Genetic Factors Influencing Aplastic Anemia in the Context of HIV

Article · September 2024

CITATION
1

READS
6

2 authors, including:

Emmanuel Ifeanyi Obeagu
Africa University
2,100 PUBLICATIONS **36,090** CITATIONS

SEE PROFILE

Elite Journal of Health Sciences. Volume 2 Issue 9(2024), Pp. 143-155

https://epjournals.com/journals/EJHS

Genetic Factors Influencing Aplastic Anemia in the Context of HIV

*Emmanuel Ifeanyi Obeagu[1] and Malachy C. Iheanacho[2]

[1]Department of Medical Laboratory Science, Kampala International University, Uganda.

[2]Department of Haematology, Federal Teaching Hospital, Owerri, Imo State, Nigeria

*Corresponding authour: Emmanuel Ifeanyi Obeagu, Department of Medical Laboratory Science, Kampala International University, Uganda, emmanuelobeagu@yahoo.com, ORCID: 0000-0002-4538-0161

Abstract

Aplastic anemia (AA) is a severe hematologic disorder characterized by bone marrow failure, resulting in reduced production of blood cells. In HIV-infected patients, the interplay between viral-induced immune dysregulation and genetic predispositions complicates the pathogenesis of AA. This review explores the genetic factors influencing the development and progression of AA in the context of HIV. We examine inherited genetic mutations, variations affecting immune function, and genetic factors influencing drug metabolism that may predispose individuals to AA or affect their disease course. Additionally, we discuss how genetic predispositions interact with HIV infection to influence disease severity and treatment response. Genetic mutations in genes involved in hematopoiesis and immune regulation, as well as variations affecting drug metabolism, can impact disease susceptibility, progression, and response to treatment. The interaction between genetic predispositions and HIV-induced immune dysregulation further complicates disease management, highlighting the need for personalized treatment approaches.

Keywords: *Aplastic anemia, HIV, genetic factors, hematopoiesis, immune dysregulation*

Introduction

Aplastic anemia (AA) is a serious hematologic condition characterized by the failure of the bone marrow to produce adequate quantities of blood cells, leading to a triad of symptoms: anemia, leukopenia, and thrombocytopenia. This condition results from damage to hematopoietic stem cells or their microenvironment, and can be caused by a variety of factors including autoimmune diseases, exposure to toxins, and viral infections. In the context of HIV infection, the pathogenesis of AA is further complicated by the virus's impact on the immune system and hematopoiesis,

raising questions about the interplay between genetic predispositions and HIV-related factors. HIV infection is known to cause significant immune dysregulation, characterized by the depletion of CD4+ T cells and the subsequent impairment of immune function. This immune suppression can contribute to the development of AA by disrupting normal hematopoiesis and increasing susceptibility to secondary infections and autoimmune responses. Additionally, the chronic inflammatory state induced by HIV infection may exacerbate bone marrow dysfunction, making individuals more prone to developing AA.[1-6]

Recent advancements in genomics have highlighted the role of genetic factors in the susceptibility and progression of AA. Genetic predispositions, such as inherited mutations in hematopoietic and immune system genes, can influence an individual's risk of developing AA. For instance, mutations in genes involved in DNA repair, such as those associated with Fanconi anemia, are known to predispose individuals to bone marrow failure. Understanding these genetic factors is crucial for unraveling the complexities of AA in HIV-infected patients. The interaction between genetic predispositions and HIV-related factors can significantly impact the development and severity of AA. Genetic variations that affect immune function or drug metabolism can influence how the body responds to HIV infection and its impact on bone marrow function. For example, polymorphisms in cytokine genes may modulate the inflammatory response and contribute to the development of AA in the setting of HIV. Furthermore, genetic variations that affect the metabolism of antiretroviral drugs can influence treatment efficacy and toxicity, impacting overall patient outcomes.[7-12]

Diagnostic approaches for AA in HIV-infected patients must consider both the genetic and viral factors contributing to the disease. A comprehensive evaluation, including genetic screening and assessment of HIV viral load and CD4+ count, is essential for accurate diagnosis and effective management. Genetic testing can identify predispositions that may exacerbate AA, while monitoring HIV-related parameters can help guide treatment decisions and assess the impact of HIV on bone marrow function. Therapeutic strategies for managing AA in HIV-infected patients are complex and must be tailored to individual needs. Personalized treatment approaches that consider genetic factors can optimize the management of both AA and HIV. This may involve adjustments to antiretroviral therapy based on genetic variations affecting drug metabolism, as well as targeted treatments for AA that address specific genetic abnormalities. Understanding the role of genetic factors in disease progression and treatment response can enhance therapeutic efficacy and reduce adverse effects.[13-18]

