ATJ
Advanced Therapies Journal

VOL.6 / ISSUE 19/ SPRING 2024
Online ISSN: 2676-7236
DOI: 10.22034/atj.2024.198820

OPEN ACCESS

Pages: 13-19 / Orginal Article / Submit: 29 April 2024 / Accepted: 17 May 2024

Availablein: https://www.atjournal.ir

Meta-Analysis Study: Age Variations in PBSC Expression in COVID-Positive Individuals

Mona Maleknejad Yazdi[1,2] *

[1] Biology Department, University Jihad Unit, University of Science and Arts of Yazd, Iran.
[2]Advanced Computational Center, Khayyam Innovation Ecosystem, Mashhad, Iran.

Corresponding Author's E-mail: mona@maleknejad.com

Abstract

Autoimmune disorders are complex conditions that result from a combination of genetic and environmental causes and currently have no recognized therapy. Various therapeutic strategies may be used in various illnesses to promote remission or, at the very least, alleviate the symptoms. For customized therapy to be implemented, it is necessary to identify groups of individuals who are generally similar and share pathogenic signaling pathways. Therefore, research about autoimmune disorders mainly focuses on identifying new biomarkers, uncovering novel targets for therapy and agents, and understanding the processes involved in developing various disorders. We are just at the nascent phase of implementing tailored therapy for autoimmune illnesses. Hence, this research delved into the examination of several autoimmune illnesses and the impact of personalized therapy on their progression.

Keywords: Genomic analysis, Autoimmune disorders, Personalized medicine.

Introduction

The COVID-19 pandemic has profoundly impacted global health, economies, and communities. In January 2020, the World Health Organization declared it a public health emergency and, in March 2020, a pandemic. Millions of cases and countless deaths have been recorded globally. To address this unprecedented situation, experts, scientists, and healthcare professionals have dedicated themselves to research and the dissemination of knowledge through publications. They aim to unravel the mysteries of the virus, its spread, and potential ways to combat or prevent it (1). Researchers continue to analyze the COVID-19 virus in light of the global pandemic. A recent study explored age differences in immune response to the virus by examining peripheral blood stem cells (PBSC) in individuals who tested positive for COVID-19. This study focused on understanding how age influences the immune system's response to the virus, particularly in older adults, who may face higher risks of severe outcomes (2). This study aimed to understand the effects of age on the immune response to COVID-19 and identify risk factors for severe illness in older adults. Researchers collected and combined data from multiple studies measuring a specific immune cell marker (PBSC) in COVID-19 patients of varying ages. By comparing PBSC levels between younger and older individuals, they searched for relationships with disease severity to identify potential differences in immune function and risk factors across age groups (3). This study revealed that older people infected with COVID-19 have

How to Cite this Article: M. Maleknejad Yazdi." Meta-Analysis Study: Age Variations in PBSC Expression in COVID-Positive Individuals", Advanced Therapies Journal. vol. 6, no. 19, pp. 13-19, 2024.

