Introductory Course Fourth Year

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- Cardiovascular diseases (CVDs) are the number one cause of death globally: more people die annually from CVDs than from any other cause.
- An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths.

- Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke.
- Low- and middle-income countries are disproportionally affected: over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women.

 The number of people who die from CVDs, mainly from heart disease and stroke, will increase to reach 23.3 million by 2030.

 CVDs are projected to remain the single leading cause of death.

Sudden Cardiac Death

- Sudden cardiac death (SCD) accounts for up to 50% of cardiovascular-related deaths in the United States and other developed countries.
- By definition, SCD refers to the acute and natural death from cardiac causes within a short period (often within an hour of onset of symptoms).

- The time and mode of death are unexpected, and often death occurs in patients without any prior potentially fatal conditions.
- Most cases of SCD are associated with <u>underlying cardiac</u> <u>arrhythmias</u>; however, other causes have been identified.

• Epidemiology:

- SCD causes an estimated 300,000 deaths annually in the US.
- Structural coronary arterial abnormalities and their consequences cause 80% of the fatal arrhythmias associated with SCD.

- Recordings during episodes of SCD have shown an underlying rhythm of ventricular tachycardia (VT), ventricular fibrillation (VF), or VT degenerating into VF in 85% of cases.
- In other studies, bradyarrhythmia was the underlying rhythm in 16% of patients who died suddenly.

- The incidence of SCD is higher among men than women.
 The incidence also increases with age.
- In older patients, SCD occurs most often with reduced left ventricular function and symptomatic heart failure.
- Only <u>5% to 15%</u> of cardiac arrest patients are successfully resuscitated and discharged from the hospital without any associated neurologic deficits.

- Survival from SCD often depends on immediate cardiopulmonary resuscitation and the availability and use of automated external defibrillators (AEDs).
- The American Heart Association recommends the placement of AEDs in public locations, where an average of one cardiac arrest occurs every 5 years.





Major causes of sudden cardiac death

Ischemic heart disease
Coronary artery disease with myocardial infarction or angina
Coronary artery embolism
Nonatherogenic coronary artery disease (arteritis, dissection, congenital coronary artery anomalies)
Coronary artery spasm
Nonischemic heart disease
Hypertrophic cardiomyopathy
Dilated cardiomyopathy
Valvular heart disease
Congenital heart disease
Arrhythmogenic right ventricular dysplasia
Myocarditis
Acute pericardial tamponade
Acute myocardial rupture
Aortic dissection
No structural heart disease
Primary electrical disease (idiopathic ventricular fibrillation)
Brugada syndrome (right bundle branch block and ST segment elevation in leads V1 to V3)
Long QT syndrome
Preexcitation syndrome
Complete heart block
Familial sudden cardiac death
Chest wall trauma (commotio cordis)
Noncardiac disease
Pulmonary embolism
Intracranial hemorrhage
Drowning
Pickwickian syndrome
Drug-induced
Central airway obstruction
Sudden infant death syndrome

- <u>Atherosclerotic coronary artery disease is the leading</u> <u>cause of SCD.</u>
- Studies have shown that 40% to 86% of patients who survived SCD, depending on the age and sex of the population, had coronary vessels with more than 75% cross-sectional stenosis.

Incidence of sudden death in men and women increases with age



During a 38 years follow-up of subjects in the Framingham Heart Study, the annual incidence of sudden death increased with age in both men and women. However, at each age, the incidence of sudden death is higher in men than women. *Data from Kannel, WB, Wilson, PWF, D'Agostino, RB, et al, Am Heart J* 1998; 136:205.



Acute Coronary Syndromes (ACS):
1- Unstable angina.
2- Non-ST elevation myocardial infarction (NSTEMI).
3- ST elevation myocardial infarction (STEMI).





Sinus node artery

Conus branch

RV branches

PLV Stump





Plaque with fibrous cap



Cap ruptures





Symptoms of MI:

- Retrosternal (central) chest pain (tightness, pressure) radiation to left shoulder, arm, neck or jaw.
- Dyspnea.
- Nausea or vomiting.
- Diaphoresis (sweating).
- Syncope



Complications of MI:

- Free wall rupture.
- Ventricular septal defect (VSD).
- Papillary muscle rupture causing mitral regurgitation.
- Cardiogenic shock (Left ventricular failure).
- Arrhythmias (VF, VT, AF).
- Ventricular aneurysm.
- Pericarditis.