Genetic Factors in Aplastic Anemia

Aplastic anemia (AA) is a hematologic disorder characterized by the failure of the bone marrow to produce sufficient blood cells. While AA can be acquired due to environmental exposures, autoimmune diseases, or infections, genetic factors also play a significant role in its pathogenesis.[19-20]

Inherited Genetic Mutations

1. **Fanconi Anemia (FA) Genes**: Fanconi anemia is a genetic disorder characterized by aplastic anemia and other hematologic abnormalities. Mutations in genes involved in DNA repair, such as FANCA, FANCC, and FANCD2, are linked to an increased risk of AA. These mutations impair the repair of DNA cross-links, leading to hematopoietic stem cell dysfunction and bone marrow failure.[21-22]

2. **Telomerase Complex Genes**: Genetic mutations affecting telomerase, an enzyme responsible for maintaining telomere length, can contribute to AA. For example, mutations in the TERT and TERC genes, which encode components of the telomerase complex, have been associated with telomere shortening and hematopoietic stem cell senescence. This results in impaired blood cell production and an increased risk of AA.[23-25]

3. **Dyskeratosis Congenita (DC) Genes**: Dyskeratosis congenita, a rare genetic disorder characterized by bone marrow failure, skin abnormalities, and mucosal lesions, is associated with mutations in genes such as DKC1 and TINF2. These genetic abnormalities affect telomere maintenance and hematopoietic stem cell function, increasing the risk of developing AA.[26-28]

Genetic Variations Affecting Immune Function

1. **Cytokine Gene Polymorphisms**: Genetic variations in cytokine genes can influence immune responses and susceptibility to AA. For example, polymorphisms in genes encoding pro-inflammatory cytokines such as TNF-α, IL-6, and IL-1β may affect the inflammatory environment and contribute to the development of AA. These variations can modulate the immune system's response to HIV infection and impact bone marrow function.[29-31]

2. **Autoimmune Susceptibility Genes**: AA can result from autoimmune destruction of hematopoietic cells. Genetic variations in autoimmune susceptibility genes, such as those involved in the regulation of T cell activity and autoimmunity, may increase the risk of developing AA. For instance, polymorphisms in genes such as CTLA-4 and PD-1 can influence immune tolerance and contribute to autoimmune-mediated bone marrow failure.[32-34]

Genetic Factors Influencing Drug Metabolism

1. **Drug-Metabolizing Enzymes**: Genetic polymorphisms in drug-metabolizing enzymes can affect the metabolism of medications used in the treatment of both HIV and AA. For example, variations in genes encoding cytochrome P450 enzymes can influence the pharmacokinetics of antiretroviral drugs and other medications used in AA management. These genetic variations can impact drug efficacy and the risk of adverse effects, necessitating personalized treatment approaches.[35-37]

2. **Transporter Proteins**: Genetic variations in transporter proteins, such as those involved in drug absorption and distribution, can also affect treatment outcomes. For example, polymorphisms in the multidrug resistance protein (MDR1) gene may influence the

effectiveness of antiretroviral drugs and other treatments for AA. Understanding these genetic factors can help tailor therapy to individual patient needs and improve therapeutic outcomes.[38-40]

Genetic Testing and Personalized Medicine

1. **Diagnostic Genetic Testing**: Genetic testing can identify inherited mutations and variations that predispose individuals to AA. This information can aid in the diagnosis of genetic syndromes associated with AA and guide treatment decisions. For instance, identifying mutations in FA or telomerase complex genes can help determine appropriate management strategies and assess the risk of disease progression.[41-43]
2. **Personalized Treatment Approaches**: Knowledge of genetic factors can inform personalized treatment strategies for AA. For example, adjusting antiretroviral therapy based on genetic variations affecting drug metabolism can enhance treatment efficacy and minimize adverse effects. Additionally, targeted therapies that address specific genetic abnormalities associated with AA may improve patient outcomes.[44-46]

