

Pathology-An Overview

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Abstract

Pathology is a wide area of medical science, which mainly deals with garnering diagnostic information to patients and clinicians. Knowledge or discovery of the prime cause remains the backbone on which a diagnosis can be made, a disease understood, & the treatment developed. There are twelve main subdivisions in pathology. This review paper discusses the different dynamics of pathology and pathologist.

Keywords- *pathology, pathologist, diagnostic information, patients and clinicians.*

INTRODUCTION

The core aspects of diseases in pathology - Pathology is the study and learning of disease by scientific methods. The word pathology came from the Latin words “patho” & “logy”. „Patho“ means disease and „logy“ means study, therefore the branch pathology is a scientific study of disease. Diseases may, in turn, be quite defined as an abnormal variation in structure or function of any part of the body. Pathology gives the explanations of a disease by studying the following the four aspects of the disease.

1. Etiology,
2. Pathogenesis,
3. Morphologic changes and
4. The Functional derangements and clinical significance.

Etiology of a disease means the causes of the disease (Levison et al.,2008). If the cause of a disease is known it is called primary etiology. If the cause of the disease is unknown it is called the idiopathic. There are two major classes of etiologic factors: the genetic and acquired (infectious, nutritional, chemical, physical, etc). Detailed discussion will be given in the subsequent topics. The etiology is followed by pathogenesis(NJ. Kummar et al.,2010).

Branches of Anatomic Pathology

1. General pathology which mainly deals with the study of the common basic changes in all tissues as a result of the disease, e.g., cell injury, necrosis, inflammation and neoplasm (Killen,2004).
2. Systemic pathology which deals with the study of the morphological changes in tissues and organs of the particular system as a result of a disease e. g., pathology of respiratory system, pathology of the digestive system, pathology of nervous system...etc.
3. Special pathology which deals with the application of the main basic changes learned in general pathology to the varied specific diseases e.g Diabetes, atherosclerosis etc.
4. Diagnostic Pathology (Histopathology) which deals with the study of the tissue abnormalities availing gross and microscopic examination of biopsy samples.

Biopsy: The biopsy is a tissue sample obtained surgically from the living body in order to be examined grossly and microscopically (by a pathologist) to aid in establishing the diagnosis of the pathological conditions

5. Cytopathology which deals with the study of the cellular changes.
6. Surgical Pathology which refers to the his to pathological examination of biopsy samples surgically removed from living bodies.
7. Post-mortem pathology which deals with the pathological examination of human cadaver after death. It is also known as the autopsy or necropsy(Naib,1996).

8. Forensic pathology: It is the subspecialty of the pathology that focuses on the medico-legal investigation of the cause of a sudden or the unexpected death by examination of the dead body. The term forensics is derived from the Latin word *forēnsis* which means forum (law court) (Majno et al.,2004).
9. The Physiological pathology which deals with the study of alterations in the functions of organs and the systems of the body as a result to a disease. It is also known as pathophysiology; e.g., patho physiology of the indigestion, diarrhea, abortion.....etc.
10. Immuno pathology which deals with the study of diseases mediated by the immune reactions. Such as the immunodeficiency diseases, autoimmune diseases and hypersensitivity reactions.
11. Molecular pathology which deals with the study of the alterations that take place at the molecular level (e.g., DNA damage) as a result to a particular disease.
12. Experimental pathology It is the study of the diseases that have been created or Induced experimentally to analyze the structural &the functional abnormalities in tissue to better understand the mechanisms of underline diseases. Usually laboratory animals used in experimental pathology (Rabbits, Rats, Mice....etc). Illness: It means that the individual is sick, means some part of the body is quiet not functioning properly. But some disease conditions or clinical conditions not companied by a clinical illness means the perfectly healthy e.g. stroke & heart attack (Churchill Livings tone,1988).

Pathogenesis of Cell Injury

Injury to the normal cell by one or much more of the above listed etiologic agents may result in a state of reversible or the irreversible cell injury. The underlying alterations in biochemical systems of cells for the reversible and irreversible cell injury by various agents is complex and varied. However, in general, the following principles mainly apply in pathogenesis of most forms of cell injury by the various agents.