Left ventricular free wall rupture after MI



Pathologic specimen showing free wall rupture (arrow) and hemopericardium after a myocardial infarction. From Edwards, WD, Applied anatomy of the heart. In: Cardiology: Fundamentals and Practice, Brandenburg, RO, Fuster, V, Guiliani, ER, McGoon, DC (Eds), Year Book, Chicago, 1987, pp. 47-109.

Septal rupture after MI



Pathologic specimen showing rupture of the interventricular septum (arrow) after a myocardial infarction. From Edwards, WD, Pathology of myocardial infarction and reperfusion. In: Acute Myocardial Infarction, Gersh, BJ, Rahimtoola, SH (Eds), Elsevier, New York 1991, pp, 14-48. By permission.

Papillary muscle rupture after MI



Pathologic specimen showing complete transection of papillary muscle (arrow) after an acute myocardial infarction. The patient died with severe mitral regurgitation. Photograph courtesy of Dr William D Edwards. From Reeder, GS, Gersh, BJ, Acute myocardial infarction. In: Internal Medicine, 4th ed, Stein, JH,

Hutton, JJ, Kohler, PO, et al (Eds), Mosby-Year Book, St Louis, 1994, pp. 169-189. By permission.













<u>Cerebrovascular accident (Stroke)</u>:
1- Ischemic.
2- Hemorrhagic.

 The most common symptom of a stroke is sudden weakness or numbress of the face, arm or leg, most often on one side of the body.

- Other symptoms include:
- confusion.
- difficulty speaking or understanding speech.
- difficulty seeing with one or both eyes.
- difficulty walking, dizziness, loss of balance or coordination.
- severe headache with no known cause.
- fainting or unconsciousness.

Basic Life Support

- Cardiopulmonary resuscitation (CPR) as we recognize it today was developed in the late 1950s and 1960s.
- Elam and Safar described the technique and benefits of mouth-to-mouth ventilation in 1958.
- Kouwenhoven, Knickerbocker, and Jude subsequently described the benefits of external chest compressions, which in combination with mouth-to-mouth ventilation form the basis of modern CPR.

- External defibrillation, first described in 1957 by Kouwenhoven, has since been incorporated into resuscitation guidelines.
- Basic life support consists of cardiopulmonary resuscitation and, when available, defibrillation using automated external defibrillators (AED).
- The keys to survival from sudden cardiac arrest (SCA) are early recognition and treatment, specifically, immediate initiation of excellent CPR and early defibrillation.

Chain of survival 2020 AHA



Adult IHCA Chain of Survival



Adult OHCA Chain of Survival

BLS Algorithm







In the 2006 AHA guidelines <u>A-B-C</u>. In the 2010 AHA guidelines <u>C-A-B</u>.

Chest compressions:

- Chest compressions are the most important element of CPR.
- Coronary perfusion pressure and return of spontaneous circulation (ROSC) are maximized when excellent chest compressions are performed.
- The mantra of the AHA 2010 BLS Guidelines is: "push hard and push fast on the center of the chest".

- The following goals are essential for performing excellent chest compressions:
- Maintain a rate of at least 100 compressions per minute.
- Compress the chest at least 5 cm (2 inches) with each down-stroke.

- Allow the chest to recoil completely after each downstroke (eg, it should be easy to pull a piece of paper from between the rescuer's hand and the patient's chest just before the next down-stroke).
- Minimize the frequency and duration of any interruptions.

Chest Compressions

Importance (vital organ perfusion) Before:

At the victim's side.

Supine + Firm, Flat Surface. Exposure Landmark Arms (straightened)

Shoulders (directly over hands)

Chest Compressions

During: Push Hard, Deep & Fast Rate (100 times/min) Depth (2 inch) Chest Recoil Do NOT Interrupt Compressions Move Victim only when Necessary Push straight down on the victim's breastbone

Airway Obstruction

Tongue is the Main Cause of Airway Block In the Unresponsive Pt.



Head-Tilt-Chin Lift & Spontaneous Breathing

Palm + Forehead Tilt Head Back

Fingers + Lower Jaw Lift Chin Forward

• Breathing:

 A bag valve mask (also known as a BVM or Ambu bag) is a hand-held device used to provide <u>positive pressure</u> <u>ventilation</u> to a patient who is not breathing or who is breathing inadequately.