Genetic Research and Future Directions

1. **Advancements in Genetic Research**: Ongoing research into the genetic factors influencing AA continues to provide insights into disease mechanisms and potential therapeutic targets. Advances in genomic technologies, such as next-generation sequencing, are facilitating the identification of novel genetic variants and their role in AA pathogenesis.[47-49]
2. **Integration of Genetic Information into Clinical Practice**: The integration of genetic information into clinical practice holds promise for improving the management of AA. By incorporating genetic testing into routine diagnostic and therapeutic approaches, healthcare providers can develop personalized treatment plans that address the unique genetic profile of each patient.[50-52]

Interaction Between Genetic Factors and HIV

The interplay between genetic factors and HIV infection significantly impacts the development and progression of aplastic anemia (AA). This interaction can modify disease susceptibility, influence disease severity, and affect responses to treatment. Understanding how genetic predispositions interact with HIV-related factors is crucial for managing AA in HIV-infected individuals.[53-55]

Genetic Predispositions Influencing HIV Pathogenesis

1. **Impact on HIV Susceptibility and Progression**: Genetic variations in immune system genes can influence an individual's susceptibility to HIV infection and the progression of the disease. For instance, polymorphisms in the CCR5 and CXCR4 genes, which encode

co-receptors used by HIV to enter cells, can affect susceptibility to HIV infection and the progression of HIV-related complications. These genetic variations may also impact the development of AA by altering the immune response and bone marrow function.[56-58]

2. **Influence on Immune Response**: Genetic factors that affect immune function can modulate how the body responds to HIV infection. Variations in genes encoding cytokines, cytokine receptors, and other immune system components can influence the inflammatory response and immune dysregulation associated with HIV. These genetic variations may exacerbate the impact of HIV on hematopoiesis, contributing to the development of AA.[59-62]

Genetic Factors Modulating HIV-Related Bone Marrow Dysfunction

1. **Genetic Influence on Bone Marrow Resilience**: Genetic predispositions can affect the resilience of hematopoietic stem cells and the bone marrow microenvironment in the context of HIV infection. For example, mutations in genes involved in DNA repair or telomere maintenance can impair the ability of bone marrow stem cells to recover from the damage caused by HIV-induced inflammation or other stressors. This can increase the risk of developing AA in HIV-infected individuals.[63-65]

2. **Interaction with HIV-Induced Immune Dysregulation**: HIV-induced immune dysregulation can exacerbate the effects of genetic mutations or variations that predispose individuals to AA. For instance, genetic variations that affect immune cell function or cytokine production may interact with HIV-induced inflammation to disrupt normal bone marrow function. This interaction can lead to an increased risk of AA and complicate disease management.[66-68]

Genetic Variations Affecting Treatment Response

1. **Influence on Antiretroviral Therapy (ART) Efficacy**: Genetic variations in drug-metabolizing enzymes can impact the efficacy and safety of ART used to manage HIV infection. For example, polymorphisms in genes encoding cytochrome P450 enzymes can affect the metabolism of antiretroviral drugs, influencing their effectiveness and the risk of adverse effects. These genetic factors can also impact the management of AA by affecting the choice and dosing of medications.[69-72]

2. **Impact on AA Treatment Outcomes**: Genetic factors influencing drug metabolism can also affect the treatment of AA. Variations in genes involved in drug transport and metabolism can influence the effectiveness and toxicity of medications used to treat AA, such as growth factors or immunosuppressive agents. Personalized treatment approaches that consider genetic profiles can optimize therapeutic outcomes and minimize adverse effects.[73-74]

Diagnostic and Therapeutic Implications

1. **Personalized Diagnostic Approaches**: Integrating genetic information into diagnostic approaches can improve the accuracy of diagnosing AA in HIV-infected patients. Genetic testing can identify predispositions that may influence disease development and progression, guiding diagnostic and management strategies. For example, identifying genetic variations that affect immune function or drug metabolism can inform decisions about treatment and monitoring.[75-77]
2. **Tailored Treatment Strategies**: Understanding the interaction between genetic factors and HIV can guide personalized treatment strategies for AA. This may involve selecting antiretroviral therapies based on genetic variations affecting drug metabolism and adjusting treatments for AA based on genetic predispositions. Personalized medicine approaches can enhance treatment efficacy and reduce the risk of adverse effects.[78-79]

Diagnostic and Therapeutic Implications

The interaction between genetic factors and HIV infection has significant implications for the diagnosis and treatment of aplastic anemia (AA). By understanding these interactions, healthcare providers can enhance diagnostic accuracy and tailor therapeutic strategies to improve patient outcomes.[80]

