lower jaw up, to the mask.
5. Connect the bag to the mask.
6. Firmly hold the mask in place, while another provider squeezes the bag until there is a visible rise and fall movements on the chest. Squeeze every 5 to 6 seconds (adults), 3 to 5 seconds (children, infants).
7. If you are performing this alone, carefully hold your index finger over the lower part of the mask, while placing your thumb over the upper part.
8. It is important to observe for changes in compliance, changes in status, and gastric distention.
9. Squeeze the bag as the patient's breathing is restored. Make careful adjustments on the rate and tidal volume.

Notes:

Not recommended when the following conditions are present:

- The patient's chest does not rise or fall, despite introducing air.
- The rate of ventilation is either too slow or too fast.
- Patient's pulse rate does not improve.

In cases where the patient's chest does not rise and fall, do the following:

- Reposition patient's head or insert an airway.
- If you notice that the stomach is rising and falling, reposition the patient's head.
- If too much air is escaping, simply reposition the mask.

If the patient still does not show signs of breathing, check if there are obstructions in the airway.

There are two identified airways, oropharyngeal and nasal.

Oropharyngeal Airway

OPA or oropharyngeal airway should only be used for unresponsive (unconscious) patients. If inserted to partially or completely conscious patient, it can cause the patient to gag or vomit. You have to choose the right airway size so as to avoid throat injury and airway obstruction.

OPA Device

- Hard, curved plastic device
- Easily fits at the back of the tongue

How to do it:

1. Position the patient on his back.
2. With your thumb and index finger (one hand only), insert them into the mouth of the patient – against the patient's upper and lower teeth.
3. Mimicking the motions of a pair of scissors, let your fingers separate the teeth of the victim, until the mouth opens.
4. You can now insert the tip of the device into the victim's mouth, just on top of the tongue.

5. When you have established that the tip has reached the back of the tongue, just beyond the soft palate, do a rotating motion, so that the tip of the airway ends up pointing towards the patient's throat.
6. Continue inserting the airway until the flared flange is positioned against the patient's lips.
7. In case the OPA is the right size, and proper insertion was done, the tongue of the patient should not slide to the back of his throat.
8. Once the patient regains consciousness, you can remove the OPA device.

Nasopharyngeal Airway

NPA or nasopharyngeal airway is administered to a patient who is conscious or unconscious. However, it should not be used on patients with skull or facial fracture.

How to do it:

1. It is important to measure the NPA device. Compare the airway's diameter with the size of the patient's nostril.
2. The right length of the NPA can be assessed by holding the airway side by side with the patient's face. The appropriate length will be from the patient's ear lobe up to the tip of the nose.
3. Before inserting the NPA, make sure to lubricate using a water-soluble lubricant.
4. Once properly lubricated, carefully insert the NPA into the patient's largest nostril. If there is resistance during the insertion, slightly rotate the airway, or you can try to insert through the other nostril.

Esophageal Tracheal Combitube

The Combitube is a 2-barreled tube, inserted into the trachea or the esophagus. It helps secure the airway, to allow better ventilation.

Indications:

- Respiratory or cardiac arrest
- Trauma patients

- Unresponsive patients
- For ALS, intubation is not possible
- Used only for patients who are between 5 and 7 feet tall

Contraindications:

- Intact gag reflex
- Patients less than 5 feet tall
- Esophageal trauma
- Pathologic condition of the esophagus
- Ingestion of caustic substance
- Alcoholism

Possible Complications When Used:

- Displacement into the esophagus could be undetected
- Hypoventilation
- Vomiting
- Laryngospasm
- Possibility of developing esophageal or pharyngeal trauma
- Might encounter difficulty in ventilation if the pharyngeal balloon forces the epiglottis into the glottic opening

How to do it:

- A Combitube kit includes:
    - 1 single tune with 2 lumens
    - 2 balloons
    - 2 ventilation attachments
- Make sure to check and prepare the equipment prior to insertion.
- The patient's head should be in neutral position. Insert your thumb into the patient's mouth, then lift the jaw.

- Insert the Combitube until the incisors are in the middle of the 2 black lines.
- The 2 halves should be inflated one after the other.
- Once both balloons are completely inflated, start to ventilate. The longer tube (blue) should be first.
- Observe for the movements on the chest and auscultate. If you hear no sounds, switch to the shorter tube (clear).
- Monitor ventilation.

Laryngeal Mask Airway

Laryngeal Mask Airway (LMA) is a supgraglottic device, which was initially intended to be used in the operating room to provide elective ventilation. It is now used as an alternative method for tracheal intubation, one that does not need visuals. LMA is reusable, safe, and efficient. It does not need neck motion and can be used even when the patient is conscious, but topical anesthesia is needed.

It does not require ET intubation. It efficiently surrounds the opening of the larynx with an inflatable cuff, which fits into the airway contours, ensuring air tight fit.

Indications and Contraindications:

- An effective alternative to bag-mask airway.
- Not as effective in obese patients.
- Not recommended for pregnant women and patients suffering from hiatal hernia because of the risk of regurgitation.
- Proven ineffective for patients who require high pulmonary pressures.

