

Demystifying pathology: Understanding the science behind disease diagnosis

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SUMMARY

Pathology, a vital field of medicine, plays a critical role in the diagnosis, prognosis, and treatment of diseases. Pathologists are medical doctors who specialize in the study of diseases and their effects on the human body. Through the examination of tissues, cells, and body fluids, pathologists provide valuable insights into the nature and characteristics of diseases, helping clinicians make informed decisions about patient care. In this article, we will delve into the fascinating world of pathology, uncovering the science behind disease diagnosis.

Keywords: Pathology; Treatment; Tissues

INTRODUCTION

Pathology, derived from the Greek words "pathos" meaning disease and "logos" meaning study, is the scientific study of diseases, their causes, mechanisms, and effects on the human body. Pathologists are responsible for diagnosing diseases by examining samples of tissues, cells, and body fluids obtained from patients through various diagnostic procedures, such as biopsies, blood tests, and cytology. They analyze these samples under a microscope, use molecular techniques, and conduct a wide array of specialized tests to identify the presence, nature, and extent of diseases [1].

LITERATURE REVIEW

Pathology is a multidisciplinary field that encompasses several subspecialties, including anatomical pathology, clinical pathology, molecular pathology, forensic pathology, and hematopathology, among others. Anatomical pathology involves the examination of tissues and organs removed from the body through surgery or autopsy to diagnose diseases, while clinical pathology focuses on the analysis of blood, urine, and other body fluids to diagnose diseases and monitor their progression. Molecular pathology employs techniques like DNA testing and gene expression analysis to understand the genetic basis of diseases. Forensic pathology deals with the investigation of the cause and manner of death in cases of sudden or unexpected deaths, and hematopathology specializes in the diagnosis of diseases related to blood and bone marrow [2,3].

Pathologists are pivotal in the process of disease diagnosis, and their expertise is critical in guiding clinical decision-making. When a patient presents with symptoms that suggest an underlying disease, the pathologist plays a crucial role in identifying the disease and providing insights into its characteristics. The process of disease diagnosis typically involves the following steps: Sample Collection: The first step in diagnosing a disease is obtaining a sample from the patient, which can be tissues, cells, or body fluids. This is usually done through procedures such as biopsies, where a small portion of tissue is removed from the affected area for examination, or blood tests, where a sample of blood is drawn from the patient. The pathologist may be involved in the collection process to ensure that the appropriate sample is obtained for accurate diagnosis [4].

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DISCUSSION

Sample preparation: Once the sample is collected, the pathologist prepares it for examination. This may involve fixing the tissues in formalin, embedding them in paraffin, and cutting thin sections for microscopic examination, or processing blood or other body fluid samples to isolate and analyze specific components, such as cells or proteins. The preparation process is crucial as it ensures that the sample is preserved and processed in a way that allows for accurate analysis [5].

Microscopic examination: Microscopic examination is a cornerstone of pathology and involves the examination of tissues, cells, or body fluids under a microscope to identify any abnormal changes that may indicate a disease. Pathologists use their expertise to examine the samples for changes in cellular structure, cellular composition, and cellular behavior that may be indicative of a disease process. This may include identifying abnormal cells, inflammation, necrosis, or other pathological changes.

Specialized tests: In addition to microscopic examination, pathologists may conduct specialized tests to further investigate the nature and characteristics of a disease. These tests may include immunohistochemistry, which involves the use of antibodies to identify specific proteins in tissues; molecular testing, which analyzes the genetic or molecular changes in cells; cytogenetics, which studies the chromosomes and their abnormalities; and microbiology, which involves identifying microorganisms that may be causing infections [6].

These tests provide additional information that aids in the accurate diagnosis of diseases and helps guide treatment decisions. **Diagnosis and Reporting:** Once the examination and testing are completed, the pathologist integrates the findings to arrive at a diagnosis. The diagnosis is then communicated to the treating physician through a formal pathology report, which includes a description of the findings, interpretation, and recommendations for further management. Pathologists work closely with clinicians, radiologists, and other healthcare professionals to ensure that the diagnosis is accurate and timely, and to provide guidance on appropriate treatment options [7].

Pathologists play a crucial role in classifying diseases based on their characteristics, which is essential for accurate diagnosis and appropriate treatment. Diseases are classified into different categories based on various criteria, including the affected organ or tissue, the underlying cause, the clinical presentation, and the microscopic features observed in the samples. Here are some common disease classification systems used in pathology:

Morphological classification: This classification system is based on the structural characteristics of cells and tissues observed under a microscope. Pathologists examine the size, shape, and arrangement of cells, as well as the presence of any abnormal features, such as cellular atypia or abnormal cell division, to classify diseases. For example, cancers are often classified based on the type of

cells they originate from, such as adenocarcinoma (arising from glandular cells) or squamous cell carcinoma (arising from squamous cells).

Etiological classification: This classification system is based on the underlying cause of a disease. Pathologists investigate the presence of infectious agents, such as bacteria, viruses, fungi, or parasites, in the samples to determine if the disease is caused by an infection. For example, tuberculosis is caused by the bacterium *Mycobacterium tuberculosis*, and its diagnosis involves identifying the presence of the bacteria in the affected tissues.

Clinical classification: This classification system is based on the clinical presentation of the disease, such as the symptoms, signs, and patient characteristics. Pathologists consider the clinical context, along with the microscopic findings, to arrive at a diagnosis. For example, autoimmune diseases, such as lupus or rheumatoid arthritis, are diagnosed based on the presence of specific antibodies in the blood and the clinical symptoms presented by the patient. **Molecular Classification:** With advances in molecular testing, pathologists are increasingly using molecular techniques to classify diseases based on their genetic or molecular characteristics. For example, certain types of leukemia are classified based on specific genetic mutations present in the leukemia cells. This information is valuable in guiding treatment decisions, as some genetic mutations may respond differently to targeted therapies [8].

Pathology is an essential component of patient care, as accurate diagnosis is critical for appropriate treatment and management of diseases. Pathologists provide vital information that guides clinicians in developing treatment plans tailored to each patient's specific condition. Here are some key aspects highlighting the importance of pathology in patient care: **Early Detection and Diagnosis:** Pathologists play a crucial role in the early detection and diagnosis of diseases. Through microscopic examination and specialized tests, they can identify diseases in their early stages, even before clinical symptoms become evident. Early detection allows for timely intervention and treatment, which can significantly impact patient outcomes.

Differential diagnosis: Many diseases present with similar symptoms, making it challenging to differentiate between them clinically. Pathologists can provide a definitive diagnosis by examining tissue samples and identifying the specific disease process. This helps avoid misdiagnosis and ensures that patients receive appropriate treatment for their specific condition. **Personalized Medicine:** Pathology also plays a crucial role in personalized medicine, which involves tailoring treatment plans to an individual patient's specific condition. Through molecular testing and genetic analysis, pathologists can identify specific genetic mutations or molecular alterations in a patient's tumor or tissues, which can help determine the most effective treatment options. For example, certain cancers may have specific genetic mutations that make them responsive to targeted therapies, while others may require more traditional chemotherapy or radiation [9].

CONCLUSION

Pathology plays a crucial role in the field of medicine by providing insights into the nature, cause, and progression of diseases. Pathologists are specialized physicians who study and diagnose diseases through the examination of tissues, organs, and body fluids. Pathology encompasses a wide range of disciplines, including anatomical pathology, clinical pathology, and molecular pathology. Anatomical pathology involves the examination of tissues and organs

removed during surgery or obtained from autopsies to identify and characterize diseases such as cancer, infectious diseases, and autoimmune conditions.

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CONFLICT OF INTEREST

None.

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