DANJUMA JANET JAGILA

18/MHS02/202
NURSING 300l
CELLULAR PATHOLOGY ASSIGNMENT

1 <u>Diagnostic techniques used in pathology</u>
The pathologist uses the following techniques to the diagnose diseases:

a. Histopathology
b. Cytopathology
c. Immunohistochemistry d. Cytogenetics
e.. Autopsy

A. **Histopathological techniques**

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 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 which facilitates differential staining with dyes and other reagents.

Once the tissue arrives at the pathology department, the pathologist 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 μm or one cell 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, & 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 & the cytoplasm & 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.

B. **Cytopathologic 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.

2. 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, inflammatory conditions and infections of various organs.

3. 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.

Advantages of cytologic examination
Compared to histopathological technique it is cheap, takes less time and needs no anesthesia to take specimens. Therefore, it is appropriate for developing countries with limited resources like Ethiopia. In addition, it is complementary to histopathological examination.

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. Virtually any organ or tissue can be sampled by fine-needle aspiration. The aspirated cells are then stained & are studied under the microscope. Superficial organs (e.g. thyroid, breast, lymph nodes, skin and soft tissues) can be easily aspirated. Deep organs, such as the lung, mediastinum, liver,

pancreas, kidney, adrenal gland, and retroperitoneum are aspirated with guidance by fluoroscopy, ultrasound or CT scan. FNAC is cheap, fast, & accurate in diagnosing many diseases.

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

3. Abrasive cytology
Refers to methods by which cells are dislodged by various tools from body surfaces (skin, mucous membranes, and serous membranes). E.g. 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. Cervical cancer is the most common cancer in Ethiopian women.

C. **Clinical genetics (cytogenetics)**
Cytogenetics is the study of chromosomal structure, location and function in cells. It includes the study of chromosome number and appearance (karyotyping), the physical location of genes on chromosomes, and chromosomal behaviour in processes such as cell division.
It is a method in which inherited chromosomal abnormalities in the germ cells or acquired chromosomal abnormalities in somatic cells are investigated using the techniques of molecular biology. Cytogenetic techniques are central to the assignment and localization of genes to chromosomes and thus to the construction of genetic maps. They have played an important role in the verification of gene order in such maps and have contributed to the effort to sequence the human genome.

D. **Immunohistochemistry**
It is the most common application of immunostaining. It involves

the process of selectively identifying antigens (proteins) in cells of a tissue section by exploiting the principle of antibodies binding specifically to antigens in biological tissues.

Visualising an antibody-antigen interaction can be accomplished in a number of ways, mainly either of the following:

Chromogenic immunohistochemistry (CIH), wherein an antibody is conjugated to an enzyme, such as peroxidase (the combination being termed immunoperoxidase), that can catalyse a colour-producing reaction.

Immunofluorescence, where the antibody is tagged to a fluorophore, such as fluorescein or rhodamine. This is a method is used to detect a specific antigen in the tissue in order to identify the type of disease.

E. **Autopsy**

An autopsy (also known as a post-mortem examination or necropsy) is the examination of the body of a dead person and is performed primarily to determine the cause of death, to identify or characterize the extent of disease states that the person may have had, or to determine whether a particular medical or surgical treatment has been effective. Autopsies are performed by pathologists, medical doctors who have received specialty training in the diagnosis of diseases by the examination of body fluids and tissues.

The relative importance of each of the above disciplines to our understanding of disease 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 disease. Whereas in the diagnosis of tumors, FNAC & histopathology contribute much. However, for most diseases, diagnosis is based on a combination of pathological investigations.

2. <u>Cellular adaptation precedes cell death discuss!!!</u>

The diagram below explains this sequence. Cellular adaptation is the ability of cells respond to various types of stimuli and adverse environmental changes. These adaptations include Hypertrophy (enlargement of individual cells), Hyperplasia (increase in the number of cells), Atrophy (reduction in the number and size of cells), Metaplasia (transformation of one epithelium to another) and Dysplasia (disordered growth of cells). Tissues adapt differently depending on the replicative characteristics of the cells that make up the tissue. For example, labile tissue such as the skin can rapidly replicate and therefore can also regenerate after injury whereas permanent tissue such as neural and cardiac tissue cannot regenerate after injury. Its cells are not able to adapt to the adverse environmental changes. Cellular adaptation could be normal (physiological) or abnormal (pathological).

When cells are injured, one or two patterns will gradually occur; reversible cell

injury leading to adaptation of the cells and tissues, or irreversible cell injury leading to cell death and tissue damage. Injured cells may accumulate materials including fat, cholesterol, protein, glycogen or pigment. When cells are irreversibly injured and dying, specific nuclear changes may be visible including pyknosis, karyrrhexis and karyolysis. If large number of cells dies, tissue necrosis may occur. Observable patterns of necrosis include; coagulative, liquefactive, fibrinous, gummatous, fat, gangrene and caseous necrosis.

Cell Injury
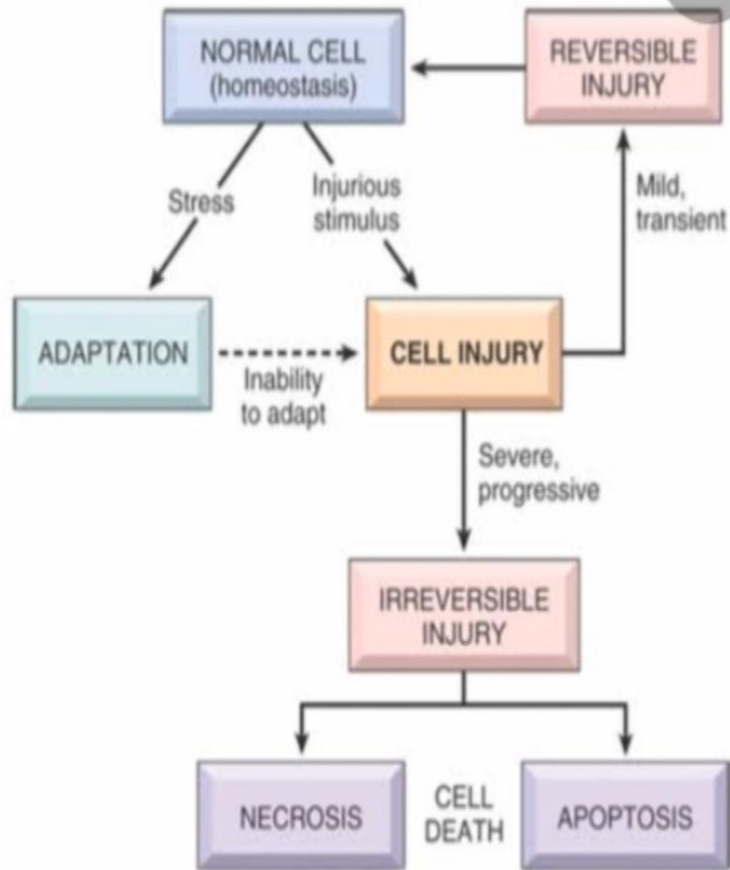
References

Bezabeh ,M. ; Tesfaye,A.; Ergicho, B.; Erke, M.; Mengistu, S. and Bedane,A.; Desta, A.(2004). General Pathology. Jimma University, Gondar University Haramaya University, Dedub University.