Sudden natural death
Objectives

- Definition of sudden natural death.
- The incidence and distribution of SND.
- Major causes of sudden natural death.
- Working approach.
definition of sudden death

- **Sudden death** (WHO –ICD10- ): death from natural diseases occurring within 24 hours of the onset of symptom.
- Sudden death divided into:
  1- **Unnatural death** (exp: suicidal, accident, criminal, violent deaths)
  2- **Natural unexpected death**: sudden death of an individual who appears healthy due to pre-existing disease or functional disorder or known with natural disease hadn't explain death.
Sudden unexplained death syndrome (SUDS): Sudden death in an otherwise healthy individual with no cause identified following a complete and detailed autopsy and death investigation; also known as "sudden adult death syndrome" or "sudden arrhythmogenic death syndrome" (SADS).

Sudden cardiac death (SCD): The unexpected natural death from a cardiac cause within a short time period, generally ≤1 hour from the onset of symptoms, in a person without any prior condition that would appear fatal.

Sudden infant death syndrome (SIDS): The sudden death of an infant younger than 1 year that cannot be explained after a thorough investigation is conducted, including a complete autopsy, examination of the death scene, and review of the clinical history.
Epidemiology

- SND Occur in all age groups with different etiologies by age.
- The incidence of SND in the general population ages 20 to 75 years is 1 in 1000 individuals (18.5 % of all deaths).
- The incidence of SND in 1 to 40 year age group is approximately 1.3 to 8.5 per 100,000 person-years (highest in the first 5 years).
- The incidence increases with age in both sexes.
- less in women than in men at all ages.
Etiologies

- Diseases of cardiovascular system (account the major cause of SND in adult)
- Diseases of respiratory system (most commonly seen to lead SND in neonate and children)
- Diseases of central nervous system
- Diseases of gastrointestinal system
- Disease of genitourinary system
Sudden death from cardiac diseases

Done by : Bayan Khalil Al-Nimrawi
Heart diseases

Valvular heart diseases

Arteries diseases
Disease of the heart:

Coronary artery disease

1-Coronary atherosclerosis:
   - The most common cause of sudden death.
   - Mostly affects:
     * Left Anterior Descending Artery (LADA)
     * Right Coronary Artery (RCA)
     * Left Common Carotid Artery (LCCA)
- complications:

1- rupture of ulcer atheromatous plaque.
2- sub-intimal hemorrhage.
3- Thrombosis ➔ most common
eccentric atherosclerosis

concentric atherosclerosis

hemorrhage of atherosclerosis
2- Myocardial Infarction:

- Myocardial infarction occurs when there is severe stenosis - 75% or more of the lumen of a major branch - or complete occlusion of a coronary artery. But death can be attributed to coronary artery disease (CAD) with less stenosis if other signs of chronic myocardial ischemia are apparent (left ventricular hypertrophy [LVH], fibrosis, previous infarct).
- **Complication of MI:**

  1. **Rupture of myocardial infarct:**

     The area of the myocardial infarct is weakest between 3 days and 1 week after the clinical onset of the infarct and it is at this time that the weakened area of myocardium may rupture, leading to sudden death from:

     * haemopericardium
     * cardiac tamponade
Figure 6.2 Myocardial infarction. (a) Macroscopic appearance of acute left-ventricular myocardial infarction. (b–d) Microscopic appearance of myocardial infarction with early necrosis (b), organization including residual haemosiderin-laden macrophages and fibroblasts (c), and extensive replacement fibrosis (d).
Figure 6.3 Haemopericardium causing cardiac tamponade. The distended pericardial sac has been opened to reveal fluid and clotted blood.
2- Cardiac aneurysms:
- One week post MI.
- May form at sites of infarction; they may calcify and they may rupture.
3- Papillary muscle rupture:
- 6-14 days post MI.
- Allow part of the mitral valve to prolapse, or may present as a sudden onset of valve insufficiency.
Hypertensive heart disease:

- This condition may lead to sudden cardiac death from left ventricular hypertrophy (500-700 grams).
- Associated with atherosclerosis.
Aortic stenosis:
- classically affects older individuals with calcified tricuspid aortic valves
- may also be seen in younger people who have a congenital bicuspid aortic valve.
- leading to left ventricular hypertrophy.
Myocarditis:

