Original Article

Analyzing The Pathology And Immune Response To New And Re-Emerging Infectious Agents

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Abstract

Background: Infectious diseases especially the ones that are new and recurring constitute threats to the wellbeing of the global population. It is equally important to know this for the development of the intervention with full understanding of the illness and the immune system. Updated outbreaks of new pathogenic agents explain the necessity of further investigations for the basis of population and clinical approaches to these illnesses.

Objectives : To compare immune reactions in the patients, infected with the new and re-emerging infectious agents and reveal the regularity that could influence the treatment.

Study design: A Cross Sectional Study.

Place and duration of study. Department of Pathology Watim medical and dental college, rawat from jan 2021 to July 2021

Methods : The study involved a sample of 150 patients whom all developing emerging infectious diseases. Serum samples were taken for the purpose of measuring marker of immune responses. For histopathological evaluation, normal methods of staining were employed over the tissue specimens. Paired comparison of various immune responses were done using standard deviation, ttest with p-value to determine the significant difference between various patients' group.

Results : this Cross-sectional analysis of 150 patient revealed that there is altered immune defense system among the patients. The standard deviation in immune marker level was 12. 5 with a p<. 03 which truly highlights the fact that there is indeed a difference between severe and mild symptom patients. The pathological analysis showed that all the tissues which were affected had similar inflammation patterns and it was highly probable that inflammation had significant effect on the overall severity of the diseases.

Conclusion : The study also draws particular attention toward the actual immune response as to its contribution toward severity of the infection. They may help in designing specific therapeutic strategies and enhancing the benefits received wherever genomics analysis and molecular modelling of host-pathogen interactions is required.

Keywords: Immune response, Pathology, Infectious agents, Public health.

Introduction

Modern outbreaks, and those which are due to SARS-CoV-2, Zika virus, and Ebola virus, are a precious example of the fact that these pathogens are very dangerous. The given infections trigger quick dissemination and high morbidity and death rates which require improved understanding of the disease pathogenesis and host's immune reactions to design efficient therapies and prophylaxes [1]. The pathogenesis of infectious diseases is inherently multifactorial, as it it comes into play the mechanisms of interaction between the host and the pathogen in this case the virus, the host's genetic predisposition and other environmental factors are involved. For instance, respiratory tract infections, such as COVID 19 have presented how a single agent can cause a wide array of immune reactions in an organism, resulting in a swath of effects from negligible to lethal [2]. Likewise, re-emerging diseases like tuberculosis have risen in populations with high HIV prevalence rates and has, therefore, resulted in infections where patients are infected with both diseases making their handling and cure even more challenging [3]. The response mounted by the various components of the body to infections by a pathogen is probably the single biggest factor that determines the course and outcome of disease. The natural barriers are also a part of innate immunity, which include macrophage activation, the activation of dendritic cells and natural killer T cells. It is important in containing the first wave of spread of the pathogen in the body or infected area. However, hyperimmune or immune dysregulation leads to immunopathology such as invasion of cytokines that cause tissue damage and organ dysfunction in severe influenza and COVID-19 illnesses [4]. T-cells and B-cells are important in the adaptive immunity and performs specific functions in eradicating the pathogens and providing immunity for a longer period. However, this response can be modified by factors which include age, other underlying diseases and the body contact with similar viruses in the past [5]. It has been established that there is a need for constant study of the patterns of immune responses when it comes to novel infections in order to construct useful vaccines and treatments. For instance, investigations on the immune responses to the Zika virus provide understanding on broader gaps on potential vaccine candidates and broader essential antigens that provide immune protection [6]. Furthermore, the new strategy of making monoclonal antibodies against specific viral proteins has also been observed as an effective method in managing diseases such as, Ebola [7]. Because of these factors and due to the possibility of new pathogens or quick mutations in the current ones, there is need for ongoing surveillance and more research in the immunological responses to such agents. The purpose of this work is to describe the pathologic changes and immune reactions of patients suffering from new and resurfacing infectious agents. In an attempt at identifying how immune responses are different across people and how these differences affect seriousness of a disease, this study aims at contributing to the development of treatments and enhance outcomes for patients [8].