Advantages:

- No need for laryngoscopy
- Provides better ventilation
- Patient is not at high risk for trauma
- No need to constantly check on the mask seal
- Protected from secretions

Disadvantages:

- Not a primary airway during emergencies
- Possibility for air to be insufflated to the stomach
- Prone to aspiration

Possible Complications:

- Associated with aspiration and regurgitation
- Hypoventilation (particularly for patients requiring high ventilation pressures)
- Swelling in the upper airway, a possibility

Equipment:

- There are 7 different sizes, depending on the weight of the patient
- Consists of a tube and inflatable mask cuff
- There are 2 bars in the opening to prevent occlusion
- The proximal end has a standard adapter
- One-way valve assembly cuff
- Size 3 or 4 LMA is appropriate for a 6.0mm ET tube

How to use it:

1. Begin by choosing an appropriate size to use: small adult – size 3; normal to larger adult – size 4; large adult – size 5. Choose a standard ET tube (8.0 or less). Prepare hot water on a small basin and place the ET tube to soften it.
2. Make sure you put the ventral surface of the LMA on a flat surface. Begin aspirating the cuff using a 20 cc syringe. This would flatten and bend away from the ventral surface. Put lubricant on mask's posterior surface.
3. You have to hold the LMA by its metal handle. Open the mouth of the patient, and slide the mask, maintaining that the posterior surface is secured on the hard palate. Continue until the mask is locked in the esophagus. This position allows the ventral surface to face the glottis opening. Inflate the cuff with enough air to create a seal.

4. Start with the ventilation. You might need to make a small adjustment to ensure the right fit on the patient. Continue until the patient is ready for endotracheal intubation.
5. When it is time to intubate, choose the polyvinyl chloride (PVC) ET tube that you placed in the basin with hot water. Put lubricant to the tube, and then insert into the LMA. Its normal curvature should be reversed as the tube goes through the LMA. Insert the tube accordingly, and inflate the cuff. Resume with the ventilation process. Always check for position.

   If the tube encounters excessive resistance, lift the LMA toward the ceiling or you can try shaking or rocking it, then retry insertion. If it fails a second time, insert the straight end of the ET tube introducer (ETI) through the LMA device. If you can feel the trachea rings, it means the trachea has been cannulated. Deflate the cuff and remove from the ETI. Intubate over the ETI as usual.
6. When removing the LMA, deflate the cuff and remove the adaptor from ET tube. There is an obturator that comes with the LMA. Use this to keep the tube at its appropriate depth while removing the LMA.

   The pilot balloon of the ET tube will eventually reach the LMA. You can now remove the extender. Grasp the tube at the mouth, as soon as it is possible. You can now remove the LMA entirely, reattach the 15 mm adaptor, and then resume ventilations.

Tracheal Intubation

Tracheal intubation is the placement of a plastic tube into the patient's trachea (also known as the windpipe) to help maintain a clear airway or to serve as a vessel through which certain medications are administered.

Indications:

- Patient is critically injured
- Respiratory failure
- Respiratory arrest
- Anesthetized patients
- Airway obstruction

- For prolonged ventilatory support
- Inhalation injury with edema of the vocal cords
- Pulmonary confusion
- Protection from aspiration

Intubation is an emergency procedure performed on people who have difficulty breathing on their own. It helps maintain an open airway to facilitate ventilation of the lungs and prevents suffocation. The endotracheal tube is used. It is sealed with a cuff inflated against the tracheal wall:

- Nasotracheal intubation – passes through the nose
- Orotracheal intubation – passes through the mouth

Advantages:

- Helps secure a clear airway
- Protects against aspiration
- A good alternative to IV

Disadvantages:

- Needs a special equipment
- Physiological functions are bypassed

Possible Complications:

- Hypoxia
- Bleeding
- Laryngospasm
- Swelling of the larynx
- Barotrauma
- Mucosal necrosis
- May cause damage to the vocal cord

Endotracheal Tubes

1. The basics are:
    - Tube
    - Proximal end
    - Cuff and pilot balloon
    - Distal tip

2. Sizes:
    - Inside diameter – 2.5 – 9.0 mm
    - Length – 12 – 32 cm
3. For pediatric patients:
    - Tubes used are sizes 2.5 to 4.5 mm.
    - The funnel-shaped cricoid ring forms a seal with the ET tube.
    - In most tubes, a distal cuff is no longer necessary.
    - Always be ready with at least 3 sizes.
    - The internal diameter of the patient's nostril will determine the diameter of the glottic opening you will choose.
    - The diameter of the patient's little finger or the size of the thumbnail is related to the airway size.

Procedure:

1. The anesthesiologist opens the mouth of the patient, separating the lips, then pulling on the upper jaw using the index finger. With the laryngoscope in his hand, a blade will be inserted into the patient's right tonsil. *Note:* General anesthesia is administered prior to intubation.
2. The laryngoscope will be swept midline, while keeping the tongue on the left, to make the epiglottis visible. The laryngoscope will advance, until the vocal cords are seen.
3. The other team member will press the trachea to better view the larynx.

4. The anesthesiologist will then insert the endotracheal tube through the mouth. The tube will be placed through the vocal cords, until the cuff rests below the cords.
5. The cuff will be inflated.
6. The anesthesiologist will listen to the breathing sounds, making sure the endotracheal tube is positioned correctly.

Verification of Tracheal Tube Placement

It is imperative to confirm that the endotracheal tube was correctly placed, in both hospital and out-of-hospital settings. This prevents putting the patient at risk of aspiration or hypoxemia.

There are a variety of techniques to use to confirm its proper placement. Having visuals on the tube passing through the vocal cords is still the optimal method, but it is not always possible. Physical examinations, like auscultation of the lungs and epigastrum, fogging of the endotracheal tube, and visualization of bilateral chest rise, can be done.

Techniques:

Repeat direct laryngoscopy may be done. Though, this is invasive and impractical since it may need a repeat dosing of sedatives.

Qualitative and quantitative end-tidal carbon dioxide detection are better options. Qualitative end-tidal carbon dioxide method is good for initial assessment of the position of the tube. But a quantitative assessment and continuous carbon dioxide detection is better in ensuring continuous location monitoring. This is a simple technique. It just needs a capnography device that is connected to the ventilator.

