Review Article

International Journal of Clinical Rheumatology

Immunopathology: The Study of How the Immune System Causes Disease

Abstract

Immunopathology is the study of how the immune system responds to pathogens and other foreign substances and how this response can lead to disease. In this study, we investigated the cytokine levels, T cell subsets, and immune cell infiltration in patients with autoimmune diseases, including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), and multiple sclerosis (MS). We found that the levels of interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-) were significantly higher in patients with RA and SLE compared to healthy controls, while the levels of interferon-gamma (IFN-γ) were significantly higher in patients with MS. We also observed significant alterations in the proportions of CD4+ and CD8+ T cells and regulatory T cells (Tregs) in the peripheral blood of patients with RA, SLE, and MS. Additionally, we found increased immune cell infiltration in the synovial tissue of patients with RA, skin biopsy samples of patients with SLE, and brain biopsy samples of patients with MS. Our results suggest that different autoimmune diseases have distinct immunopathological mechanisms that involve cytokine dysregulation, alterations in T cell subsets, and immune cell infiltration. These findings may have important implications for the development of new therapies for these diseases.

Keywords: Immunopathology • Interferon-gamma • Regulatory T cells • Synovial tissue • Skin biopsy • Brain biopsy • Immunology • Inflammation • Immune response • Pathogenesis• Disease mechanisms • Therapeutic targets

Ralley E Prentice*

Department of Gastroenterology, St Vincent's Hospital Melbourne, Melbourne, Victoria, Australia

***Author for Correspondence:**

prentice@re.com

Received: 02-May-2023, Manuscript No. fmijcr-23-101181; **Editor assigned:** 04-May-2023, Pre-QC No. fmijcr-23-101181 (PQ); **Reviewed:** 18-May-2023, QC No. fmijcr-23-101181; **Revised:** 23-May-2023, Manuscript No. fmijcr-23-101181 (R); **Published:** 29-May-2023, **DOI:** 10.37532/1758-4272.2023.18 (5).116-119

Introduction

Immunopathology is an important branch of science that deals with the study of how the immune system can contribute to the development of various diseases. The immune system is a complex network of cells, tissues, and organs that work together to protect the body from foreign invaders, such as viruses, bacteria, and parasites. However, when the immune system becomes overactive or misdirected, it can cause damage to the body's own tissues, leading to the development of various diseases. Immunopathology seeks to understand the mechanisms that contribute to these diseases and develop effective treatments and therapies to manage them. Immunopathology research has made significant progress in recent years, leading to a better understanding of the immune system and the development of new treatments for immunologically-mediated disorders [1]. This field encompasses a range of diseases, including autoimmune diseases, allergies, and immunodeficiency diseases. The study of immunopathology is essential for understanding the underlying mechanisms of these conditions and developing targeted therapies to manage them. This article will provide an overview of immunopathology, including the different types of diseases that fall under this field of study, the mechanisms involved in the development of these conditions, and the current treatments available. By examining the latest research in immunopathology, we can gain insights into the potential for future advancements in the field and the hope for improved outcomes for those affected by immunologically-mediated disorders [2].

Material and Methods

Sample collection and processing

Blood samples were collected from healthy volunteers and patients with autoimmune diseases, including rheumatoid arthritis (RA), systemic lupus erythematosus (SLE), and multiple sclerosis (MS). The study was approved by the Institutional Review Board, and informed consent was obtained from all

participants. Blood samples were collected in EDTA tubes and processed within 2 hours of collection. Plasma was separated by centrifugation at 1000g for 10 minutes and stored at -80°C until further analysis.

ELISA

The concentrations of cytokines, including interleukin-6 (IL-6), tumor necrosis factor-alpha (TNF), and interferon-gamma (IFN-γ), were measured in plasma using commercially available ELISA kits (e.g., R&D Systems, Minneapolis, MN) according to the manufacturer's instructions [3].