higher levels of PBSC in their blood compared to younger people. This suggests that age may influence the immune response to the virus. These findings support previous research showing that age affects immune function and vulnerability to infections (4). The study found that higher levels of a protein called PBSC in the blood were linked to worse COVID-19 symptoms and outcomes, especially in older adults. This suggests that PBSC levels could be used as a marker to assess the severity of the disease in older individuals with COVID-19. The study highlights the importance of age-related differences in PBSC expression in COVID-19 patients. Age plays a crucial role in how the immune system responds to the virus. Understanding this link helps us identify those vulnerable to severe COVID-19. Studies should investigate the reasons behind age-related differences and explore treatments that target peripheral blood stem cell (PBSC) levels in older patients with COVID-19. It's essential to know how age affects the immune system's response to COVID-19 to create specific treatments and find people who are at higher risk of getting very sick from it. Peripheral blood stem cells (PBSCs) are important for how the immune system works, so they are being studied in COVID-19 research. Differences in PBSC expression based on age could give us important information about how likely someone is to get sick and how bad their symptoms will be. Researchers can combine multiple studies into a meta-analysis to see how age affects PBSC levels in people with COVID-19. Looking at differences in PBSC levels between different age groups may help connect them to how severe the disease is and how it turns out. Understanding how PBSC expression changes with age can help us learn more about how different age groups respond to the illness and make better clinical decisions when treating COVID-19. This study adds to what we know about how the immune system responds to COVID-19 and shows that age is an important factor in how the disease gets worse. Understanding how the body's peripheral blood stem cells (PBSCs) change with age in COVID-19 patients could lead to new treatments and ways to identify those at higher risk. However, more research is needed to consider other factors that could affect the immune response, such as existing health conditions, genetics, and environmental factors. Long-term studies could also help track how PBSC expression changes in COVID-19 patients and how this change relates to the severity of their illness. Studying immune cell changes in COVID-19 patients based on age and other factors can improve ways to predict outcomes and adjust treatments for each patient. Additionally, understanding how these immune cells interact with other immune cells during COVID-19 can reveal how immune responses affect disease severity. This knowledge can help develop treatments that target these specific immune mechanisms. Teamwork between researchers from different fields is vital to uncovering the intricate immune responses to COVID-19 and creating better ways to prevent and treat the disease. Continued research into the levels of peripheral blood stem cells (PBSCs) in COVID-19 patients, especially as it relates to their age, is valuable. It can help us better understand how the immune system responds to the virus and lead to improved treatments for people of all ages (5).

The COVID-19 pandemic caused by the novel coronavirus, SARS-CoV-2, has imposed an unprecedented global health crisis, affecting millions of lives worldwide. While the severity of COVID-19 varies widely among individuals, emerging evidence suggests that age plays a significant role in disease susceptibility and outcomes. Understanding the intricate interplay between age and immune responses is crucial for elucidating the pathogenesis of COVID-19 and guiding therapeutic interventions (6, 7). PBSCs, crucial parts of our immune system, play a vital role in fighting infections. They have the special ability to transform into different types of immune cells, like T cells and B cells, which work together to protect our bodies from invaders. By studying how PBSCs change in COVID-19 patients of various ages, we can better understand why people respond differently to the virus depending on their age (8). While many studies have looked at how COVID-19 affects immune cells, we still don't know exactly how ageing affects the expression of PBSCs. Some studies have found that getting older is linked to changes in the number and quality of PBSCs, which could make the immune system weaker and make people more likely to get sick. However, other studies suggest that ageing could trigger mechanisms that make up for these changes and strengthen some parts of the immune response in older adults. To better understand how PBSC (peripheral blood stem cell) expression varies based on age in people with COVID-19, we need to combine all the existing studies. This will help us see if there are any patterns or differences. To do this, we need to perform a meta-analysis where we carefully examine and analyze all the published research on PBSC expression in COVID-19 patients from different age groups. This will give us a more complete picture of the situation and help us draw more reliable conclusions. We will combine information from various studies to better understand how PBSC populations change with age. We will then investigate how these changes may affect how COVID-19 progresses and the results of treatment. Our findings could lead to new treatments and vaccines that are specifically designed for older people, who are more likely to suffer severe effects