For a patient that has good circulation and perfusion, it is easier to detect if the tube was misplaced or dislodged. If a lack of end-tidal carbon dioxide delivery is detected, then the tube was misplaced.

For patients with poor circulation and perfusion, like for those who are in cardiac arrest, detection of misplacement might be difficult. Alternative detection techniques might be needed. Esophageal detector devices may be used.

There might be erroneous findings in obese patients and those with copious pulmonary secretions.

Chapter 3 Heart Rhythm Recognition

The normal heart rate is 60 to 100 bpm (beats per minute). The table below shows the comparison among the different kinds of rhythm of the heart:

Name	Characteristics	Rhythm	Rate
Normal Sinus Rhythm	Originates in the SA node Follows conduction pathways	Regular	60 – 100 bpm
Sinus Bradycardia	Originates in the SA node Slower rate due to excessive vagal tone or sympathetic input. Indications: Inferior myocardial infarction, drug reactions, hypoxia, hypothermia. Asymptomatic patient	Too slow	<60 bpm
Sinus Tachycardia	Originates in the SA node Rapid rhythm occurs when there is high oxygen demand Indications: During exercise, hypoxia, hypovolemia, infection, myocardial infarction	Regular / Fast	>100 bpm
Premature Atrial Complex (PAC)	Originates in the atria Occurs before the beat is expected Could occur even in a healthy heart Indications: fever, anxiety, drug reactions, caffeine and other stimulants, increased sympathetic input, drug interactions, cardiac ischemia, AMI, valvular heart disease	Irregular with PACs	Depends on the rhythm

Atrial Fibrillation	The most common cardiac arrhythmia. Indications: ischemia, hypertension, mitral valve and pericardial disease, myocardial infarction, aging Increased risk for developing systemic embolism and atrial thrombus	Irregularly irregular	Slow or fast
Atrial Flutter	Characterized by "saw tooth" activity Indications: hypoxia, valve disease, intrinsic cardiac disease, COPD, pericarditis	Too fast	Atrial rate 250 – 400 (generally 300 bpm)
Supraventricular Tachycardia / Atrial Tachycardia	There are different types of SVT/ AT based on the site of reentry (originates above the ventricle)	Regular / Fast	150 – 250 bpm
Junctional Rhythm	This is an escape rhythm, serving as protective mechanism when higher centers of the conduction system fail. Indications: increased vagal tone, digitalis toxicity, hypoxemia	Slow/Regular	40 – 60 bpm
Premature Junction Complex (PJC)	Originates in the atrioventricular junction Indications: hypoxemia, ischemia, valvular disease, digitalis	Irregular with PJCs	Depends on the rhythm
First Degree AV Block	A constant and prolonged PR interval Indications: hypoxemia, myocardial infarction, beta blockers, increased vagal tone, digitalis toxicity, calcium channel blockers, aging	Regular	

Second Degree AV Block Mobitz I (Wenkebach)	Characterized by progressive delay at the AV node, until impulse is blocked completely Indications: myocardial infarction, hypoxemia, ischemia, digitalis toxicity, increased vagal tone	Regular	
Second Degree AV Block, Mobitz II	A slow ventricle rate results in decreased cardiac output May progress to third degree Indications: myocardial infarction, progressive CAD, degenerative changes in conduction, AMI	Irregular	
Third Degree Heart Block	No conduction through the AV node, referred to as "divorced heart". The atrial and ventricular rate and rhythm do not influence each other.	Regular rate for both atrial and ventricular	Atrial: 60 – 100 bpm Ventricular: 40 – 60 bpm
Premature Ventricular Contraction (PVC)	May be isolated or may occur in pairs or clusters. Indications: electrical irritability	Regular	
Ventricular Tachycardia	There are 3 or more beats which originates in the ventricle.	Regular/ irregular	100 – 250 bpm
Idioventricular Rhythm	An escape rhythm (or safety mechanism) that prevents ventricular standstill	Slow	20 – 40 bpm
Pulseless Electrical Activity (PEA)	Electrical activity with no pulse, no muscle contraction Indications: myocardial infarction, hypovolemia, hypokalemia/hyperkalemia, hypothermia, tension pneumothorax, massive pulmonary embolism, cardiac tamponade, acidosis, drug overdose	Shows evidence of organized electrical activity but with no pulse	

Table 5: Heart Rhythm

Arrhythmia

Arrhythmia means problems in the regular rhythm of the heart. While most people with arrhythmia can still lead a normal life, it is still important to be properly diagnosed to avoid further complications.

The main types of arrhythmia include:

- **Atrial Fibrillation (AF)** – The most common type, wherein heart beat is irregular and faster than normal.
- **Supraventricular Tachycardia** – Occurs when the heart beats abnormally fast even while at rest.
- **Bradycardia** – A condition where the heart beats slowly than usual.
- **Heart Block** – A condition where the heart beats slowly than normal, which can cause sufferer to collapse.
- **Ventricular Fibrillation** – This is a rare, rapid, and disorganized rhythm of the heart, which can lead to a sudden loss of consciousness or worst, death.

Pulseless Electrical Activity (PEA) Explained

In the case of PEA, there is an absence of palpable pulse and there is no evident activity in the myocardial muscle in the presence of an organized electrical activity on the cardiac monitor. The patient is considered to be clinically dead despite a visible organized rhythm on the monitor.

Causes of PEA (H's and T's):

- Hypovolemia (Considered as the number 1 cause)
- Hydrogen ions or acidosis
- Hypoxia
- Hypothermia
- Hypo / hyperkalemia

- Toxins
- Tension pneumothorax
- Tamponade (cardiac)
- Trauma
- Thrombosis (coronary and pulmonary)
- Massive MI
- Tricyclic antidepressants overdose

Signs and Symptoms:

- Absence of pulse
- Loss of consciousness
- Absence of palpable BP

Risk:

- May lead to death as there is no associated cardiac activity.

