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Cytopathology: An Important Aspect of Medical Diagnosis

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Abstract

The scientific subject of pathology examines how illness develops and how infrastructure changes. There are several subspecialties within pathology that focus on the ultimate diagnosis and serve as the cornerstone for the patient's treatment and recovery. It includes blood banking, serology, histopathology, cytopathology, microbiology, biochemistry, and hematology. From the days when a microscope was considered unnecessary to the present, when it is considered essential, pathology has advanced quickly. Surgeons and physicians initially invented the notion and field of pathology. It underwent a protracted legal battle before emerging as a crucial component of illness diagnosis. Microscopy is currently used to make the majority of pathological diagnoses, apart from normal compound microscopes, which are commonly used in every pathology more advanced microscope with high resolution such as electron microscopes and fluorescent microscopes has been introduced. Pathology advanced swiftly with the advent of microscopes, analyzers, centrifuges, ELISA readers, many types of stains, and other tissue processing techniques, propelling it to the forefront of illness diagnosis, where it subsequently diversified into several subspecialties. Pathology is a broad subject that encompasses every system of the human body and has numerous subdivisions such as histopathology, which deals with tissues and their interpretation; cytopathology, which deals with aspirated material and effusion fluids; hematology, which deals with the study of blood disorders; biochemistry, which deals with blood serum for various enzymatic tests; and microbiology, which deals with culture and identification of microorganisms using various stains. Blood transfusions are provided by a blood bank. Pathology is an essential component of healthcare units because it provides a comprehensive investigation that serves as the foundation for patient therapy. Pathological findings are heavily relied on by surgeons and physicians when deciding on a course of therapy for a patient.

Keywords: Diagnosis, grossing, surgeon, reports, investigation, treatment

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INTRODUCTION

Pathology can be understood in two steps, the first step is general pathology, which deals with the basic mechanisms and characteristics of the disease process, such as the process of inflammation, cancer formation, and thrombus formation. The second step is systemic pathology, which is the study of organ-wise pathological changes such as cardiac diseases, and lung diseases. However, due to the vastness of the subject and the limitation of time, undergraduate students need to focus on basic diseases. Pathological samples of many types can be used for diagnosis, including blood for hematological examination and fine needle aspiration for cytological investigation. Fluid, such as effusions for fluid cytology, Tru-cut biopsy, Needle biopsy, such as renal and liver biopsies, and Excision biopsy are all histological procedures [1, 2].

PROPER DIAGNOSIS REQUIREMENTS

Accurate pathological diagnosis requires the pathologist to have a medium of reference.

- Clinical information in detail
- Sufficient tissue
- Tissue that has been thoroughly treated
- A thorough history
- Local investigation
- Systemic investigation
- Radiological examination
- Research into biochemistry.
- Hematological examination
- Pathological examination

Detailed Clinical Information

Many of the diagnoses depend on clinicopathological correlation, for example,

- Skin diseases,
- Bone and joint diseases.
  For accurate diagnosis of bone diseases, a correlation with X-ray findings is mandatory. Osteopathological diagnosis is based on clinicoradiological and pathological correlation.

Adequate Tissue

Pathologists always favor excisional biopsy since it is a large volume and allows for additional specialized investigations, such as specific stains, immunohistochemistry, molecular pathology, and so on. However, some of the newer procedures, such as fine needle aspiration cytology (FNAC), are very painless, inexpensive, and yield speedy findings [3, 4].

TYPES OF SAMPLING

Fine Needle Aspiration Cytology (FNAC)

A conventional 23-gauge injection needle is manually inserted into a lesion or guided by computed tomography (CT) or ultrasound. Suction is created by the syringe and the material is sucked in. The needle is removed, the contents of the sucked-in tube are put onto a clear slide, and a smear is created with another slide. The smear is stained by:

- *Hematoxylin and Eosin stain (H&E stain):* It is one of the most important stains used in histopathology.
- Giemsa stain
- *Papanicolaou stain (PAP stain):* This method of diagnosis from the examination of aspirated cells is called cytopathology. This is one of the initial techniques used in pathological diagnosis. However, the sample is often inadequate or further investigations on the aspirated material become difficult due to low cellularity.
- The other type of cytopathological investigation is exfoliative cytology.

Advantages

- *Rapid diagnosis:* The smear is quickly fixed, stained, and examined within a few minutes.
- It is an extremely minor procedure that can be done in the department of pathology.
- No significant complications.
- Does not damage vital structures.

Disadvantages

- Sampling is often inadequate.
- Conclusive opinion is not always possible.
- Anaphylactic shock may occur while aspirating parasitic cysts, for example, cysticercosis.

Exfoliative Cytology

Exfoliative cytology is the study of cells that naturally drop off or shed off (exfoliate) from epithelial surfaces into body cavities such as the cervical canal or respiratory system. Scraping can be used to gather exfoliated cells. Brushing or lavage can be performed, as well as the preparation of a slide smear. The smear is frequently stained with PAP stain for microscopic inspection [5–9]. Application of exfoliative cytology are:

- Detection of mucosal and skin lesions of the mouth, for example, acantholytic cells of pemphigus, Candida hyphae, etc.
- Detection of premalignant and malignant lesions of the cervix. This is also called pap smear cytology. The cervix is scraped by Ayers spatula and the content is put on a glass slide; a smear is made which is then stained by Papanicolaou stain. Hence, the name pap smear.
- Diagnosis of bronchial carcinoma by:
  - Sputum
  - Bronchoalveolar lavage
  - Brush cytology through the bronchoscope.
- Detection of urinary tract lesions by urine cytology.
- Diagnosis of malignant or benign lesions in effusion fluid of the peritoneal cavity, pleural cavity, pericardial cavity, etc.
- Detection of central nervous system (CNS) lesions through cerebrospinal fluid (CSF) cytology.