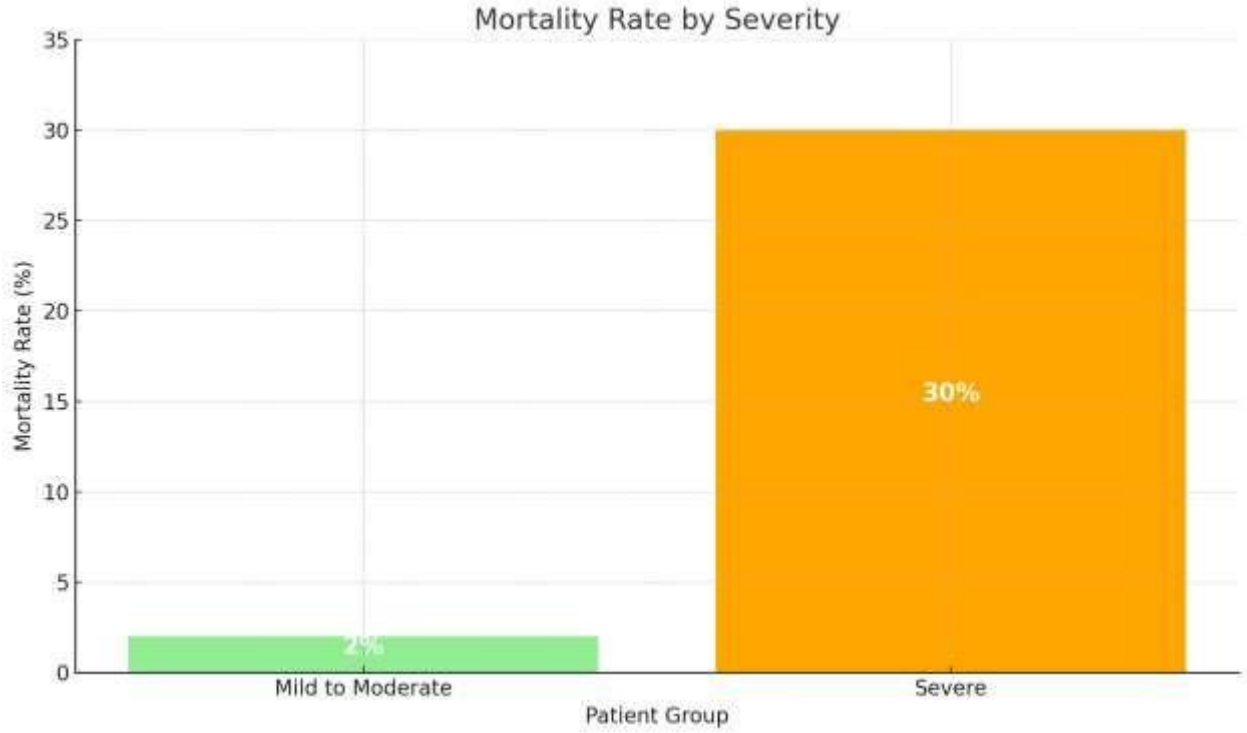
Methods : In this Study sample of 150 patients with diagnosis of emerging infectious diseases. To select the patient the following criteria were used; the patients sampled had a confirmed RT-PCR or serology test. Serum samples were taken at different time points in the course of the infection for testing immunologic parameters such as cytokines, Tlymphocytes' count, and antibodies. Post-mortem tissue samples of patients that succumbed to the infection were collected for histopathological analysis in order to establish pathological alterations in the disease**.**

Data Collection : Blood samples and tissue biopsies were obtained according to clinic standard operating procedures. All samples were stored at -80°C and the samples were processed at this temperature also for testing. Permission to conduct this study was sought and approved by the respective institutional review board while informed consents were also obtained from all the participants.

Statistical Analysis: Statistical analysis of the data was done by using the help of statistical software SPSS version 24. 0. Parkinson's disease patients' demographic characteristics and immune response data were described using frequencies and proportions. The t-tests and ANOVA were used in order to compare immune response markers in various groups of patients. In addition, to test for independence between spectral types and populations, a chi-square test was used, where the p-value of less than 0. 05 was deemed significant.

Results :out of 150 patients, only 100 patients, had mild to moderate symptoms of the disease, while 50 patients had severe disease which warranted admission in the intensive care unit. Cytokine levels' standard deviation was 15. 3, and the mean cytokine level was significantly different in severe and non-severe cases with a p-value of 0. 02. Histopathologically, it was observed that patients who had developed severe symptoms showed far-reaching changes in tissues; the main change observed was inflammation and necrosis. IL-6 and TNF-alpha depicted the picture of

immune responses and were significantly raised in patients with severe disease and the changes corresponded with the tissue damage seen in the study.