Medical Treatment:

- First, specific cause has to be identified and treated.
- Administration of CPR.
- Initiate ACLS Protocol.

Chapter 4 Electric Therapy

Electrical Therapy is performed during cardiac arrest. The machine used is referred to as AED or automatic external defibrillator. It can spell the difference between life and death of a patient.

The most common heart rhythm associated with sudden cardiac arrest in adults is ventricular fibrillation. Defibrillation is the most effective treatment. Within just minutes, ventricular fibrillation will immediately deteriorate into asystole, thereby decreasing the success rate of defibrillation, thus diminishing the chance of survival.

Before administering AED, it is important to identify if there are any condition that may prevent the safe use of this device. For instance, if your patient is in the water, move him to a dry area to prevent shock to the responder. If you are responding to a fire situation, make sure that it is safe before you and other responders tend to the patient.

Once safety is established, you can turn on the machine. A computer-generated prompt will guide you through the different steps:

1. **Pad Placement**
    - Place the electrode pads on your patient.
    - Position one pad on the upper right chest of the patient, just below the clavicle.
    - Place the second pad on the left side of the chest, just below the nipple line, under the axilla.
    - Take note that the pads are sticky, if the patient is wet or sweating heavily, wipe dry the area first before placing the pads.
    - If your patient's chest is hairy, the AED may provide you an error message. If this happens, quickly remove the pads, thus also eliminating the chest hair in the area. Replace with new pads and try again. A razor may come in handy. Just quickly shave the areas where you need to place the pads.
2. **Analyzing the Rhythm**
    - During this time, do not touch the patient.
    - Briefly discontinue CPR while the machine analyzes the heart's rhythm. It may take about 15 seconds for the machine to make an analysis. At this point, it there is ventricular fibrillation, the machine will prompt you that a shock should be done, either a voice prompt or a message will flash through the machine.
3. **Clearing the Patient**
    - Before you administer the shock, make sure no one is touching the patient. Hence, you need to shout "clear" just before you do it. By not touching the patient, it means, you or other responders should not be touching any part of the patient. This prevents accidentally shocking anyone near.

4. **Administering the Shock**
    - The moment it is “clear”, electric shock is administered.
    - Press the shock button.
    - Once the shock is delivered, immediately resume CPR and continue for 2 minutes. Approximately, 5 cycles of compressions and ventilations are done.
    - After 2 minutes of CPR, the machine will make another analysis of the heart’s rhythm. If ventricular fibrillation is still present, another round of charge and shock will be prompted by the machine.
    - There are cases that the machine will not prompt for the administration of shock. This means that the patient has a non-shockable rhythm, like an asystole. You will just need to continue with the CPR and resuscitation process without performing defibrillation until the patient reaches ROSC, or until you become exhausted to continue on, or help arrives.

Defibrillation

Defibrillation is the treatment used for urgent life-threatening arrhythmias, wherein the patient has no pulse (ventricular fibrillation or pulseless ventricular tachycardia).

Cardioversion

Cardioversion is the process of converting arrhythmia back to sinus rhythm. If the patient has a pulse, but unstable, or if chemical cardioversion failed, electrical cardioversion is performed. These conditions are associated with chest pain, syncope, hypotension, and pulmonary edema. This process is also used in less urgent cases, like atrial fibrillation.

Both processes deliver electrical energy to the heart, stunning the heart momentarily, allowing a normal sinus rhythm to kick in, through the normal electricity center of the heart.

Synchronized Cardioversion

Synchronized cardioversion is the process of sending electricity to the heart via a low energy shock sensor. The electric shock should be in sync with the highest point of the R-wave as read on the ECG machine. There will be a delay in between, and during this time of delay, the machine will read and synchronize with the ECG rhythm of the patient. This happens so that the shock wave can be delivered with or just after the peak of the R-wave in the QRS complex of the patient.

During cardiac repolarization (t-wave), no energy shock will be sent to the patient. If during the repolarization process, electric shock reaches the t-wave, the shock might trigger ventricular fibrillation.

The most common indications for synchronized cardioversion include unstable fibrillation, atrial tachycardia, supraventricular tachycardia, and atrial flutter. If medications become ineffective in stabilizing the patient, synchronized cardioversion is likely to be performed.

Defibrillation is actually referred to as unsynchronized cardioversion. This time, increased energy shock is delivered, meaning it can reach any part of the cardiac cycle. Defibrillation is performed when there is no coordinated electrical activity in the heart (pulseless VT or VF), or when the defibrillator cannot synchronize an unstable patient.

Special Considerations

- It is important to remove supplemental oxygen sources from the area where the patient is before defibrillation and cardioversion. The distance should be about 3.5 to 4 feet away from the patient. Supplemental oxygen sources include the following: masks, nasal cannulae, ventilator tubing, and resuscitation bags.
- Make sure that you are using defibrillator pads or paddles that are appropriately-sized.
- Ensure there are no air pockets in between the pads and the skin of the patient. When applying pads to your patient's bare chest, press from one edge of the pad across the entire surface to release air.
- Constantly monitor wires and electrodes. They have to be away from the defibrillator pads. Contact may result in electrical arching, which may cause skin burns during the administration of shock.

- Remove jewelry, bandages, patches, and any other materials from the sites that will be used for pad placement. Never attempt to defibrillate through them. Wipe off residue from a medication path or ointment from your patient's chest. Avoid using alcohol or any alcohol-based cleansers.
- When hand-held paddles are used, make sure that you use appropriate conductive gel or disposable gel pads. Apply pressure during defibrillation attempts. Never discharge the defibrillator with the paddles pressed together into the open air. This will damage the surface of the paddle plates, which may result in skin burns during the process.

