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COURSE; Cellular pathology

**ANSWERS**

1. 5 diagnostic techniques used in pathology are;
* Histopathology
* Cytopathology
* Flow cytometry
* Immunocytochemistry
* Immunohistochemistry
1. **Histopathology**

Histopathological examination studies tissues under the microscope. During this study, the pathologist looks for abnormal structures in the tissue.

Tissues for histopathological examination are obtained by biopsy. Biopsy is a tissue sample from a living person to identify the disease. Biopsy can be either incisional or exicisional .

Once a tissue is removed from the patient, it has to be immdediately 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 which facilitate diffferntial 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 (i.e five to seven um or one thick 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 Hemotoxylin/Eosin stain or special stains such as PAS, immunohistochemistry, etc….

The Hemotoxylin/Eosin stain is usually abbreviated as H&E stain. The H&E stain is routinely used. It gives the nucleus a blue colour and the cytoplasm and the extracellular matrix a pinkish colour. 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.

1. **cytopathology**

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 cytopathology include the following;

1. **screening for the early detection of asymptomatic cancer**

for example the examination of scrapings from cervix is used 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 in the diagnosis of cysts, inflmmatory conditions and infections of various organs.

1. **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 periodic urine cytology to monitor the recurrence of cancer of the urinary tract.

**Cytopathologic methods;**

There are different cytopathologic methods including;

1. **Fine-needle aspiration cytology (FNAC)**

In FNAC , cells are obtained by aspirating the diseased organ using a very thin needle under negative pressure.

1. **Exfoliative cytology**

This refers to the examination of cells that are shed spontaneously into the body fluids or secretions. Examples include sputum, cerebrospinal fluids, urine.

1. **Abrasive cytology**

Refers to methods by which cells are dislodged by various tools from body surfaces (skin, mucous membranes, and serous membranes). E.g in the preparation of cervical smears with a spatula or a small brush to detect cancer of the uterine cervix at early stages. Such cervical smears, also called pap smears, can significantly reduce the mortality from cervical cancer.

1. **Flow cytometry**

(FCM) is a technique used to detect and measure physical and chemical characteristics of a population of cells or particles.

In this process, a sample containing cells or particles is suspended in a fluid and injected into the flow cytometer instrument. The sample is focused to ideally flow one c ell at a time through a laser beam, where the light scattered is characteristic to the cells and their components.

Cells are often labeled with fluorescent markers so light is absorbed and then emitted in a band of wavelengths. Tens of thousands of cells can be quickly examined and the data gathered are processed by a computer.

Flow cytometry is routinely used in basic research, clinical practice, and clinical trials.

Uses for flow cytometry include;

* Cell counting
* Cell sorting
* Determining cell characteristics and function
* Detecting microoragnisms
* Bio marker detection
* Protein engineering detection
* Diagnosis of health disorders such as blood cancers

A flow cytometry analyzer is an instrument that provides quantifiable data from a sample. Other instruments using flow cytometry include cell sorters which physically separate and thereby purify cells of interest based on their optical properties.

1. **Immunocytochemistry (ICC)**

This is a common laboratory technique that is used to anatomically visualize the localization of a specific protein or antigen in cells by use of a specific primary antibody that binds to it. The primary antibody allows visualization of the protein under a florescence microscope when it is bound by a secondary antibody that has a conjugated flurophone. ICC allows researchers to evaluate whether or not cells in a particular sample express the antigen in question. In cases where an immuopositive signal is found, ICC also allows researchers to determine which sub cellular compartment are expressing the antigen.

1. **Immunohistochemistry (IHC)**

Using the principle of antibodies binding specifically to antigens in biological tissues to detect the antigens (e.g.proteins) in cells of a tissue section. Immunohistochemistry (IHC) is a process used to diagnose some types of cancer including mesothelioma. The procedure involves locating antigens in biopsy tissue through the use of a visual marker. Common markers include fluorescent dye, enzymes, colloidal gold and radioactive elements. If cellular events associated with cancerous tumors –such as an increase In cell death – are evident in the tissue, then the abnormal activity will be highlighted by the stained tissue sample. Immunohistochemistry cannot only help in the identification of a tumor, but it can also distinguish whether or not a tumor is benign or malignant.

1. Cellular adaption is the ability of cells to respond to various types of stimuli and adverse environmental changes. These adaptations include hypertrophy (enlargement of individual cells), hyperplasia (increase in cell number), atrophy (reduction in size and cells number), metaplasia (transformation from one type of epithelium to another), and dysplasia (disordered growth of cells)

When cells are injured or exposed to adverse environmental changes it may either be reversible cell injury leading to adaptation or irreversible cell injuries which occurs cells are not able to adapt to the adverse environmental changes, which leads cell death that occurs physiologically in the form of apoptosis , or pathologically, in the form of necrosis.

