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MATRIC NUMBER: 17/MHS02/080

COURSE: CELLULAR PATHOLOGY ASSIGNMENT (NSC 308)

DEPARTMENT: NURSING SCIENCE

LEVEL: 300LEVEL

1. Write explicitly on five diagnostic techniques use in pathology, relevant illustrations and examples required.

2. Cellular adaptation precedes cell death, discuss. Diagrams essential.

1. The pathologist uses the following techniques to diagnose diseases;
2. Histopathology
3. Cytopathology
4. Hematopathology
5. Immunohistochemistry
6. Autopsy
7. **Histopathological Techniques**

Histopathological techniques examination studies tissues under the microscope. During the study, the pathologist looks for abnormal structures in the tissue. Biopsy is a tissue sample from a living person to identify the disease. Biopsy can be either incisional or excisional. Once the tissue is removed from the patient, it has to be immediately fixed by putting it into adequate amount of 10% formaldehyde (10% formalin) before sending it to the pathologist.

The purpose of fixation is;

1. To prevent autolysis and bacterial decomposition and putrefaction.
2. To coagulate the tissue to prevent loss of easily diffusible substances.
3. To fortify the tissue against the deleterious effects of the various stages in the preparation of sections and tissue processing.
4. To leave the tissues in a condition this facilitates differential staining with dyes and other reagents.

Once the tissue arrives at the pathology department, the pathologists will exam it macroscopically (i.e. naked-eye examination of tissues). Then the tissue is processed to make it ready for microscopic examination. The whole purpose of the tissue processing is to prepare a very thin tissue processing is to prepare a very thin tissue which can be clearly seen under the microscope. The tissue is processed by putting it into different chemicals. It is then impregnated (embedded) in paraffin, sectioned (cut) into thin slices and is finally stained. The stains can be Hematoxylin/Eosin stain or special stains such as PAS, immunohistochemistry, etc…..

The Hematoxylin/Eosin stain is usually abbreviated as H&E stain. The H&E stain is routinely used. It gives the nucleus a blue color and the cytoplasm and the extracellular matrix a pinkish color. Then the pathologist will look for abnormal structures in the tissue and based on this abnormal morphology he/she will make the diagnosis. Histopathology is usually the gold standard for pathologic diagnosis.

Example: punch biopsy: removal of a cone shaped core of tissue can be used for investigation of palpable breast lumps (breast cancer)

1. **Cytopathology techniques**

 Cytopathology is the study of cells from various body sites to determine the cause or nature of disease.

Applications of cytopathology

 The main applications of cytology include the following:

1. Screening for the early detection of asymptomatic cancer.

For example, the examination of scrapings from cervix for early detection and prevention of cervical cancer.

1. Diagnosis of symptomatic cancer: Cytopathology may be used alone or in conjunction with other modalities to diagnose tumors revealed by physical or radiological examinations. It can be used to diagnosis of cysts, inflammatory conditions and infections of various organs.
2. Surveillance of patients treated for cancer

 For some types of cancers, cytology is the most feasible method of surveillance to detect recurrence. The best example is the periodic urine cytology to monitor the recurrence of cancer of the urinary tract.

Cytopathology methods

 There are different cytopathologic methods including

1. fine-needle aspiration cytology (FNAC): In FNAC, cells are obtained the diseased organ using a very thin needle under negative pressure. Virtually any organ or tissue can be sampled by fine needle aspiration. The aspirated cells are then stained and are studied under the microscope.

2. Exfoliative cytology: Refers to the examination of cells that are shared spontaneously into body fluids or secretions. Examples include sputum, cerebrospinal fluid, urine, infusions in body cavities (pleural, pericardium, peritoneum), nipple discharge and vaginal discharge.

3. Abrasive cytology: This refers to methods by which cells are dislodged by various tools from body surfaces (skin, mucous membranes, and serous membranes).

Example: Sputum cytology can be done if pneumonia or tuberculosis is suspected, urine cytology in cases of suspected transitional cell carcinoma.

1. **Hematological Examination**

 This is a method by which abnormalities of the cells of the blood and their precursors in the bone marrow are investigated to diagnose the different kinds of anemia, diseases related to defective blood clothing, abnormalities of the red blood cells, thromboembolic disease such thrombus formation. Furthermore it is used to diagnose and identify the best treatment for blood cancer, Hodgkin’s disease, acute myeloma and myeloproliferative disorders such as essential thrombocythemia, polycythemia Vera and myelofibrosis.

Example: Full blood count or FBC testing is a routine test that evaluates three major components found in blood: white blood cells, red blood cells and platelets.

1. **Immunohistochemistry**

 This is the study of the chemistry of the immune system. This involves the study of properties, functions, interactions and production of the chemical component (antibodies/ immunoglobulin, toxin, epitopes of proteins like CD4, antitoxins, cytokines/chemokines, antigens) of immune responses and determination of immune materials by immunochemical assays.

 In addition, immunochemistry is the study of identities and functions of the components of the immune system. Immunochemistry is also used to describe the application of immune system components, in particular antibodies, to chemically labeled antigen molecules for visualization.

 Immunochemistry is also studied from the aspect of using antibodies to label epitopes of interest in cells (immunocytochemistry) or tissues (immunohistochemistry)

Example: BrdU, cytokeratins, immunochemistry is used as the wasserman test to detect syphilis.

1. **Autopsy**

 Autopsy is examined of the dead body to identify the cause of death. This can be for forensic or clinical purposes.

 The relative importance of each of the above disciplines our understanding of diseases varies for different types of diseases. For example, in diabetes mellitus, biochemical investigation provides the best means of diagnosis and is of greatest value in the control of the diseases. Whereas in the diagnosis of tumors, FNAC and histopathology contribute much. However, for most diseases, diagnosis is based on a combination of pathological investigations.

Example: A forensic autopsy is carried out when the cause of death may be a criminal matter, while a clinical or academic autopsy is performed to find the medical cause of death and is used in cases of unknown or uncertain death, or for research purposes.

2. Cellular adaptation refers to changes made by a cell in response to adverse or varying environmental changes. The adaptation may be physiologic (normal) or pathologic (abnormal). Four types of morphological adaptations include atrophy, hypertrophy, hyperplasia, and metaplasia. Cell damage (also known as cell injury) is a variety of changes of stress that a cell suffers due to external as well as internal environmental changes. Amongst other causes, this can be due to physical, chemical, infectious, biological, nutritional or immunological factors. Cell damage can be reversible or irreversible. Depending on the extent of injury, the cellular response may be adaptive and where possible, homeostasis is restored. Cell death occurs when the severity of the injury exceeds the cell's ability to repair itself. Cell death is relative to both the length of exposure to a harmful stimulus and the severity of the damage caused. Cell death may occur by necrosis or apoptosis.