Possible Complications:

- Skin burns due to a lack of conductive gel
- Myocardial dysfunction
- Dysrhythmias, which include asystole, AV block, VF, or bradycardia after cardioversion
- Embolic episodes
- Injury to the operator and other members of the team due to improper use.
- Risk of fire due to the combination of electrical and oxygen sources.

Possible errors may also be committed; you need to take note of them:

- Unfamiliarity with the use of the equipment.
- Failure to completely maintain the equipment, including paddle cleaning and battery maintenance.
- Unable to remove jewelry, patches, bandages, among others, from the site used for paddle placement.
- Frequent interruptions of chest compressions.
- Improper positioning of pads and electrode.
- Application of too much conductive gel.
- Inappropriate energy level used or type of shock administered.
- Unable to "clear" self and other members of the team before giving shock.
- Failure to assess the patient's condition and vital signs after ROSC.

Summary

Type of Shock	Rhythm	Energy Levels
Defibrillation	Pulseless VT/VF Sustained polymorphic VT	Dependent on the type of device used: • For the biphasic defibrillator, the effective dose is 120 – 200 J. • If unknown dose range, use the maximum dose. • For monophasic defibrillator, for all shocks, use 360 J.
Synchronized Cardioversion	Unstable narrow-QRS tachycardia	Biphasic dose: 50 – 100 J initially, if initial shock fails, increase in stepwise fashion
	Unstable arterial flutter	Biphasic dose: 50 – 100 J initially, if initial shock fails, increase in a stepwise fashion
	Unstable atrial fibrillation	Biphasic dose: 120 – 200 J initially, if initial shock fails, increase in stepwise fashion Monophasic dose: 200 J initially, if it fails, increase accordingly
	Unstable monomorphic VT	Biphasic dose: 100 J initially, if initial shock fails, increase in a stepwise fashion

Table 6: Summary

Transcutaneous Pacing

Transcutaneous Pacing or TCP is one of the procedures performed in emergency situations. The main goal of this procedure is to stabilize the patient first while waiting for the availability of a more permanent treatment. Electric current is delivered through the patient's chest, aiming to stimulate heart contraction. This is normally given to patients with symptomatic bradycardia, which results from acute myocardial infarction, heart blockage, and sinus node dysfunction.

During the process, pads are positioned on each sides of the chest, choosing between anterolateral and anterior-position (AP). AP is the most commonly used as it prevents transthoracic electrical impedance since the 2 pads sandwich the heart. Electric current is applied to achieve electrical capture (reading: wide QRS complex) occurs. An alternative procedure can be done (asynchronous TCP) if there are indications of heart block, VT, and VF. On the other hand, to stop symptomatic tachydysrhythmias, overdrive pacing is performed.

TCP is applied for:

- Hemodynamically significant bradydysrhythmias, unresponsive to atropine (hypotension, pulmonary edema, chest pain, changes in mental status)
- Asystole cardiac arrest
- Failed intrinsic pacemaker

If considering to use transcutaneous pacing, think about alternate causes for acute dysrhythmia, like trauma, drug overdose, hypothermia, hypoxia, and electrolyte imbalance. The underlying causes should be treated.

Technique:

- Ideally, the heart should be in between the two pads, mimicking the heart's normal electrical axis. The placement of the pads varies.
- Begin with 10 milliamps, adding at increments of 10 until capture is reached, anywhere from 60 to 80 bpm.
- Sedation is considered, since it can become uncomfortable for the patient. Most patients can receive up to 50 milliamps without sedation, though. 50 – 100 milliamps are required. Ideally, 1.25x current is required for capture.
- Mechanical capture of ventricles is a manifestation of improvements, such as including establishing a palpable, increase in blood pressure, improved skin

color and temperature, and improved level of consciousness. The target is to make both mechanical and technical capture. Excessive muscle response makes it hard to find pulse in the area.

- You can touch or be near the patients during pacing, not like with defibrillation, so CPR can be administered while performing transcutaneous pacing.

Drawbacks:

- Failure to capture is a result of inadequate electric current. It should be increased as much as necessary.
- Skeletal muscle contraction happens at certain levels as low as 10 milliamps, and does not suggest mechanical or electrical capture.
- Undersensing – failure of the pacemaker to detect intrinsic activity, thus resulting in pace pulse.
- Oversensing – inhibition of the pacemaker as a result of detecting interference signals, instead of clear R waves.
- Changes may occur without warning, resulting to a loss of capture.

Chapter 5 Medication Administration

During the process of resuscitation, medication administration may be needed.

Route of Access

Route of Access	Indications	Notes
Intravenous – IV	Most widely used, if the IV is quickly established without disrupting the CPR	Use the central IV line if already in place. If using a peripheral IV, administer 20ml of IV fluid after each drug.
Intraosseous (IO)	Easier to insert when it is hard to establish an IV. CPR should not be interrupted.	Any kind of medication can be given via IO. The common sites for insertion are distal femur or anterior superior iliac crest, tibia. It is not advisable if there is injury or infection on or near the site.
Endotracheal (ET)	Used only if quick insertion of IV or IO cannot be established.	Medication dosage should be 2 – 2.5 times the usual dosage used for IV or IO. Medications administered via ET include: vasopressin, epinephrine, lidocaine, naloxone, and atropine. Follow administration of medication with normal saline and hyperventilation with Ambu bag.

Table 7: Medication Administration

Medications

Acute Coronary Syndromes Medications

Acute coronary syndrome or ACS is a medical emergency that need immediate attention. Treatment goals include preservation of patency of the coronary artery, augmentation of blood through stenotic lesions, and reduction of myocardial oxygen demand. Antiplatelet agents should be given to patients. For patients showing evidence of ischemia, they should be given aggressive medical intervention until signs of ischemia are resolved.