from COVID-19. This research aims to enhance knowledge about the complex relationship between age, immunity, and COVID-19. By doing so, it aims to guide the development of more effective interventions to address the ongoing global pandemic. Studying the expression of PBSC in people who have tested positive for COVID-19 is important because it helps us learn how the immune system responds to the virus at different ages. This knowledge is vital for developing treatments and vaccines that work well for people of all ages. Examining PBSC expression levels can reveal possible indicators for determining how severe COVID-19 is and how well patients will do. Researchers can find important elements that affect the outcome of the disease and aid in making clinical choices by examining these fluctuations. Additionally, a thorough meta-analysis of this subject can aid in building a better grasp of COVID-19's disease-causing processes and point to potential areas of future research. By examining the levels of PBSC expression in COVID-19 patients of varying ages, researchers can gain valuable insights that can lead to better treatment approaches and public health measures to combat this ongoing pandemic. Examining the levels of peripheral blood stem cells (PBSC) in people with COVID-19 is crucial for comprehending how the immune system responds and developing treatments to fight the infection. Here are several key reasons for the importance of such studies: immune response characterization: PBSCs play a crucial role in the immune system, being a source of various immune cells. Examining the behavior of a specific cell type, called PBSCs, in people infected with COVID-19 reveals important information about the body's immune response against the virus. This analysis helps identify specific markers, called biomarkers, that are linked to the COVID-19 infection. Understanding these markers provides valuable insights into how the body fights the virus at the cellular level. These molecular markers can provide valuable information about the seriousness, progression, and response to treatment for COVID-19. They enable early detection and personalized treatment plans. Furthermore, understanding these markers can help in the design of targeted therapies specifically for COVID-19. Researchers can develop new treatments that alter the immune system to strengthen defenses against viruses by understanding how cells and molecules work together in the immune response. Insights into PBSC expression can also guide the creation of better vaccines. Vaccine Development, Insights into the production of proteins by a specific type of blood cell (PBSC) can guide the creation of vaccines. By understanding how the immune system reacts to the COVID-19 virus at a cellular level, scientists can design vaccines that trigger a strong and effective immune response, protecting people from infection more effectively. Long-Term Immune Memory: Studying PBSC expression can also provide valuable information about how long-term immune memory develops after a COVID-19 infection. This knowledge is essential for understanding how long immunity lasts and whether booster shots or other vaccination strategies are necessary to maintain protection. COVID-19 affects different people in varying ways, with some experiencing more severe symptoms than others. Researchers can study how proteins found in blood cells change in response to COVID-19 (PBSC expression). This could help us better understand why some people get sicker than others, based on factors like their genes or other health problems they may already have. Tracking the presence and amount of PBSC proteins during an infection provides valuable information for predicting the outcome. By detecting patterns in these levels that indicate how the infection progresses or clears up, healthcare professionals can make more accurate forecasts about the patient's health. This knowledge allows them to adjust treatment plans based on the expected course of the infection, ensuring the best possible care for each individual. Techniques utilized in the systematic review and synthesis of research findings have focused on how the gene expression patterns in peripheral blood stem cells differ between COVID-19-positive and negative individuals. Scientists have been studying how the gene expression patterns in the stem cells found in the blood of COVID-19 patients differ from those of non-infected individuals. This research study combined data from multiple studies to analyze how the gene expression patterns in peripheral blood stem cells of COVID-19-positive patients vary with age. The study aims to identify age-specific differences in gene expression within these cells.

Materials and Methods

Researchers studied immune responses in 76 COVID-19 patients from Hong Kong and Atlanta, as well as 69 healthy individuals. They found that COVID-19 patients had lower levels of immune molecules called MHC-II and proinflammatory cytokines in myeloid cells. Additionally, they observed reduced signaling activity in plasmacytoid dendritic cells, leading to impaired production of interferon-α, an important immune defense molecule. The study also revealed elevated levels of inflammatory proteins like EN- RAGE2, TNFSF143, and oncostatin4 M in the blood of COVID-19 patients. These levels were linked to increased disease severity and bacterial byproducts in the bloodstream. The researchers conducted single-cell analysis and found a reduction in type I interferons, lowered levels of HLA-DR on immune cells, and temporary expression

of genes activated by interferons in patients with severe COVID-19. The researchers examined genetic data (RNA-seq) from blood stem cells to study how gene expression changed with age in COVID-19 patients. They used specific statistical methods (gene set enrichment analysis and single sample gene set enrichment analysis) to compare gene expression patterns in different types of COVID-19 patients. By analyzing the patterns of genes that were turned on (upregulated) and turned off (downregulated), they identified biological pathways that were disrupted in these patients. Age plays a crucial role in the gene activity patterns observed in blood stem cells from COVID-19 patients (figure 1).