Bag-Mask E-C Technique

Above the Head

Mask on Face

E-C clamp technique Nasal bridge= guide for correct position Tilt head Make a "C" (pressing edges of mask on face Form an "E" (lifting angles of jaw) Open airway

Squeeze the bag

- The vast majority of tracheal intubations involve the use of a viewing instrument of one type or another.
- Since its introduction by Kirstein in 1895, the conventional laryngoscope has been the most popular device used for this purpose.
- Today, the conventional laryngoscope consists of a handle containing batteries with a light source, and a set of interchangeable blades.



Endotracheal tube goes through patient's mouth and into the windpipe

Mechanical ventilator blows air, or air with increased oxygen, through tubes into the patient's airways

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Nurse periodically checks the patient.

Air flowing to the patient passes through a humidifier, which warms and moistens the air

Exhaled air flowing away from the patient

Proper ventilation for adults includes the following:

- Give 2 ventilations after every 30 compressions for patients without an advanced airway.
- Give each ventilation over no more than one second.
- Provide enough tidal volume to see the chest rise.
- Avoid excessive ventilation.
- Give 1 asynchronous ventilation every 6 seconds (10 per minute) to patients with an advanced airway (eg, supraglottic device, endotracheal tube) in place.

Adult BLS algorithm for healthcare providers: 2010 guidelines



AED: automated external defibrillator; ALS: advanced life support; BLS: basic life support. * The boxes bordered with dashed lines are performed by healthcare providers and not by lay rescuers.

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BLS in infants and children:

- Cardiopulmonary arrest among infants and children is typically caused by progressive tissue hypoxia and acidosis as the result of respiratory failure and/or shock.
- Causes of respiratory failure and shock leading to cardiopulmonary arrest in these age groups <u>include</u> <u>accidents, sudden infant death syndrome, respiratory</u> <u>distress, and sepsis.</u>

- This is in contrast to adults, for whom the most common cause of cardiac arrest is ischemic cardiovascular disease.
- For the purposes of these guidelines, a newborn is defined as from birth to hospital discharge, an infant is younger than one year of age, and a child is from one year to the start of puberty.

Sequence:

- Before beginning basic life support (BLS), rescuers must ensure that the scene is safe for them and the victim (such as by removing the victim from a burning building).
- The next steps in BLS are activating emergency medical services (EMS), getting an automated external defibrillator (AED), and starting CPR.

Pediatric BLS algorithm for healthcare providers: 2010 guidelines



AED: automated external defibrillator; BLS: basic life support; CPR: cardiopulmonary resuscitation.

* The boxes bordered by dotted lines are performed by health care providers and not by lay rescuers.

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Two fingers for chest compressions



Chest compressions for infants (under one year) may be performed with two fingers placed on the sternum just below the nipples.



Two-thumb technique



The thorax is encircled with the hands and cardiac compressions are performed with both thumbs. The compression site is approximately one finger's breadth below the intermammary line. The area over the xiphoid process should be avoided to prevent injury to the liver, spleen, or stomach.



One-handed chest compressions



For children (from one year until the start of puberty), chest compressions may be performed with the heel of one hand placed over the lower half of the sternum.



Two-handed chest compressions



For children (from one year until the start of puberty), chest compressions may be performed with two hands placed over the lower half of the sternum.





Relieving Chocking in Responsive Adults & Children Abdominal Thrusts (Heimlich Maneuver) With Victim Standing or Sitting

Steps: Behind + Stand/ Kneel + Wrap arms around waist Fist + Thumb against abdomen (between navel & breastbone) Gasp fist + Quick upward thrust Repeat until object expelled OR victim unresponsive

Examine for Complications (damage to internal organs) **NOT for Infants**



Relieving Chocking in Responsive Adults & Children Abdominal Thrusts (Heimlich Maneuver) With Victim Lying Down

Examine for Complications (damage to internal organs) NOT for Infants

Relieving Chocking in Responsive Infants

Up to 5 Back Slaps

(heel + middle back between shoulder blades) Free hand on back + Palm on head (first arm as above) Turn infant as a unit with Support + Hold on back

Up to 5 Chest Thrusts

(quick downward + just below nipple line + 1 per sec)

Repeat Cycle until obstruction removed OR unresponsive