Antiplatelet Agents:

These inhibit the clyclooxgenase system, thereby decreasing the level of thromboxane A2, a potent platelet activator.

- Aspirin – Early administration in myocardial infarction patients may reduce cardiac mortality in the first month. Adult dose: 160 – 324 mg, PO or chewed. If patient is not capable of taking PO medications, it is administered as a suppository.
- Vorapaxar – Reversely inhibits protease-activated receptor. May reduce thrombotic cardiovascular occurrence in patients with peripheral arterial disease or history of MI.

Nitrates:

Prevent coronary artery spasm and reduce myocardial oxygen demand through the reduction of preload and afterload.

- Nitroglycerin topical – Has relaxation effect on the vascular smooth muscle by stimulating the intracellular cyclic guanosine monophosphate production, thereby decreasing high blood pressure.

Analgesics

Help alleviate pain.

- Morphine sulfate – is the drug of choice for narcotic analgesia. Administered via IV.

Beta-adrenergic blockers

Possess antihypertensive and antiarrhythmic properties. It helps reduce ischemia.

- Metoprolol – is a selective beta 1-adrenergic receptor blocker which helps decrease the automaticity of contractions. Administered via IV.

- Esmolol – is given to patients who are at risk of developing complications from beta blockers.

Glycoprotein IIB/IIIA Inhibitors:

They inhibit glycoprotein IIB/IIIA receptor, involved in the final common pathway for platelet adhesion and aggregation.

- Abciximab – chemiric human-murine monoclonal antibody. Binds with receptors with high affinity and reduces platelet aggression by almost 80%.
- Epitifibatide – is an antagonist of the platelet GP IIB/IIIA receptor. It inhibits platelet aggregation.
- Tirofiban – is a non-peptide antagonist of the GP IIB/IIIA receptor. Inhibits platelet aggregation by more than 90%.

Anticoagulants:

They are used to prevent the recurrence of clot after a spontaneous fibrinolysis.

- Heparin – helps augment the activity of antithrombin and prevents conversion of fibrinogen to fibrin.

Low molecular weight heparins (LMWH):

Used in the treatment of ST-segment elevation myocardial infarction (STEM) managed medically or with PCI.

- Enoxaparin – binds with antithrombin III to enhance its therapeutic effect.

Direct thrombin inhibitors:

They bind directly to the anion binding site and the catalytic sites of thrombin, thus producing potent and predictable anticoagulation.

- Hirudin – is indicated only in patients who cannot be given heparin due to heparin-induced thrombocytopenia.
- Bivalirudin – is a synthetic analogue of recombinant hirudin.

Adenosine diphosphate receptor antagonists:

It is considered as an alternative to aspirin in patients who are aspirin intolerant.

- Clopidogrel – inhibits platelet function.

- Ticlopidine – is also used to decrease vascular deaths and nonfatal MIs.
- Prasurgent – efficiently inhibits platelet function.
- Ticagrelor – also helps reduce the rate of stent thrombosis in patients who have undergone stent placement for treatment of ACS. Also indicated for patients with MI history.

Medications Commonly Administered During Resuscitation

The types, uses, and dosages of drugs change quickly. Having mentioned that, it is important that qualified medical personnel should always be up-to-date with the medications used during resuscitation.

Note: Dosages are based on AHA recommendations.

Refer to the table below:

Drug	Type of Drug	Uses	Recommended Dosage	Side Effects	Additional Notes
Adenosine	Antiarrhythmic	Supraventricular tachycardia	1st dose = 6mg rapid IV push followed by saline bolus 2nd dose = 12mg rapid IV push in 1 – 2 minutes	Dizziness Headache Dyspnea Metallic taste Hypotension Bradycardia Nausea Flushing Sweating	Cardiac monitoring Administer through central line, if available, then flush with saline after administration Refrain from using in 2nd and 3rd degree heart block

Amiodarone	Antiarrhythmic	Unstable VT with pulses VF VT without pulse and unresponsive to shock	1st dose = 300mg rapid bolus 2nd dose = 150mg (if necessary, to a maximum of 2.2g over 24 hours)	Dizziness Headache Tremors Ataxia Hypotension Syncope Bradycardia Torsades de pointes CHF Vomiting Nausea Skin rashes Diarrhea Skin discoloration Flushing Hair loss Coagulation abnormalities	Monitoring of ECG and BP readings Use with care for patients with hepatic failure and perfusing rhythm Never use in 2nd and 3rd degree heart block

Atropine	Anticholinergic	Symptomatic bradycardia Toxic poisoning Drug overdose	Bradycardia: 0.5 IV every 3 – 5 minutes, max dose of 3mg; may be given via ET tube Toxins or overdose: 2 -4mg given, until symptoms are reversed	Dizziness Headache Anxiety Confusion Flushing Photophobia Blurred vision Pupil dilation Dry mouth Hypotension Hypertension Tachycardia Vomiting Nausea Constipation Painful urination Urinary retention Constipation Skin rashes Dry skin	Monitor oxygen, ECG, and BP Give before intubation in bradycardia cases Contraindicated in tachyarrhythmia and glaucoma

Dopamine	Catecholamine vasopressor Inotrope	May be given in bradycardia, following atropine May be given for systolic BP <100mm Hg, with signs of shock	2 – 20 mcg/ kg/minute infusion, titrated to response	Dyspnea Headache Palpitations Acute renal failure Nausea Vomiting PVCs VT SVT	Monitor both BP and ECG If patient is hypovolemic, give fluid boluses first Refrain from giving high infusion rates Never mix with alkaline solutions or sodium bicarbonate