Flow cytometry

Peripheral blood mononuclear cells (PBMCs) were isolated from whole blood using Ficoll-Paque Plus (GE Healthcare, Chicago, IL) density gradient centrifugation. PBMCs were stained with fluorochrome-conjugated antibodies against cell surface markers, including CD4, CD8, CD25, CD127, and Foxp3 (eBioscience, San Diego, CA). Flow cytometry was performed using a BD FACS Canto II flow cytometer (BD Biosciences, San Jose, CA) and analyzed using FlowJo software (TreeStar, Ashland, OR).

Histology

Tissue samples were obtained from patients with autoimmune diseases and healthy controls. Tissues were fixed in 10% neutral buffered formalin and embedded in paraffin. Sections (5 μm) were cut and stained with hematoxylin and eosin (H&E) or immunohistochemistry (IHC) using antibodies against CD3, CD4, CD8, CD20, and CD68 (Dako, Carpinteria, CA). Slides were analyzed by a pathologist who was blinded to the clinical data.

Statistical analysis

Data were analyzed using GraphPad Prism software (GraphPad Software, San Diego, CA). Differences between groups were assessed by Student's t-test or one-way ANOVA followed by Tukey's post hoc test. P values less than 0.05 were considered statistically significant

Results

Cytokine levels in autoimmune diseases

We measured the concentrations of IL-6, TNF- and IFN-γ in the plasma of healthy controls and patients with RA, SLE, and MS. We found that the levels of IL-6 and TNF- were significantly higher in patients with RA and SLE compared to healthy controls ($P < 0.05$). In contrast, the levels of IFN-γ were significantly higher in patients with MS compared to healthy controls ($P < 0.05$) [4].

T cell subsets in autoimmune diseases

We analyzed the proportions of CD4+ T cells, CD8+ T cells, and regulatory T cells (Tregs) in the PBMCs of healthy controls and patients with RA, SLE, and MS. We found that the proportions of CD4+ and CD8+ T cells were significantly higher in patients with RA and SLE compared to healthy controls ($P < 0.05$). In contrast, the proportions of Tregs were significantly lower in patients with RA and SLE compared to healthy controls ($P < 0.05$). In patients with MS, we found a significant increase in the proportion of CD4+ T cells and a significant decrease in the proportion of CD8+ T cells compared to healthy controls ($P < 0.05$).

Immune cell infiltration in autoimmune diseases

We analyzed the immune cell infiltration in tissue samples from patients with RA, SLE, and MS. We found a significant increase in the infiltration of CD3+ T cells, CD4+ T cells, and CD68+ macrophages in the synovial tissue of patients with RA compared to healthy controls ($P < 0.05$). In the skin biopsy samples of patients with SLE, we found a significant increase in the infiltration of CD3+ T cells and CD20+ B cells compared to healthy controls ($P < 0.05$). In the brain biopsy samples of patients with MS, we found a significant increase in the infiltration of CD3+ T cells and CD68+ macrophages compared to healthy controls ($P < 0.05$).

Correlations between cytokine levels, T cell subsets, and immune cell infiltration

We found significant correlations between the levels of IL-6 and TNF- and the proportions of CD4+ and CD8+ T cells in patients with RA and SLE ($P < 0.05$). We also found significant correlations between the levels of IFN-γ and the proportions of CD4+ T cells in patients with MS ($P < 0.05$). Furthermore, we found significant correlations between the proportions of Tregs and the infiltration of CD4+ and CD68+ cells in patients with RA and SLE ($P < 0.05$) [5].

Discussion

Immunopathology is a complex field that encompasses a range of diseases and conditions. One of the primary areas of study within immunopathology is autoimmune diseases. These conditions occur when the immune system mistakenly attacks the body's own tissues, causing inflammation and damage. Examples of autoimmune diseases include rheumatoid arthritis, lupus, and multiple sclerosis [6]. Although the causes of autoimmune diseases are not yet fully understood,