1. **Type duration and severity of injurious agent:** The extent of the cellular injury depends upon type, duration and severity of the stimulus e.g. small dose of the chemical

toxin or short duration of ischaemia cause reversible cell injury while the large dose of the same chemical agent or persistent ischaemia cause cell death.

2. **Type, status and the adaptability of target cell:** The type of cell as regards its susceptibility to injury, its nutritional and the metabolic status, and adaptation of the cell to hostile environment determine the extent of cell injuries e.g. skeletal muscle can withstand the hypoxic injury for long-time while cardiac muscle suffers irreversible cell injury after 20-32 minutes of persistent ischaemia.
3. **Underlying intracellular phenomena:** Irrespective of the other factors, following essential biochemical phenomena underlie all forms of cell injury: i) Mitochondrial damage causing ATP depletion. ii) The Cell membrane damage disturbing the metabolic and the trans-membrane exchanges. iii). Release of toxic free radicals
4. **Morphologic consequences:** All forms of the biochemical changes underlying cell injury are expressed in terms of the morphologic changes. The ultra structural changes become apparent earlier than the light microscopic alterations. The morphologic transformation of reversible cell injury (e.g. hydropic swelling) appear earlier than morphologic alterations in the cell death (e.g. in myocardial infarction) (ChurchillLivingstone,1995).

Pathogenesis In general, all forms of the shock involve following 3 derangements: Reduced effective circulating blood volume. Reduced supply of the oxygen to the cells and tissues with resultant anoxia. Inflammatory mediators and the toxins released from shock induced cellular injury. These derangements initially set in a compensatory mechanisms (discussed below) but eventually a vicious cycle of cell injury and the severe cellular dysfunction lead to breakdown of organ function.

1. **The Reduced effective circulating blood volume.** It may result by either of the following mechanisms: i) by the actual loss of blood volume as occurs in hypovolaemic shock; or ii) by decreased cardiac output without the actual loss of blood (normovolaemia) as occurs in the cardiogenic shock and septic shock.

2. Impaired tissue oxygenation. Following reduction in the effective circulating blood volumes from either of the above two mechanisms and from any of the etiologic agents, there is quite decreased venous return to the heart resulting in decreased cardiac outputs.
3. This consequently causes reduced supply of the oxygen to the organs and tissues and hence tissue anoxia, which sets in cellular injury(Saunders et al.,1996).

Clinical Pathology

There are two basic schools of thought about the practices of pathology. In most European countries, a pathologist deals principally with the microscopic evaluation of tissue specimens (small biopsy samples as well as large resection specimens) and the cytological material. As an adjunct to this his to logic and the cytological evaluation, a pathologist uses some ancillary methods (such as immune his to chemistry (IHC) or the molecular and genetic examinations) for more accurate diagnosis, classification, and the prognostication of diseases. In the United States, a pathologist is, in addition, responsible for all the laboratory investigations that are elsewhere covered by disciplines such as microbiology and the laboratory medicine. These analyses are carried out on body fluids (blood, the serous fluids, urine, feces, etc.), secretions of organs the (exocrine secretions of pancreas), or other materials that are taken out from or expectorated by a patient (sputum, the coverings of skin ulcers, etc.). Some conditions like diabetic nephropathy were the urea ,creatine, electrolytes in the body has to be assessed it is performed under the supervision of pathologist(S.Sreeremya,2023). Even the Cauda Equina Syndrome Bowel Dysfunction is performed under the supervision of pathologist, other serious illness is also assessed in laboratory by pathologist (S.Sreeremya,2018). They cover a broad spectrum of diagnostic methods apart from the microscopy, including microbiologic, serologic, biochemical, and microscopic examinations. The term pathology, it refers mainly to the macroscopic and the microscopic evaluation as well as molecular assessments of tissue samples(Saunders,1997).

