FORENSIC & TOXICOLOGY SUMMARY

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Sudden Death

Death occurring instantaneously or within one hour of the onset of morbid symptoms (as per WHO 24 h is the limitation period).

✓ The autopsy is necessary to obviate the possibility of death due to foul play.

Causes:

- 1. Cardiovascular (44-50% of cases): Cardiovascular disease, particularly coronary artery atherosclerosis is the most common cause of sudden death.
- 2. Respiratory system (15-23% of cases).
- 3. Central nervous system (10-18% of cases).
- 4. Gastrointestinal system (6-8% of cases).
- 5. Genitourinary system (3-5%).
- 6. Endocrine
- 7. Iatrogenic like drug abuse.

Special Causes in Children:

- 1. Cot deaths or SIDS.
- 2. Mongols and others with congenital or mental abnormalities.
- 3. Concealed puncture wounds.

Coronary Atherosclerosis:

- The most common cause of death from cardiovascular disease is coronary atherosclerosis.
- Almost all adults show atherosclerotic plaques scattered throughout the coronary arterial system. However, significant stenotic lesions that may produce chronic myocardial ischemia show more than 75% (three- fourth) reduction in the cross-sectional area of a coronary artery or its branch.
- Acute occlusion of coronary artery may result from thrombosis or hemorrhage within the wall of the artery.
- The frequency of occlusion of the coronary arteries is:

Coronary artery	Percentage (%)
Left anterior descending Right coronary artery	40-50 30-40
Left circumflex artery	15-20

- The location of myocardial infarction (MI) is determined by the site of the vascular occlusion and by the anatomy of the coronary circulation.
- Most infarcts occur in the left ventricle in the anterior wall. Right ventricle is involved in < 10% of cases.
- Occlusion of the left anterior descending coronary artery typically causes an infarct in the anterior and apical areas of the left ventricle and the adjacent interventricular septum (anteroapical MI).
- Occlusion of the right coronary artery is responsible for most infarcts involving the posterior and basal portions of the left ventricle.
- Myocardial infarcts which involve the entire thickness of the ventricular wall are referred to as transmural infarcts, while those restricted to the inner one-third of the myocardium are called subendocardial infarcts.
- Fresh thrombi are dark-brown and are attached to the vessel walls. Old thrombi appear as homogeneous yellowish or gray, firm plugs blocking the vessels.
- Significant obstruction of the coronary artery lumen (with 75% narrowing of the lumen) without MI or thrombosis may lead to sudden death.

Postmortem Examination

- No naked eye change is seen for the first 12-18 h. The appearance of a myocardial infarct is determined primarily by its age. It is generally accepted that at least 12-24 h of survival postinfarction must occur for the earliest recognizable change to evolve in the heart.
- The essential sequence of events consists of coagulation necrosis and inflammation, followed by the formation of granulation tissue, resorption of the necrotic myocardium, and finally organization of the granulation tissue to form a collagen-rich scar. These events occur in a fairly predictable pattern, allowing one to estimate the age of a given infarct from its gross and microscopic appearance
- Immersion of tissue slices in a solution of triphenyl tetrazolium chloride (TTC) gives red color to the intact area (where dehydrogenase is preserved), but infarcted area appears pale if seen in about 4h

Enzyme histochemistry is the most reliable method of detecting early MI. Dehydrogenases – succinic, lactic, malic, hydroxybutyric and cytochrome oxidase are among those used. With malate dehydrogenase, normal myocardium stains dark blue-black and infarcted area is devoid of color:

- 1. Periodic Acid-Schiff (PAS) stain: In early infarcts (at least 28 h), damaged myofibres stain a pale purpleblue with PAS, compared with the pink color of healthy fibres.
- 2. Hematoxylin-Eosin (H&E) autofluorescence: Routine formalin-fixed H&E sections are examined under UV light. Early infarcted fibres show a shift of their secondary emission towards yellow, away from the usual olive- green of healthy fibres.
- 3. Acridine-Orange fluorescent stain: Slides are examined under UV light; normal myocardium is golden brown/yellowish brown with damaged fibres showing a shift to green.

Anaphylactic Deaths

- Most anaphylactic deaths seen by forensic pathologist are caused by insect bites, drugs or foods.
- Signs and symptoms: Faintness, itching of the skin, urticaria, tightness in the chest, wheezing, respiratory difficulty and collapse.
- A typical anaphylactic reaction results in acute respiratory distress or circulatory collapse.
- o In anaphylactic deaths, the onset of symptoms is usually immediate or within the first 15-20 min
- Death usually occurs within 1-2 h.

Vagal Inhibition (Vasovagal Shock/Reflex Cardiac Arrest/Nervous Apoplexy)

- Sudden death occurring within seconds or minutes as a result of minor trauma or harmless peripheral stimulation may be caused by vagal inhibition.
- Pressure on the baroreceptors situated in the carotid sinuses, carotid sheaths and the carotid body (located in the internal carotid artery and situated near the angle of mandible) causes an increase in blood pressure in these sinuses with resultant slowing of the heart rate, dilatation of blood vessels and fall in blood pressure.
- Causes:
 - 1. Pressure on the carotid sinuses, as in hanging or strangulation.
 - 2. Unexpected blow to the larynx, chest, abdomen and genital organs.
 - 3. Impaction of food in the larynx or sudden inhalation of fluid into the upper respiratory tract.
 - 4. Sudden immersion of body in cold water.
 - 5. The insertion of an instrument into the bronchus, uterus, bladder or rectum.
 - 6. Puncture of a pleural cavity producing a pneumothorax.

7. Sudden evacuation of pathological fluids, e.g. ascitic tap.

Postmortem examination:

There are no characteristic postmortem findings. The cause of death can be inferred only by exclusion of other pathological conditions and from the observation of reliable witnesses, history and clinical findings concerning the circumstances of death.

Notes:

- The most common cause of sudden death in a young patient after exercise is: Ruptured berry aneurysm then hypertrophic obstructive cardiomyopathy (HOCM).
- **Most common cause of unexplained death in adult females:** Ischemic heart disease
- Gordon's clarification of death signifies: Mode of death