- Myocarditis (due to many infective diseases mostly by viruses)
- Sudden death may occur some days or even weeks after the main clinical symptoms.
- In sudden death pathology, a myocarditis of unknown aetiology is sometimes discovered incidentally on histology of autopsy tissues, known as isolated, Fiedler’s or Saphir’s myocarditis.
(histopathology show inflammatory and infiltrative degenerative or necrotic myocytes).
Cardiomyopathies:

- **HCM (hypertrophic cardiomyopathy):**
  inherited disease of cardiac muscle sarcomeric proteins, characterized by symmetrical or asymmetrical hypertrophy, a sub-aortic mitral ‘impact lesion’ and myocyte disarray leading cause of sudden cardiac death in young athletes
asymmetric massive thickening of ventricular walls.

fibrosis and myocardial disarray in hypertrophic cardiomyopathy.
- **DCM (dilated cardiomyopathy)**: dilatation of the chambers with thinning of the ventricular walls.

- **Arrhythmogenic right ventricular cardiomyopathy (ARVCM)**: an inherited condition which is characterized by predominantly right-ventricular thinning with fibro-fatty myocyte replacement.

- **RCM (restrictive cardiomyopathy)**: evident fibrotic thickening of the endomyocardium which lead to decrease the myocardial compliance.
Functional abnormalities

Pathologically, there are no ‘naked eye’ or microscopic abnormalities in the heart as the defects are at a molecular level.

- Long QT syndrome (LQTS).
- short QT syndrome (SQTS).
- Brugada syndrome (It is the major cause of sudden unexplained syndrom (SUDS) in young men)
Other less common causes:

- Embolism
- Vasculitis
- Coronary artery spasm (negative autopsy with normal patent vessels in postpartum examination)
- Coronary artery dissecting aneurysm:
  - Secondary to extension of an aortic root dissection
  - Primary dissecting aneurysms: often in young female, multifocal, associated with increase eosinophil.
Valvular heart diseases

- rheumatic heart disease
- bicuspid aortic valve
- floppy mitral valve
- Bacterial endocarditis (DX by presence of valvular vegetations)

Destruction of the mitral valve, with extensive vegetations (arrows) from infectious endocarditis
Myxomatous degeneration of the mitral valve, ballooning of thick, redundant valve leaflets

Calcific aortic stenosis: valve is thickened, rigid with fusion of commissure
Diseases of the arteries

- **Rupture atheromatous aortic aneurysm:**
  These aneurysms are most commonly found in elderly individuals in the abdominal region of the aorta, could be incidental finding at autopsy or ruptured.

- **Mesenteric artery thrombus**

- **Dissecting aortic aneurysm**
  (90% occur in the ascending aorta either just distal to the aortic valve or the left subclavian artery)
  Dissecting aneurysms are principally found in individuals with hypertension, but may also be seen in younger individuals with connective tissue defects, such as Marfan syndrome.
Conti...

Cuz of SND

By: Ruba Al_nwasreh
Rupture of berry aneurysm

Any rise in the blood pressure will cause rupture of the apex of the aneurysm, one of the most common causes of death in young to middle-aged adults, if coronary disease is excluded.

Epilepsy

Sudden Unexpected Death in Epilepsy: when a person with epilepsy suddenly dies, in whom a postmortem examination fails to uncover a gross anatomical, toxicological or environmental cause of death.

This is rarely a cause of sudden or unexpected death, as the process is relatively slow.
Cerebral hemorrhage especially in old age with hypertension which cause damage to intracerebral arterioles.

Infection meningitis (5% in children, 25% in neonate), encephalitis, abscess
Asthmatic patients: may die suddenly and unexpectedly, without necessarily being in status asthmaticus or even in an acute asthmatic attack. May be due to Hypoxia and respiratory acidosis. Autopsy little or nothing is found, except confirmation of the chronic asthmatic state.

Pulmonary embolism (most common cause of death in pregnancy):
In almost every case, the source of the emboli is in the leg veins and pelvic veins. After any tissue trauma, or even surgical operation, especially where immobility or bed rest occurs, deep vein thrombosis develops.

massive hemoptysis from cavitating pulmonary tuberculosis or from a malignant tumor

Pneumonia
Fatal abdominal catastrophes
some abdominal conditions go untreated may when the victim is a solitary person living alone with no opportunity to call for help

Mesenteric thrombosis and infarction, Strangulated intestine

Esophageal varices: It is often difficult to identify the varices at autopsy, as they have collapsed, but the absence of gastric or duodenal ulceration, and the congested, bluish vessels around the cardia often give away the lesion, especially in the presence of liver cirrhosis and splenomegaly.