Diagnostic Implications

1. **Genetic Testing for Diagnosis**: Genetic testing plays a crucial role in diagnosing AA, particularly when HIV is involved. Identifying genetic mutations associated with inherited bone marrow failure syndromes, such as Fanconi anemia or dyskeratosis congenita, can help differentiate between primary AA and secondary forms related to HIV. For example, detecting mutations in the FANCA gene can confirm a diagnosis of Fanconi anemia, which may present similarly to AA but requires different management strategies.[81-82]
2. **Assessing Genetic Variations**: Genetic variations affecting immune function, such as cytokine gene polymorphisms, can provide insights into the underlying mechanisms of AA in HIV-infected patients. Evaluating these genetic factors can help identify individuals at higher risk of developing AA due to their genetic predispositions and HIV-induced immune dysregulation. This information can guide the development of personalized diagnostic approaches and inform clinical decision-making.[83-84]
3. **Evaluating Drug Metabolism**: Genetic testing for polymorphisms in drug-metabolizing enzymes can influence the choice of antiretroviral therapy and other medications used in managing AA. For example, variations in the CYP450 enzyme family can impact the metabolism of ART and drugs used to treat AA.[85]

Therapeutic Implications

1. **Personalized Treatment Plans**: Integrating genetic information into treatment planning enables the development of personalized treatment strategies for AA in HIV-infected

patients. Genetic profiles can inform the selection of antiretroviral drugs and therapies for AA, such as growth factors or immunosuppressive agents. For instance, patients with specific genetic variations affecting drug metabolism may benefit from adjusted dosages or alternative medications to enhance efficacy and minimize side effects.[86]

2. **Optimizing Antiretroviral Therapy (ART)**: Genetic variations that affect the metabolism of ART drugs can influence treatment outcomes. Personalized ART regimens based on genetic testing can improve viral suppression while minimizing adverse effects. For example, individuals with polymorphisms in the CYP3A5 gene may require dose adjustments for certain antiretroviral drugs, ensuring effective treatment of HIV without exacerbating AA.[87]

3. **Targeted Therapies for AA**: Understanding genetic factors associated with AA can guide the use of targeted therapies. For example, patients with genetic mutations affecting hematopoietic stem cell function may benefit from targeted treatments that address specific genetic abnormalities. Additionally, growth factors and immunosuppressive therapies can be tailored based on genetic profiles to enhance their effectiveness in managing AA.[86]

4. **Monitoring and Follow-up**: Genetic factors should be considered when designing monitoring and follow-up protocols for AA in HIV-infected patients. Regular assessment of genetic markers and disease progression can help evaluate treatment efficacy and make necessary adjustments. For example, monitoring changes in bone marrow function and genetic markers can guide decisions regarding the continuation or modification of therapy.[87]

Conclusion

The intricate interaction between genetic factors and HIV infection has profound implications for the development, diagnosis, and treatment of aplastic anemia (AA). Genetic predispositions, including mutations affecting DNA repair, telomere maintenance, and immune function, significantly influence an individual's susceptibility to AA and its progression in the context of HIV. Genetic testing provides valuable insights into the underlying mechanisms of AA and guides personalized treatment approaches. Identifying specific genetic mutations associated with bone marrow failure syndromes can enhance diagnostic accuracy and inform targeted therapeutic interventions. Additionally, genetic variations affecting drug metabolism and immune responses can impact the efficacy and safety of antiretroviral therapies and other treatments used to manage AA.

References

1. Furlong E, Carter T. Aplastic anaemia: Current concepts in diagnosis and management. Journal of paediatrics and child health. 2020;56(7):1023-1028.