Cell Blocks

Cell blocks are made in many laboratories using cytology samples. Samples for FNAC, or exfoliative cytology, are centrifuged and the precipitate is preserved in 10% formalin. The paraffin block is then created in the same manner as in tissue biopsies. For diagnosis, these are cut-like tissue biopsies stained with H&E. Its advantage is that it is like histopathology and multiple sections can be cut from the paraffin block and further study can be done [10–13].

Biopsies

- Excision biopsy
- Tru-cut biopsy
- Needle biopsy.

Excision Biopsy

The removal of the whole of a lesion is called an excision biopsy. It is used to confirm a clinical diagnosis and as a mode of treatment; for example, the removal of a cyst (mucocele). This is used to determine the diagnosis before deciding on a treatment. This is called an incisional biopsy [14, 15].

Tru-cut Biopsy

Tru-cut is a long needle of 18–21 gauge diameter. The needle has a trough that collects tissue. Under aseptic conditions, the lesion is fixed with fingers and the sterile cannula with a needle inside is pushed into the lesion. As the needle enters the lesion, it cuts a thin cylindrical tissue. The cannula is then slightly pushed in to cover the cylindrical tissue and the needle, along with the cannula, is then withdrawn [16].

Needle Biopsy

- Needle biopsy is used to remove the core of tissue.
- The specimen is fixed and processed like large samples.
- It is useful for lesions in difficult-to-reach regions, such as the liver, kidney, and prostate.
- Generally, it is not used in head and neck lesions.

Liver Biopsy

Vim Silvermans needle is introduced into the liver between the ninth and tenth intercostal space in the mid-axillary line [17].

Indications

- Cirrhosis of the liver
- Chronic hepatitis
- Inflammatory diseases of the liver, for example, tuberculosis
- Storage diseases
- Primary malignancy of the liver
- Liver metastasis
- Unexplained hepatomegaly
- Pyrexia of unknown origin

Renal Biopsy

Renal tissue is obtained by needle biopsy using a percutaneous method (similar to liver biopsy). Whatever may be the type of the sample, they are immediately preserved (fixed) in preservation till further processing is done. The amount of formalin should be 10–20 times the volume of the sample. The most common preservative used is formalin.

Handling of Samples

- The samples should be immediately put in a glass, plastic, or metal container, and transported to the pathology department. The proper amount and type of fixative should be added before transport.
- If a delay in transportation is anticipated, the sample should be kept at 4°C and transported as soon as possible. This will slow down autolysis.
- Small biopsies such as endoscopic biopsy, needle biopsy, or small incisional biopsy should be properly oriented and immediately placed in appropriate fixative, for example, renal biopsy is preserved in those different fixatives, such as formalin for routine H&E, glutaraldehyde for electron microscopy and phosphate buffer saline for immunofluorescence.

GROSSING

On receiving the specimen, the pathologist evaluates it grossly and records the finding on the surgical pathology requisition form. These forms contain clinical details filled in by clinical residents and sent along with the specimen.

Steps in Grossing

Scrutiny of surgical pathology requisition form. It must contain:

- Patients name, CR number
- Age
- Sex
- Clinical and investigative details
- Operative findings
- Type of sample
- Clinical diagnosis

Orientation of the Specimen

The specimen should be properly oriented to identify anatomical landmarks, resected margins, and the size of the lesions.

Grossing also includes documenting the following:

- Type of specimen received; for example, hemiglossectomy or glossectomy
- Dimension, for example,
  - Dimension of tumor
  - Dimension of an ulcer
- Weight, for example, weight of tumor
- Colour, for example, Yellow-Generally endocrine tumours are yellowish.

FIXATION AND PRESERVATION

Before the tissue is processed it has to be fixed for preservation. There is a large number of fixatives. The important ones are:

- Formalin
- Bouins fixative

CONCLUSION

Pathology is the backbone of a healthcare unit. Every treatment and diagnosis are based on a pathological report. There are various subspecialties of pathology, such as haematology, biochemistry, microbiology, blood banking, histopathology, and serology. Haematology mostly deals with anticoagulated blood, biochemistry with serum, blood banking with blood transfusion, microbiology with cultures and media preparations, etc. The Department of Histopathology and Cytopathology holds great relevance as it deals with various cancerous tissues and effusions. They form an integral part of the cancer unit in a hospital.

Unwanted development inside the human body should not be ignored, as it can be cancerous. After the removal of such development, the specimen is fixed and sent to the histopathology department for further investigation. Following a set of protocols for receiving the specimen, grossing is conducted under the supervision of pathologists. A very thin tissue section is trimmed, stained, and mounted, enabling the pathologist to take a better scan of the slide. Most pathologies are equipped with highly sophisticated machines that enable high-quality results and better treatment for patients.

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