Perforation of a peptic ulcer
If a woman in child-bearing age is found unexpectedly death, a complication of pregnancy must be considered like:

- Induced abortions
- Ruptured uterus
- Ruptured ectopic gestation
- Amniotic fluid embolism
### Autopsy-negative causes of death

<table>
<thead>
<tr>
<th>Category</th>
<th>Causes</th>
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<tbody>
<tr>
<td>Endocrinopathies</td>
<td>(DKA, thyrotoxicosis ..)</td>
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<tr>
<td>Electrolyte abnormalities</td>
<td></td>
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<tr>
<td>Other: malignant syndrome, Cardiac</td>
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<tr>
<td>dysrhythmia, anaphylaxis</td>
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Thanks!
Standards for SD investigation

- Unexpected or unexplained deaths in infants and children
- Unexpected or unexplained deaths when an individual was in apparent good health
- Deaths known or suspected to be caused by disease constituting a threat to public health
- Deaths of persons not under the care of a physician
The purposes investigation in SND

- provide invaluable information in the interest of public health by identifying public health risks and monitoring disease trends.
- identify emerging infectious disease or changes in disease patterns, hereditary diseases so proper prophylactic measurements may be taken.
- Medico legal reasons (In cases of violent deaths that have been disguised to be sudden unexpected death from natural causes).
Investigation

- Steps of Investigation
  - Preliminary steps
  - Scene Investigation
  - Post-mortem investigation (external / internal examination)
Preliminary

- Death must be certified by the attending physicians of the patient and is convinced that the death was caused by lethal disease that he knew the patient was suffering from.
- If the physician can’t certify the causal of death, then the authorities will do medico legal investigation.
Scene

- As with any scene, it should be noted whether the premises is locked and secured.
- the body and clothing should be carefully examined in order to rule out subtle signs of accidental or intentional injury.
- is the scene in appropriate order, or does there appear to have been a struggle, effort to clean up.
- When, and in what condition, was the decedent last seen? By whom?
- what condition is the body in (rigor mortis, livor mortis, decomposition, etc)?
- Where and how was the body found?
• What do they appear to have been doing at the time of death (ie, sleeping, vomiting, exercising)?
• What medications are found at the scene?
• Look in trash cans, toilets, etc, for evidence of diseases (ie, bloody emesis, melena).
• Is there a suicide note? (imp: the note may have been removed from the scene before the arrival of investigators or, less commonly, the individual may die of a natural disease before carrying out their suicidal intentions)
• Review witness and family statements
External examination

- Signs of malnutrition or dehydration.
- Supraclavicular congestion in sudden cardiac death.
- Fingernail clubbing in chronic heart disease.
- Splinter hemorrhage in infective endocarditis.
- Signs of trauma, such as manual strangulation or low-voltage electrocution.
General internal examination

- Organs should be examined in situ before manipulation.
- Fluid within any body cavity should be measured (volume) and described (serous, serosanguineous, purulent, chylous, frank blood).
- The lungs should be examined for evidence of hyperinflation (asthma, emphysema aquosum).
- Evisceration should be performed, or directly observed, by the pathologist.
- Evaluations for tension pneumothorax should be done before the thoracic cavity is entered.
- Internal examination of body systems most often implicated in sudden death (CVS, RS, CNS, GIS).
Special procedures

1- Photographs: both scenes of death and of autopsy appearance.

2- Radiography: used particularly in child abuse, gunshot wounds, identification and dentistry. X-rays\CT\ MRI\angiography.

3- Collection and preservation of evidence\or specimen.

4- microbiolology or Toxicological examination
Sudden infant death syndrome (SIDS)

- Crib death, syndrome in which healthy infants (1 month to a year) die from unknown causes (usually during sleep).

- Most deaths due to SIDS occur between 2 and 4 months of age, and incidence increases during cold weather.

- More boys than girls fall victim to SIDS.
SIDS risk factors:

- Smoking, drinking, or drug use during pregnancy.
- Poor prenatal care.
- Poor prenatal nutrition.
- Prematurity or low birth-weight.
- No breast feeding.
- Mothers younger than 20.
- Smoke exposure following birth.
- Overheating from excessive sleepwear and bedding.
- Stomach sleeping.
Thank you