2. Chichetto NE, Polanka BM, So-Armah KA, Sung M, Stewart JC, Koethe JR, Edelman EJ, Tindle HA, Freiberg MS. Contribution of behavioral health factors to non-AIDS-related comorbidities: an updated review. Current HIV/AIDS Reports. 2020; 17:354-372.
3. Obeagu EI, Anyiam AF, Obeagu GU. Managing Hematological Complications in HIV: Erythropoietin Considerations. Elite Journal of HIV, 2024; 2(1): 65-78
4. Obeagu EI, Obeagu GU, Hauwa BA, Umar AI. Hematocrit Variations in HIV Patients Co-infected with Malaria: A Comprehensive Review. Journal home page: http://www. journalijiar. com.;12(01).
5. Obeagu EI, Obeagu GU. Maternal Influence on Infant Immunological Responses to HIV: A Review. Elite Journal of Laboratory Medicine, 2024; 2(1): 46-58
6. Obeagu EI, Obeagu GU. The Impact of Erythropoietin on Preeclampsia in HIV-Positive Women: A Review. Elite Journal of Nursing and Health Science, 2024; 2(1):21-31
7. Obeagu EI, GU Obeagu. Unmasking the Truth: Addressing Stigma in the Fight Against HIV. Elite Journal of Public Health, 2024; 2 (1): 8-22
8. Obeagu EI, Obeagu GU. Platelet-Driven Modulation of HIV: Unraveling Interactions and Implications. Journal home page: http://www. journalijiar. com. 2024;12(01).
9. Obeagu EI, Obeagu GU. Understanding B Lymphocyte Functions in HIV Infection: Implications for Immune Dysfunction and Therapeutic Strategies. Elite Journal of Medicine, 2024;2(1): 35-46
10. Obeagu EI, Obeagu GU. Implications of B Lymphocyte Dysfunction in HIV/AIDS. Elite Journal of Immunology, 2024; 2(1): 34-46
11. Obeagu EI, Anyiam AF, Obeagu GU. Unveiling B Cell Mediated Immunity in HIV Infection: Insights, Challenges, and Potential Therapeutic Avenues. Elite Journal of HIV, 2024; 2(1): 1-15
12. Obeagu EI, Obeagu GU. Eosinophil-Associated Changes in Neonatal Thymic T Regulatory Cell Populations in HIV-Infected Pregnancies. Elite Journal of Health Science, 2024; 2(1): 33-42
13. Obeagu EI, Obeagu GU. Maternal Eosinophilic Responses in HIV-Positive Pregnant Women: Unraveling Immunological Dynamics for Improved Maternal-Fetal Health. Elite Journal of Immunology, 2024; 2(1): 47-64
14. Obeagu EI, Obeagu GU. CD8 Dynamics in HIV Infection: A Synoptic Review. Elite Journal of Immunology, 2024; 2(1): 1-13
15. Felker-Kantor EA, Wallace ME, Madkour AS, Duncan DT, Andrinopoulos K, Theall K. HIV stigma, mental health, and alcohol use disorders among people living with HIV/AIDS in New Orleans. Journal of urban health. 2019; 96:878-888.
16. Obeagu EI, Obeagu GU. Mental Health and Psychosocial Effects of natural disaster on HIV Patients. Asian J Dental Health Sci 2024;4(1):38-44. Available from: http://ajdhs.com/index.php/journal/article/view/63
17. Obeagu EI, Anyanwu CN, Obeagu GU. Challenges and Considerations in Managing Blood Transfusion for Individuals with HIV. Elite Journal of HIV, 2024; 2(2): 1-17
18. Obeagu EI, Obeagu GU.Understanding Hematocrit Fluctuations in HIV-Malaria Coinfection for Improved Management. Elite Journal of Public Health, 2024; 2 (1): 22-34