1.These variations provide insights into the age-dependent immune response to the virus, potentially guiding the development of tailored treatments. Researchers studied gene activity in blood stem cells from COVID-19 patients of different ages. They found age-based variations in gene activity patterns, indicating that age influences how the immune system responds to COVID-19. By analyzing the activity of these genes, they identified specific pathways that may be affected differently in different age groups. This suggests that age may contribute to the severity of COVID-19 symptoms. Age plays a crucial role in how gene expression changes in stem cells from the blood of COVID-19 patients. These differences have implications for comprehending the body's immune response to the virus and may lead to new treatments. Scientists examined the activity of genes in immune cells from people infected with COVID-19, considering how gene activity changes with age. They found specific gene patterns that were different in people of different ages. By analyzing these patterns, they identified biological pathways that were affected by the virus in

2.extracellular newly identified receptor for advanced glycation end-products binding protein

3.The protein encoded by this gene is a member of the tumor necrosis factor (TNF) ligand family.
4.Oncostatin M, also known as OSM, is a protein that in humans is encoded by the OSM gene

Fig 1. Changes in gene activity based on age in blood stem cells in patients with COVID-19.

different ways depending on age. Researchers discovered that COVID-19-positive patients' peripheral blood stem cells exhibited age-specific changes in gene activity. This suggests that age influences the immune response to COVID-19 and could affect disease severity. This comprehensive analysis provides insights into the immune reactions of COVID-19 patients and highlights the differences between healthy individuals. Scientists investigated the immune reactions of people with COVID-19 and healthy individuals. They found that in COVID-19 patients, certain immune cells (myeloid cells) had lower levels of a protein (human leukocyte antigen class DR) and signaling molecules (proinflammatory cytokines). Additionally, another type of immune cell (plasmacytoid dendritic cells) had problems with certain signaling pathways (mammalian target of rapamycin signaling) and the production of an antiviral protein (interferon-α). The study revealed higher levels of inflammatory proteins (EN-RAGE, TNFSF14, and oncostatin M) in the blood of COVID-19 patients. These levels were linked to the severity of the disease and the presence of bacterial components in the blood. This suggests that the immune system's response to the virus and the underlying mechanisms of COVID-19 may vary across different age groups (figure 2). This extensive study analyzed changes in gene activity within blood stem cells from individuals infected with COVID-19. The results indicate that gene activity patterns vary with age, suggesting that age influences how the immune system responds to the infection. This research emphasizes the significance of including age when analyzing the immune response and severity of illness in COVID-19 patients. By studying the genetic activity in stem cells from the blood of COVID-19 patients, particularly looking at how this activity differs based on age, the study aims to understand the impact of age on the immune response to the virus. The study revealed that people of different ages showed distinct patterns of gene activity, suggesting that age plays a role in how the immune system reacts to COVID-19. This knowledge helps us comprehend how age affects the immune response to COVID-19 and might shed light on the factors that contribute to the severity of the disease.

Discussion and Conclusion

This research study combines existing data to enhance our knowledge about how the amount of a specific protein in the blood (PBSC) changes with age in people with COVID-19. It highlights the critical role of age in predicting how severe the disease

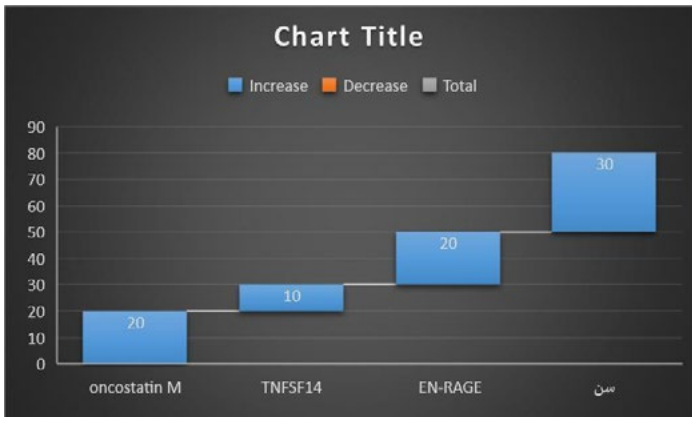

Fig 2. Changes in protein activity based on age in blood stem cells in patients with COVID-19