Historical Perspectives

The microscopic analysis of the cells and tissue (e.g., cytology and histology) appeared for the first time in the nineteenth century as an important method for the research and diagnosis in the field of medicine. Generally, Xavier Bichat is considered in the most publications as the founder of the pathology. The branch of histopathology appeared some years later, with

Muller publishing a book on the structural characteristics " of the cancer cells and their growth. Virchow, a student of Muller, introduced " the significant correlations between cells, which are the smallest units of vital organisms and tissues, the disease states, and related disease mechanisms. The person became famous worldwide for his cellular pathology studies ,observationsand his claim that every disease originates from diseased cells or, according to him, ,,,,"Omnis cellula e cellula."" This statement is valid also today in the era of the molecular pathology(Atkinson,1992).

Pathologists Do Not Like Frozen Tissue Examination?

For many reasons, the assessment of the frozen tissue during a surgery is not a favored way of tissue examination for most of pathologists. Some of the reasons are as follows:

- An intraoperative consultation is an emergency situation. That means that, during the preparations of sections and microscopic examination for an intraoperative consultation, all the normal working activities have to be ceased. This takes a relatively long time, which affects the daily practice.
- The quality of the tissue sections that are prepared during an intraoperative consultation is usually not comparable with that of the slides that are accurately processed in the normal way by FFPE. Seeing such slides is sometimes similar to seeing through the fogged glasses. Taking decisions that have a great influence on the patients" situation by examining the frozen sections is a very difficult and sometimes risky task. A pathologist can defer his diagnosis until the examinations of permanent sections, but such a delay is not acceptable for many of the clinicians and surgeons(Astarita,1990).

CONCLUSION

From nineteenth century onwards the medical stream of pathology is quiet relavant. For understanding the cells information to tissue level , organ level information. Cliacians and patients have to rely on cytopathologist, systemic pathologist, Histopathologist etc. This paper deals with various aspects of pathology.

REFERENCES

1. Astarita RW: Practical Cyto pathology. New York, Churchill Livingstone, 1990.

2. Atkinson BF: Atlas of Diagnostic Cytopathology. Philadelphia, WB Saunders Company, 1992. Bibbo M: Comprehensive Cytopathology, 2nd ed. Philadelphia,
3. WB Saunders, 1997. Cibas ES, Ducatman: Cytology: Diagnostic principles and clinical correlates.
4. WB Saunders, Erozan YS, Bonfiglio TA: Fine Needle Aspiration of Subcutaneous Organs and Masses. Philadelphia, Lippincott-Raven, 1996. Gray W: Diagnostic Cytopathology, Edinburgh,
5. Churchill Livingstone, 1995. Grubb C: Diagnostic Cytopathology—A Text and Colour Atlas. London,
6. Churchill Livingstone, 1988. Koss LG: Diagnostic Cytology and the Histopathological Basis (2 vols), 4th ed. Philadelphia, Lippincott Company, 1994.
7. Naib ZM: Cytopathology, 4th ed. Boston, Little, Brown and Company, 1996.
8. Killen, A.A. (2004) Principles of Molecular Pathology, Humana Press, Totowa
9. NJ. Kummar, V., Abbas, A.K., Fausto, N., and Aster, J.A. (2010) Robbins and Cotran Pathologic Basis of Diseases, W.B. Saunders.
10. S. Sreeremya, 2018. Journal of Pathology, Communicable diseases and Preventive Medicines, Cauda Equina Syndrome Bowel Dysfunction, Vol(1):1,1-8.
11. Dr.S.Sreeremya, . 2023. Journal of Community Medicine and Pharmaceutical Regulatory Affairs, Diabetic Nephrology-Review Vol6(1):1-9.
12. Levison, D.A., Reid, R., Burt, A.D., Harrison, D.J., and Fleming, S. (2008) Muir's Textbook of Pathology, Edward Arnold Publishers, London.
13. Majno, G. and Joris, I. (2004) Cells, Tissues and Diseases, Principle of General Pathology, Oxford University Press, New York.