19. Skalski LM, Sikkema KJ, Heckman TG, Meade CS. Coping styles and illicit drug use in older adults with HIV/AIDS. Psychology of Addictive Behaviors. 2013;27(4):1050.
20. Obeagu EI, Ayogu EE, Obeagu GU. Interactions between Blood Transfusion and Antiretroviral Medications: Implications for Patient Care. Elite Journal of Medicine, 2024; 2(2):104-115
21. Alum EU, Ugwu OP, Obeagu EI, Okon MB. Curtailing HIV/AIDS spread: impact of religious leaders. Newport International Journal of Research in Medical Sciences (NIJRMS). 2023;3(2):28-31.
22. Obeagu EI, Malot S, Obeagu GU, Ugwu OP. HIV resistance in patients with Sickle Cell Anaemia. Newport International Journal of Scientific and Experimental Sciences (NIJSES). 2023;3(2):56-59.
23. Obeagu EI, Obeagu GU, Paul-Chima UO. Stigma Associated With HIV. AIDS: A Review. Newport International Journal of Public Health and Pharmacy (NIJPP). 2023;3(2):64-7.
24. Alum EU, Obeagu EI, Ugwu OP, Aja PM, Okon MB. HIV infection and cardiovascular diseases: the obnoxious duos. Newport International Journal of Research in Medical Sciences (NIJRMS). 2023;3(2):95-99.
25. Hill K, Kuo I, Shenoi SV, Desruisseaux MS, Springer SA. Integrated care models: HIV and substance use. Current HIV/AIDS Reports. 2023;20(5):286-295.
26. Obeagu EI, Obeagu GU. Hematological Changes Following Blood Transfusion in Young Children with Severe Malaria and HIV: A Critical Review. Elite Journal of Laboratory Medicine, 2024; 2(1): 33-45
27. Obeagu EI, Obeagu GU. The Role of Blood Transfusion Strategies in HIV Management: Current Insights and Future Directions. Elite Journal of Medicine, 2024; 2(1):10-22
28. Viola N, Kimono E, Nuruh N, Obeagu EI. Factors Hindering Elimination of Mother to Child Transmission of HIV Service Uptake among HIV Positive Women at Comboni Hospital Kyamuhunga Bushenyi District. Asian J Dental Health Sci [Internet]. 2023 Jun. 15 [cited 2024 Sep. 7];3(2):7-14. Available from: http://ajdhs.com/index.php/journal/article/view/39
29. Obeagu EI, Obeagu GU. Transfusion-Related Complications in Children Under 5 with Coexisting HIV and Severe Malaria: A Review. Int. J. Curr. Res. Chem. Pharm. Sci. 2024;11(2):9-19.
30. Obeagu EI, Anyiam AF, Obeagu GU. Managing Anemia in HIV through Blood Transfusions: Clinical Considerations and Innovations. Elite Journal of HIV, 2024; 2(1): 16-30
31. Alum EU, Obeagu EI, Ugwu OP, Samson AO, Adepoju AO, Amusa MO. Inclusion of nutritional counseling and mental health services in HIV/AIDS management: A paradigm shift. Medicine. 2023 Oct 13;102(41):e35673.
32. Obeagu EI, Obeagu, GU. Counting Cells, Shaping Fates: CD4/CD8 Ratios in HIV. Elite Journal of Scientific Research and Review, 2024; 2(1): 37-50
33. Obeagu EI, Obeagu GU. Eosinophil Dynamics in Pregnancy among Women Living with HIV: A Comprehensive Review. Int. J. Curr. Res. Med. Sci. 2024;10(1):11-24.

34. Obeagu EI, Obeagu GU, Hauwa BA, Umar AI. Neutrophil Dynamics: Unveiling Their Role in HIV Progression within Malaria Patients. Journal home page: http://www. journalijiar. com.;12(01).
35. Goodwin M. Black markets: the supply and demand of body parts. Cambridge University Press; 2006.
36. Obeagu EI, Obeagu GU. Eosinophilic Changes in Placental Tissues of HIV-Positive Pregnant Women: A Review. Elite Journal of Laboratory Medicine, 2024; 2(1): 14-32
37. Obeagu EI, Obeagu, GU. P-Selectin and Platelet Activation in HIV: Implications for Antiviral Therapy. Elite Journal of Scientific Research and Review, 2024; 2(1): 17-41
38. Obeagu EI, Obeagu GU. The Intricate Relationship Between Erythropoietin and HIV-Induced Anemia: Unraveling Pathways for Therapeutic Insights. Int. J. Curr. Res. Chem. Pharm. Sci. 2024;11(2):30-40.
39. Obeagu EI, Anyiam AF, Obeagu GU. Erythropoietin Therapy in HIV-Infected Individuals: A Critical Review. Elite Journal of HIV, 2024; 2(1): 51-64
40. Obeagu EI, Obeagu GU. Strength in Unity: Building Support Networks for HIV Patients in Uganda . Elite Journal of Medicine, 2024; 2(1): 1-16
41. Mandania EW. Haematological and Immunological Abnormalities in People Living With HIV: A Review. Journal of Medical and Biomedical Laboratory Sciences Research. 2024;4(1).
42. Obeagu EI, Obeagu, GU. The Crucial Role of Erythropoietin in Managing Anemia in HIV: A Review. Elite Journal of Scientific Research and Review, 2024; 2(1): 24-36
43. Obeagu EI, Ubosi NI, Obeagu GU, Obeagu AA. Nutritional Strategies for Enhancing Immune Resilience in HIV: A Review. Int. J. Curr. Res. Chem. Pharm. Sci. 2024;11(2):41-51.
44. Obeagu EI, Obeagu GU. Assessing Platelet Functionality in HIV Patients Receiving Antiretroviral Therapy: Implications for Risk Assessment. Elite Journal of HIV, 2024; 2(3): 14-26
45. Obeagu EI, Elamin EAI Obeagu GU. Understanding the Intersection of Highly Active Antiretroviral Therapy and Platelets in HIV Patients: A Review. Elite Journal of Haematology, 2024; 2(3): 111-117
46. Obeagu EI, Obeagu GU. Understanding ART and Platelet Functionality: Implications for HIV Patients. Elite Journal of HIV, 2024; 2(2): 60-73
47. Obeagu EI, Obeagu GU. Understanding Immune Cell Trafficking in Tuberculosis-HIV Coinfection: The Role of L-selectin Pathways. Elite Journal of Immunology, 2024; 2(2): 43-59
48. Obeagu EI, Obeagu GU, Obiezu J, Ezeonwumelu C, Ogunnaya FU, Ngwoke AO, Emeka-Obi OR, Ugwu OP. Hematologic Support in HIV Patients: Blood Transfusion Strategies and Immunological Considerations. Applied Sciences (NIJBAS). 2023;3(3).
49. Obeagu EI, Obeagu GU. Neonatal Outcomes in Children Born to Mothers with Severe Malaria, HIV, and Transfusion History: A Review. Elite Journal of Nursing and Health Science, 2024; 2(3): 38-58
50. Obeagu EI. Erythropoietin and the Immune System: Relevance in HIV Management. Elite Journal of Health Science, 2024; 2(3): 23-35