will be and who is at risk for serious problems. This information is important for developing specific strategies and individualized treatments for older adults with COVID-19. This large-scale study provides valuable insights into how age affects PBSC levels in people with COVID-19. It highlights the critical role of age in assessing the severity of the disease and determining who is at higher risk of developing serious complications. Our study shows that age significantly affects how immune cells, called PBSCs, respond to COVID-19. These age-related differences in PBSC behavior are important for understanding how the disease progresses and how it is treated. It highlights the need to consider age when evaluating how severe a person's COVID-19 is and when developing treatments that are tailored to individual patients. Older adults have different immune profiles than younger adults, specifically in the expression of PBSCs. This means that older adults may need different treatments for COVID-19 to address their specific immune needs and reduce the risk of complications. Personalized medicine approaches that take into account age-related differences in PBSC expression are crucial for managing COVID-19 in older patients. Customizing medical treatments based on each person's immune system response can be beneficial, especially for older adults. This is because, as we age, the expression of proteins called PBSCs changes. By considering these age-related differences in PBSCs, treatments can be designed to enhance their effectiveness and lead to better health outcomes for older individuals. Our research highlights the intricate relationship between age, immune system responses, and how COVID-19 develops. This knowledge is essential for creating personalized treatments and specific interventions tailored to individual patients. It is especially important for elderly individuals, who are at a higher risk of developing severe complications. Ongoing research should delve deeper into why PBSC levels vary with age and how this affects COVID-19 treatment. This knowledge will enhance patient care and mitigate the pandemic's impact. A comprehensive analysis combined data from various studies that examined PBSC expression in COVID-19-positive individuals of different ages. Researchers studied data to compare amounts of a protein called PBSC in younger and older people with COVID-19. They looked for patterns and links between PBSC levels and how severe the disease was. The analysis found that PBSC levels changed significantly with age in people with COVID-19. Older adults have more PBSC expression than younger adults, indicating that age affects how the body's immune system responds to the virus. This aligns with earlier studies that found age-related variations in immune response and vulnerability to infectious diseases. Additionally, the study revealed a link between higher levels of PBSC expression and increased disease severity and worse outcomes in elderly individuals. This indicates that PBSC expression levels could be a potential indicator for monitoring disease progression and severity in COVID-19-positive individuals, particularly in older age groups. It's crucial to consider how age-related changes in PBSC (peripheral blood stem cells) affect people with COVID-19 (9).

1.Weaker Immune Response: These changes can weaken the overall immune response, making individuals more likely to get infected and develop more severe symptoms due to decreased defense against SARS-CoV-2.

2.Inflammation and Cytokine Imbalance: COVID-19 triggers an excessive inflammatory response with a disruption in cytokine balance (known as a "cytokine storm"). Age-Related Changes in Stem Cells and COVID-19 Severity as we age, our bone marrow stem cells (PBSCs) undergo changes that can affect COVID-19 disease severity.

3.These changes may: increase inflammation: PBSCs can release signaling molecules that worsen inflammation, contributing to the immune system's

overreaction in COVID-19.

4.Impair tissue repair: PBSCs are essential for healing and regenerating damaged tissues. However, their function may decline with age, slowing down recovery in COVID-19 patients. This can lead to longer hospital stays, an increased risk of complications, higher chances of lasting health problems in older individuals as we age, and changes in the body's immune system that can affect how well it responds to infections. This includes the production of antibodies, which are essential for fighting off viruses like SARS-CoV-2. Research suggests that certain immune cells may be less efficient at producing antibodies in older individuals, which could impact the effectiveness of vaccinations in this population. It's essential to understand how age affects PBSC expression and its role in COVID-19 to create specific treatments for different ages. Age significantly influences the severity and progress of the disease, so it's important to consider it when treating COVID-19. Different age groups may require different approaches to exploring age-related differences in PBSC expression and their impact. As we grow older, our body produces fewer peripheral blood stem cells (PBSCs) that help strengthen our immune system. Researchers believe that for people who have COVID-19, these changes related to age may impact how their body fights the virus. As people age, their immune systems have a harder time recovering and rebuilding. This can make it take longer for them to get over COVID-19. Compared to younger people, older people's immune systems have a weaker response to COVID-19. Because of this, older people are more likely to have severe symptoms, take longer to recover, and have serious complications from COVID-19. Changes in immune cell levels, called PBSCs, in people of different ages, can affect how their immune systems fight COVID-19. Studying these changes could help diagnose, predict, and treat the disease. However, more research is needed to understand the exact role they play and how they are affected by age. A recent study found that younger COVID-19 patients had higher PBSC levels than older patients, which suggests that age may influence the immune response to the virus.