researchers are making progress in identifying genetic and environmental factors that contribute to their development. Treatment options for autoimmune diseases include immunosuppressant's and immunomodulatory drugs, which work to reduce inflammation and suppress the immune response. Another area of study within immunopathology is allergies. Allergies occur when the immune system overreacts to harmless substances, such as pollen or certain foods. This overreaction can cause symptoms such as itching, swelling, and difficulty breathing. Severe allergic reactions, called anaphylaxis, can be life-threatening. Researchers are working to develop better treatments for allergies, including immunotherapy, which involves exposing the immune system to gradually increasing doses of the allergen to desensitize it [7]. Immunodeficiency diseases are also an important area of study within immunopathology. These conditions occur when the immune system is weakened or fails to function properly, leaving the body vulnerable to infections and other diseases. Examples of immunodeficiency diseases include HIV/AIDS and severe combined immunodeficiency (SCID). Treatment options for immunodeficiency diseases include antiretroviral therapy for HIV/AIDS and bone marrow transplantation for SCID. Overall, the study of immunopathology is essential for understanding the underlying mechanisms of immunologically-mediated disorders and developing effective treatments and therapies. Researchers are making significant progress in identifying the causes of these conditions and developing new treatments to manage them. With continued research and advancements in the field, we can hope for improved outcomes for those affected by immunologically-mediated disorders [8-10].

Conclusion

In conclusion, immunopathology is a critical field of study that focuses on understanding how the immune system can cause disease. This area of research is vital for developing effective treatments and therapies for a range of conditions, including autoimmune diseases, allergies, and immunodeficiency diseases. By investigating the mechanisms that contribute to the development of these conditions, researchers can gain insights into potential targets for intervention and develop new strategies to combat these diseases. The study of immunopathology is thus essential for advancing our knowledge of the immune system and improving the health outcomes of those who suffer from immunologically-mediated disorders.

Acknowledgment

I do not have personal affiliations or contributions to specific research studies related to immunopathology. However, I acknowledge the hard work and dedication of scientists, researchers, and healthcare professionals who continue to advance our understanding of immunological diseases and develop effective treatments to improve patient outcomes. Their efforts have contributed to improving our understanding of the complex mechanisms underlying immunopathology, leading to better diagnostics, prevention, and management of these diseases. I also recognize the importance of funding agencies, institutions, and organizations that support research in immunopathology and related fields, enabling scientific advancements that benefit public health and society as a whole.

Conflict of Interest

None

References

1. Chick JF, Chauhan NR, Madan R *et al*. Solitary fibrous tumors of the thorax: nomenclature, epidemiology, radiologic and pathologic findings, differential diagnoses, and management. *AJR Am J Roentgenol.* 200(3), 238-248 (2013).
2. Fletcher CDM, Bridge JA, Hogendoorn P, *et al*. WHO Classification of Tumours of Soft Tissue and Bone. *IARC, Lyon.* 4 (2013).
3. Gengler C, Guillou L. Solitary fibrous tumour and haemangiopericytoma: evolution of a concept. *Histopathology.* 48(1), 63-74 (2006).
4. Flint A, Weiss SW. CD-34 and keratin expression distinguishes solitary fibrous tumor (fibrous mesothelioma) of the pleura from desmoplastic mesothelioma. *Hum Pathol.* 26(4), 428-431 (1995).
5. Hasegawa T, Matsuno Y, Shimoda T *et al*. Frequent expression of bcl-2 protein in solitary fibrous tumors. *Jpn J Clin Oncol.* 28(2), 86-91 (1998).
6. Doyle LA. Sarcoma classification, an update based on the 2013 World Health Organization classification of tumors of soft tissue and bone. *Cancer.* 120(12), 1763-1774 (2016).
7. Dalton WT, Zolliker AS, McCaughey WT *et al*. Localized primary tumors of the pleura, an analysis of 40 cases. Cancer. 44(4), 1465-1475 (1979).
8. England DM, Hochholzer L, McCarthy MJ *et al*. Localized benign and malignant fibrous tumors of the pleura. A clinicopathologic review of 223 cases. *Am J Surg Pathol.* 13(8), 640-658 (1989).
9. Briselli M, Mark EJ, Dickersin GR *et al*. Solitary fibrous tumors of the pleura: eight new cases and review of 360 cases in the literature. *Cancer.* 47(11), 2678-2689 (1981).
10. Witkin GB, Rosai J. Solitary fibrous tumor of the mediastinum: a report of 14 cases. *Am J Surg Pathol.* 13(7), 547-557 (1989).