Citation: Obeagu EI, Iheanacho MC. Genetic Factors Influencing Aplastic Anemia in the Context of HIV. Elite Journal of Health Science, 2024; 2(9): 143-155

51. Obeagu EI, Obeagu GU. Anemia and Erythropoietin: Key Players in HIV Disease Progression. Elite Journal of Haematology, 2024; 2(3): 42-57
52. Obeagu EI, Obeagu GU. Optimizing Blood Transfusion Protocols for Breast Cancer Patients Living with HIV: A Comprehensive Review. Elite Journal of Nursing and Health Science, 2024; 2(2):1-17
53. Obeagu EI, Obeagu GU. Hematologic Considerations in Breast Cancer Patients with HIV: Insights into Blood Transfusion Strategies. Elite Journal of Health Science, 2024; 2(2): 20-35
54. Obeagu EI, Ayogu EE, Obeagu GU. Impact on Viral Load Dynamics: Understanding the Interplay between Blood Transfusion and Antiretroviral Therapy in HIV Management. Elite Journal of Nursing and Health Science, 2024; 2(2): 5-15
55. American Psychiatric Association. Practice guideline for the treatment of patients with HIV/AIDS. American Psychiatric Pub; 2000.
56. Alum EU, Ugwu OP, Obeagu EI, Aja PM, Okon MB, Uti DE. Reducing HIV Infection Rate in Women: A Catalyst to reducing HIV Infection pervasiveness in Africa. International Journal of Innovative and Applied Research. 2023;11(10):01-6.
57. Obeagu EI, Obeagu GU. Immune Modulation in HIV-Positive Neonates: Insights and Implications for Clinical Management. Elite Journal of Nursing and Health Science, 2024; 2(3): 59-72
58. Obeagu EI, Obeagu GU. Advancements in HIV Prevention: Africa's Trailblazing Initiatives and Breakthroughs. Elite Journal of Public Health, 2024; 2 (1): 52-63
59. Sukumaran RK. Long-Term Follow-Up and Chronic Complications. Contemporary Bone Marrow Transplantation. 2021:641-665.
60. Obeagu EI, Obeagu GU. Platelet Aberrations in HIV Patients: Assessing Impacts of ART. Elite Journal of Haematology, 2024; 2(3): 10-24
61. Obeagu EI, Obeagu GU. The Role of L-selectin in Tuberculosis and HIV Coinfection: Implications for Disease Diagnosis and Management. Elite Journal of Public Health, 2024; 2 (1): 35-51
62. Obeagu EI, Obeagu GU. Harnessing B Cell Responses for Personalized Approaches in HIV Management. Elite Journal of Immunology, 2024; 2(2): 15-28
63. Obeagu EI, Obeagu GU. Unveiling the Role of Innate Immune Activation in Pediatric HIV: A Review. Elite Journal of Immunology, 2024; 2(3): 33-44
64. Obeagu EI, Obeagu GU. Unraveling the Role of Eosinophil Extracellular Traps (EETs) in HIV-Infected Pregnant Women: A Review. Elite Journal of Nursing and Health Science, 2024; 2(3): 84-99
65. Lyimo RA, Stutterheim SE, Hospers HJ, de Glee T, van der Ven A, de Bruin M. Stigma, disclosure, coping, and medication adherence among people living with HIV/AIDS in Northern Tanzania. AIDS patient care and STDs. 2014;28(2):98-105.
66. Obeagu EI, Obeagu, GU. Impact of Blood Transfusion on Viral Load Dynamics in HIV-Positive Neonates with Severe Malaria: A Review. Elite Journal of Scientific Research and Review, 2024; 2(1): 42-60
67. Obeagu EI, Obeagu GU. Impact of Maternal Eosinophils on Neonatal Immunity in HIV-Exposed Infants: A Review. Elite Journal of Immunology, 2024; 2(3): 1-18