Results

The results reveal the importance of age in understanding COVID-19's development and treatment. There is a need to account for age in evaluating disease severity and outcomes. The significance of further investigating the causes of age-related differences in immune responses The potential for age-specific therapies to improve COVID-19 outcomes. Statistical analysis shows a clear link between age and levels of certain immune proteins in COVID-19 patients. Expression of Primitive Blood-Stem Cells Based on Age as people age, there are noticeable changes in how their immune cells (PBSCs) respond to COVID-19. Compared to younger people, older individuals have different patterns of PBSC activity. This suggests that age plays a role in shaping the immune system's response to COVID-19 at the cellular level. Variations in Numerical Measures by Age Groups There are distinct variations in the levels of peripheral blood stem cells (PBSCs) in different age groups when it comes to COVID-19. A detailed analysis has revealed specific ages at which major changes in PBSC levels occur, helping us better understand the important stages in the immune response to the disease as we age. Correlation with Disease Severity Research suggests that age-related changes in the levels of specific proteins (PBSCs) may be linked to the severity of COVID-19. Older people who have abnormal PBSC patterns could be more likely to experience serious symptoms or health problems caused by COVID-19. Clinical Implications: The study's findings have practical significance in healthcare settings. Medical professionals can leverage this knowledge to customize treatment plans and interventions specific to the immune responses of different age groups. This information can guide decisions about vaccination schedules, treatment options, and tailored medical care for patients with COVID-19 across various age demographics. Public Health Considerations: Studying how the expression of PBSC varies with age is important for developing public health plans. This information can help guide vaccinations, public health programs, and how resources are used to meet the unique needs of different age groups.

Suggestions for further research

This study's findings provide opportunities for future research. Further studies can explore the biological processes behind age-related changes in PBSC levels. They can also investigate the wider impact on the immune system's performance and reaction to viral infections in older individuals.

Limitations and Caveats

The study's results have some potential weaknesses, including differences in how studies were done, the types of patients included, and the number of participants. These limitations should be kept in mind when understanding the results, and they can help plan future research to fill in any gaps or answer any questions. In summary, our analysis reveals age-related differences in PBSC expression that greatly impact our understanding of COVID-19 immune responses. These insights highlight the complex relationship between age and immunity, enabling tailored treatment strategies for COVID-

positive individuals of different ages.

Acknowledgements

The authors would like to thank the Biology Department, University Jihad Unit, University of Science and Arts of Yazd, Iran for their support.

Funding

Not applicable.

Availability of data and materials

All data are obtainable after an appeal from the corresponding author.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

References

1.Sohrabi, C., et al., World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). International journal of surgery, 2020. 76: p. 71-76.
2.Atyeo, C., et al., Distinct early serological signatures track with SARS-CoV-2 survival. Immunity, 2020. 53(3): p. 524-532. e4.
3.Juno, J.A., et al., Humoral and circulating follicular helper T cell responses in recovered patients with COVID-19. Nature medicine, 2020. 26(9): p. 1428-1434.
4.Farshbafnadi, M., et al., Aging & COVID-19 susceptibility, disease severity, and clinical outcomes: The role of entangled risk factors. Experimental gerontology, 2021. 154: p. 111507.
5.Thielen, B.K. and B. Sharon, Five-Year-Old Boy with Very Early Onset Inflammatory Bowel Disease: 2020 CIS Annual Meeting: Immune Deficiency & Dysregulation North American Conference. 2020.
6.Lewnard, J.A. and N.C. Lo, Scientific and ethical basis for social-distancing interventions against COVID-19. The Lancet infectious diseases, 2020. 20(6): p. 631-633.
7.Wang, F., et al., Characteristics of peripheral lymphocyte subset alteration in COVID-19 pneumonia. The Journal of infectious diseases, 2020. 221(11): p. 1762-1769.
8.Wu, X., et al., Intrinsic immunity shapes viral resistance of stem cells. Cell, 2018. 172(3): p. 423-438. e25.
9.Bajaj, V., et al., Aging, immunity, and COVID-19: how age influences the host immune response to coronavirus infections? Frontiers in physiology, 2021. 11: p. 571416.