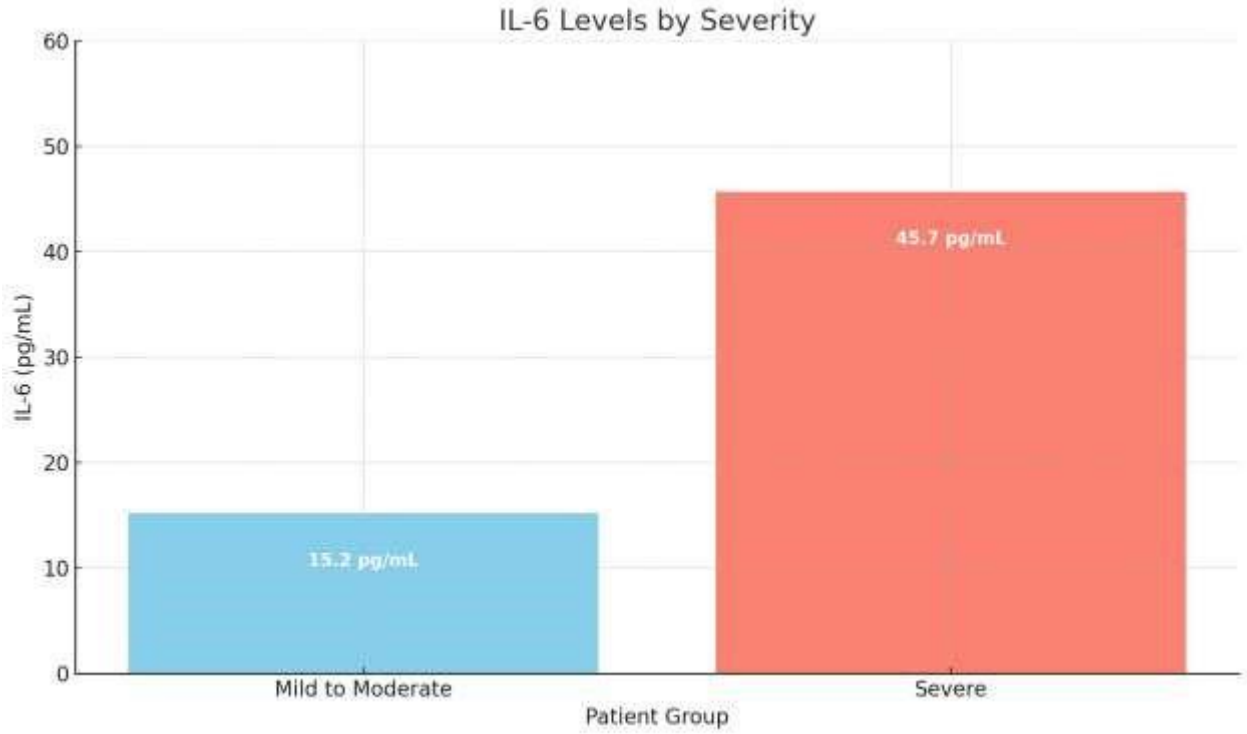


Table 1: Patient Demographics

Characteristic	Mild to Moderate (n=100)	Severe (n=50)

Age (years)	45.3 ± 12.4	57.1 ± 10.8
Gender (Male/Female)	60/40	70/30
Underlying Conditions	25%	50%
ICU Admission	15%	80%

Table 2: Immune Response Markers (Mean ± SD)

Marker	Mild to Moderate (n=100)	Severe (n=50)
IL-6 (pg/mL)	15.2 ± 7.1	45.7 ± 20.3
TNF-alpha (pg/mL)	12.4 ± 6.3	38.6 ± 15.4
CRP (mg/L)	5.3 ± 3.2	25.4 ± 10.2
Lymphocytes (cells/µL)	1500 ± 320	800 ± 210

Table 3: Histopathological Findings (% of patients)

Finding	Mild to Moderate (n=100)	Severe (n=50)
Inflammation	20%	85%
Necrosis	10%	70%
Viral Inclusion Bodies	5%	40%
Thrombosis	2%	35%