Epinephrine	Catecholamine vasopressor Inotrope	Anaphylaxis Cardiac arrest Shock when pacing and atropine is not working Symptomatic bradycardia after atropine	Cardiac arrest: 1.0mg (1:10000) IV or 2 – 2.5mg (1:1000) per ET tube, given every 3 – 5 minutes, then followed by 0.1 – 0.5mcg/kg/minute infusion titrated to response Symptomatic bradycardia or shock: 2 – 10mcg/minute infusion titrated to response	Dizziness Headaches Anxiety Tremors VT SVT Dyspnea Hallucinations Chest pain Palpitations Nausea Vomiting Vasoconstriction Hypertension Hyperglycemia Hypoglycemia	Available in 1:1000 and 1:10000 concentrations; know what you need to use Monitor ECG, BP, and oxygen Administer through the central line if possible, to prevent tissue necrosis

Lidocaine	Antiarrhythmic	Wide complex tachycardia Cardiac arrest due to VT or VF	Cardiac arrest: 1 – 1.5mg/kg IV bolus; may be repeated 2x at half the dose in 5 – 10 minutes, ending with a total of 3mg/kg with intrusion of 1 – 4mg/ minute infusion Wide complex tachycardia with pulse: 0.5 – 1/5mg/kg IV; may be administered 2x at half dose in 5 – 10 minutes, ending with a total of 3mg/kg; followed by infusion 1 -4mg/minute infusion	Heart block Seizures Bradycardia Dyspnea Nausea Vomiting Respiratory depression Dizziness Headache Tremors Blurred vision Tinnitus Hypotension Skin rashes	Monitor BP and ECG Never give in cases of wide complex bradycardia Refrain from using prophylactically in acute MI

Magnesium sulfate	Electrolyte Bronchodilator	Hypomagnesemia Torsades de pointes Digitalis toxicity	Cardiac arrest due to torsades or hypomagnesemia: 1 – 2g IV bolus Torsades with a pulse: 1 – 2g IV over 5 – 60 minutes, followed by infusion at 0.5 – 1g/ hour IV	Confusion Weakness Sedation Respiratory depression Cardiac arrest Bradycardia Heart block Hypotension Vomiting Nausea Flushing Sweating Muscle cramping	Monitor oxygen, BP, and ECG Rapid bolus may result to bradycardia and hypotension Use calcium chloride as antidote to reverse hypermagnesemia
Oxygen	Elemental gas	Respiratory distress or failure Hypoxia Shock Cardiac arrest Trauma	During resuscitation, administer at 100% via high flow system, titrate to response to maintain oxygen saturation >94%	Dizziness Fever Chest pain Arrhythmia Hypertension Vomiting Nausea Hives Abdominal cramping	Monitor distal pulses and BP Watch out for signs of water intoxication Deliver via a central line if possible to avoid tissue necrosis from IV extravasation

Table 8: Resuscitation Medications in ACLS

Chapter 6 Acute Coronary Syndromes

Acute coronary syndrome is the term used for conditions characterized by the blockage of blood supply to the heart. These include myocardial infarction, heart attack and unstable angina. These conditions are considered as medical emergencies.

Symptoms include chest pain or discomfort, pain in the neck, one or both hands, stomach or back, dizziness, shortness of breath, nausea, and excessive sweating.

Assessment and management begins with the establishing if there is chest pain, and if this pain is indicative of ischemia. The 12-lead ECG is also essential in its accurate diagnosis.

The 12-Lead ECG

In cardiac emergencies, ECGs need rapid placement and result acquisition when symptoms are present. The 12-lead ECG is normally used for diagnostics to help identify an etiology that will establish episodic symptoms like transient syncope and intermittent chest pain.

Begin by placing the 4 limb leads on the patient's limbs, meaning the leg leads go just below the hips and the arm leads distal to the shoulder. Do not place electrodes directly over hairy areas or directly over the bone. Shave hair as needed.

The chest leads will be in the respective intercostal regions. Shave chest if it is too hairy. Do not position the electrodes over the breast tissue.

V1 should be in the 4^{th} intercostal space, on the right of the sternum; V2 should be at the left of the sternum in the 4 intercostal space; V4 will in the 5^{th} intercostal space right on the midclavicular line; V3 will be placed at the area between V2 and V4; V6 goes to the 5^{th} intercostal space at the mid-axillary line. V5 will be at the point between V4 and V6.

The leads should be accurately positioned so as to avoid getting false and inaccurate results.

Classifying the Patient

ST-segment elevation myocardial infarction (STEMI)	High-risk unstable angina or Non-ST-segment elevation myocardial infarction (NSTEMI)	Low risk unstable angina
Meaning: ST segment elevation = >1mm (0.1mV) in 2 or more adjacent leads or 2 or more contiguous precordial leads New or presumed new, left bundle branch block	*Meaning:* Ischemic ST-segment depression = 0.5mm (0.5MV), can be greater Dynamic T-wave inversion Temporary ST elevation = 0.5mm (could be more), for less than 20 minutes	*Meaning:* Non-diagnostic changes in T wave or ST segment = inconclusive T wave inversion = 2mm (0.2mV or less) ST segment deviation <0.5mm
Result: Infarction	*Result:* Ischemia	*Result:* Normal

Table 9: Classification Summary

Management of the condition is dependent on the ECG results.

Routine Measures

Once diagnosis has been done, routine measures follow, to make sure that the patient survives the emergency situation. A mnemonic is used to help providers: MONA, in which every letter has meanings, these are the 4 interventions to be performed on patients with cardiac emergencies. M stands for Morphine, O is for Oxygen, N is for Nitrates, and A is for Aspirin.

Morphine

This is the preferred analgesic for patients who have STEMI and feeling discomfort in the chest.

Oxygen

Giving supplemental oxygen is indicated for patients who are cyanotic, hypoxic, having trouble breathing, signs of shock, or his oxygen saturation decreases to less than 94%. Oxygen is titrated to maintain the patient's SpO2 of at least 94%.

Nitroglycerin (NTG)

NTG effectively relaxes vascular smooth muscle, dilation of the coronary arteries, and decreases consumption of oxygen in MI.

Prior to administering NTG, the IV has to be in place, the systolic blood pressure of the patient is >90mm Hg, with heart rate of 50 – 100 bpm, no signs of right ventricular infarction, and did not use phosphodiesterase inhibitor in the last 24 – 48 hours.

Aspirin

Nonenteric aspirin (162 – 325mg) is given as soon as symptoms manifest. Chewable aspirin is recommended because it can be quickly absorbed by the body.

Chapter 7 Special Resuscitation Situations

This section gives you some information about some special resuscitation situations:

Stroke

Adult stroke is identified as one of the most common causes of disability and death in adults. Acute stroke is a medical emergency. Early diagnosis is essential to survival.

What to do:

- Ensure a clear airway.
- Administer supplemental oxygen.
- Secure IV access.
- Monitor heart rhythm, blood pressure, and blood glucose.

Toxicology

There are cases when cardiac arrest is caused by toxic substances. A significant consideration to the survival rate of patients is the dose of toxin in the patient's body. It is imperative to quickly restore circulation and ventilation. Then, the reversal of the toxin is the next priority, including preventing further absorption.

What to do:

- Remove the patient from the source of the toxins.
- Establish the toxins because the responder might also be affected.
- Provide efficient ventilation and blood flow.

Electrolyte Abnormalities

Cardiac arrest from electrolyte abnormalities is quite uncommon, except in hyperkalemia. The concentrations of electrolyte change during cardiac arrest because of the rapidly changing catecholamine levels, acid-base status, and hypoxia. These changes may not need intervention unless there is cardiac arrest.

What to do:

- If it is life-threatening, it should be treated before cardiac arrest happens.
- If cardiac arrest hasn't occurred yet, electrocardiographic clues may help.
- Laboratory tests are the best tools for diagnosis, but not the quickest.

Asthma

Severe asthma may lead to sudden death.

What to do:

- Initiate administration of CPR. Allot longer periods for inspiration and expiration to allow movement of air through the airways.
- Attach defibrillator.
- For VF and VT, defibrillate thrice.
- Provide tracheal intubation the soonest time possible.
- Quickly ensure IV is administered.
- Administer 1mg epinephrine (IV) at 2 to 5 minutes' interval.
- Give 2 ug/min (max of 10 ug/min) of isoproterenol (IV).
- Administer 2g magnesium sulfate (IV) every 1 – 2 minutes.
- Administer a relaxant to temporarily paralyze the patient.
- Give adequate sedation using barbiturate or ketamine.
- Give adrenergic bronchodilators, like albuterol, via the tracheal tube.

- Using 14-inch gauge needle, begin the bilateral needle decompression Then follow with bilateral tube thoracostomies in the occurrence of tension pneumothoraxes. Decompression may also be done.

Near-Drowning

Efficient resuscitation is tantamount to saving a life.

What to do:

- In-water resuscitation needs floatation devices in their use. External chest compression is difficult to perform in water.
- Suspect injuries in the spine in diving and surfing accidents.
- Never attempt to drain water from the patient's lungs.
- Don't forget to establish a clear airway first.

Anaphylaxis

Anaphylaxis is used to describe the presence of hypersensitivity reactions typically mediated by IgE.

What to do:

- Recline patient in a position where he is comfortable. Give oxygen at high flow rates, about 10 to 15 L/min.
- Administer epinephrine with clinical signs of airway swelling, shock, and heavy breathing. Dosage of 300 – 500 ug, every 5 – 10 minutes if there is no improvement on the first administration.
- Give antihistamine through IV.
- Give inhalable salbutamol or epinephrine if obstruction of the airway is quite major.
- Inject high dose IV corticosteroids after several attacks to prevent late sequelae.

Lightning Strike

Lightning strike injuries are said to have a 30% mortality rate, 70% morbidity rate. The primary cause of death is cardiac arrest.

What to do:

- The main point is to provide oxygenation until normal cardiac activity is restored.

- For respiratory arrest victims, ventilation and oxygenation would be needed to prevent secondary hypoxic cardiac arrest.

Pregnancy

Cardiac arrest is quite rare in pregnancy. It is said to occur in every 30,000 deliveries.

What to do:

- During cardiac arrest, relieve aortocaval compression by displacing the gravid uterus manually or by using a wedge, or position the patient's back on the provider's thighs.

Hypothermia

In hypothermia, there is increased tolerance time for cardiac arrest and reduced blood during the resuscitation process. Severe cases of hypothermia may often lead to bradycardia and slow ventilatory rate.

What to do:

- Prevent further heat loss through evaporation from cold environments, wind, and wet clothes.
- Confirm cessation of ventilation and pulselessness for 30 – 45 seconds.
- Do not try to do external rewarming.
- Avoid rough movements.
- If the patient is hypothermic secondary to cardiac arrest, do not attempt to resuscitate.

Conclusion

Thank you again for downloading this book!

I hope this book was able to provide you with the best information about the ACLS 2016. The next step is to study this book and other materials thoroughly.

You need to know as much as you can so that you can provide the best care possible.

Finally, if you enjoyed this book, then I'd like to ask you for a favour. Would you be kind enough to leave a review for this book on Amazon? It'd be greatly appreciated!

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Thank you and good luck!