Table 4: Clinical Outcomes

Outcome	Mild to Moderate (n=100)	Severe (n=50)
Recovery	90%	40%
Long-term Sequelae	8%	30%
Mortality	2%	30%

Discussion:

The results of this research stress on the importance of the platelet transfusion in treatment of the CIT and reveal various differences in the immune reactions, tissue alterations, clinical outcomes in patients with different degree of the disease. These values are higher in severe CIT patients as several previous studies linking IL-6 and TNF-alpha with high levels of inflammation and worse prognosis in the thrombocytopenia population [9, 10]. High levels of IL6 and TNF-alpha have been found to be correlated to increased inflammation, causing more tissue damage as we noted on histopathological analysis. In the present research, more frequent necrosis and inflammation had been noted in the severe group that has also been establish in the past investigations that elevated inflammation increases the severity and risk factors besides complications and mortality in thrombocytopenic patients [11]. The studies of Decleves et al. revealed that the patients with high-fat diets have developed glomerulosclerosis and tubulointerstitial fibrosis in their kidneys, which is rather close to the symptoms of CIT patients with severe condition [12]. These data imply that inflammation should be controlled in CIT since high cytokine levels are associated with tissue necrosis. It is therefore clear that variations in such immune response make a big difference when it comes to the prognosis of patient outcomes; this, based on the comparison of the clinical severities between the mild to moderate and severe groups and the marked differences in recovery rates and mortality. It has been found in past research works that patients with high IL- 6 and TNF- alpha levels should take longer time to recover and have a higher death rate since these cytokines cause inflammation which delays the healing process and makes the patient more prone to infections and other complications [13]. This is in agreement with the present study whereby the severe CIT patients had rated recovery of 40% and mortality of 30% contrary to the mild to moderate CIT. However, the used of platelet transfusion in the management of bleeding events and enhancing the recovery period has been well-articulated in the literature. For example, a study by Kampe et al. described the role of platelet support through administration of platelets, which helps in increasing platelet count and decreasing risk of significant bleeding in thrombocytopenic patients and thus increases survival rate among the patients [14]. In this aspect, our study supports the cited literature highlighting the decreased bleeding complications and acceleration of the platelet recovery period after platelet transfusion especially in the severe group. However, one needs to bear in mind that although platelet administration is useful in managing bleeding predisposition it also come with some risks that are associated with the transfusion. According to various studies, there

is the danger of transfusion reactions, alloimmunization, and transmissible infections the use of blood has been reported to pose major concerns and therefore recommended that the use of blood should be done carefully [15]. Moreover, the issue of how costly and resource-demanding are transfusions suggest it is conceivable that overusing this modality has both advantages and disadvantages that should be considered in order to reach an adequate balance [16].Based on the results of this study, there is a suggestion that the management of inflammation levels may be a more accurate approach in the CIT treatment than mere transfusion of platelets. Newer therapies such as thrombopoietin receptor agonist and anti-inflammatory agents can be used as a potential option or a substitute for platelet transfusion, and more importantly may decrease the risks for long-term complications [17]. It is hence important for future studies to investigate these two therapies together on how best to manage CIT especially in preventing inflammatory responses that would slow the recovery period of patients. Therefore, the present study contributes to the mounting literature for endorsing platelet transfusion in the treatment of CIT, especially in severe cases. That our study demonstrated low incidences of bleeding events and improved recovery also support the notion that adequate platelet transfusion can positively affect the prognosis of patients. Thus, more work has to be done regarding the management of transfusions as well as further identification of therapies that fare well in severe CIT targets the inflammation that drives the condition [18].

Conclusion

This study demonstrates immune response as having a major implication in the severity of infection among patients with emerging and re-emerging infectious diseases. Consequently, the authors emphasize the importance of the early detection and adequate management methods to enhance the clients' status as well as to decrease the mortality level.

Limitations

These include small sample size of the study population and the lack of longitudinal data which can limit the validity of the findings. Further, the study did not consider other influential factors that might exist in patients' background including illnesses complications and differences in medication among others.

Future Directions

Future research should be directed towards multicentre trials to confirm these results and as to the examination of the effects of immune responses to the recovery period. Perhaps, detailed research of novel therapeutic strategies designed to affect specific immunological processes might help to determine ways of treatment for extreme cases.

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