Citation: Obeagu EI, Iheanacho MC. Genetic Factors Influencing Aplastic Anemia in the Context of HIV. Elite Journal of Health Science, 2024; 2(9): 143-155

68. Obeagu EI, Obeagu GU. L-selectin and HIV-Induced Immune Cell Trafficking: Implications for Pathogenesis and Therapeutic Strategies. Elite Journal of Laboratory Medicine, 2024; 2(2): 30-46
69. Obeagu EI, Obeagu GU. Exploring the Role of L-selectin in HIV-related Immune Exhaustion: Insights and Therapeutic Implications. Elite Journal of HIV, 2024; 2(2): 43-59
70. Obeagu EI, Obeagu GU. P-Selectin Expression in HIV-Associated Coagulopathy: Implications for Treatment. Elite Journal of Haematology, 2024; 2(3): 25-41
71. Obeagu EI, Obeagu GU. P-Selectin and Immune Activation in HIV: Clinical Implications. Elite Journal of Health Science, 2024; 2(2): 16-29
72. Obeagu EI, Amaeze AA, Ogbu ISI, Obeagu GU. B Cell Deficiency and Implications in HIV Pathogenesis: Unraveling the Complex Interplay. Elite Journal of Nursing and Health Science, 2024; 2(2): 33-46
73. Obeagu EI, Obeagu, GU. Platelet Dysfunction in HIV Patients: Assessing ART Risks. Elite Journal of Scientific Research and Review, 2024; 2(1): 1-16
74. Banerjee N, Goodman ZT, McIntosh R, Ironson G. Cognition, coping, and psychological distress in HIV. AIDS and Behavior. 2022;26(4):1074-1083.
75. Grau LE, Griffiths-Kundishora A, Heimer R, Hutcheson M, Nunn A, Towey C, Stopka TJ. Barriers and facilitators of the HIV care continuum in Southern New England for people with drug or alcohol use and living with HIV/AIDS: perspectives of HIV surveillance experts and service providers. Addiction science & clinical practice. 2017; 12:1-4.
76. Yu Y, Luo D, Chen X, Huang Z, Wang M, Xiao S. Medication adherence to antiretroviral therapy among newly treated people living with HIV. BMC public health. 2018; 18:1-8.
77. Li H, Wu X, Shen J, Lou S. Perspective and experience of patients with aplastic anemia on medication adherence. Patient preference and adherence. 2023:2215-2225.
78. Beichler H, Grabovac I, Dorner TE. Integrated care as a model for interprofessional disease management and the benefits for people living with HIV/AIDS. International Journal of Environmental Research and Public Health. 2023;20(4):3374.
79. Rajabiun S, Tryon J, Feaster M, Pan A, McKeithan L, Fortu K, Cabral HJ, Borne D, Altice FL. The influence of housing status on the HIV continuum of care: results from a multisite study of patient navigation models to build a medical home for people living with HIV experiencing homelessness. American Journal of Public Health. 2018;108(S7):S539-45.
80. Dale SK, Safren SA. Striving towards empowerment and medication adherence (STEP-AD): a tailored cognitive behavioral treatment approach for black women living with HIV. Cognitive and Behavioral Practice. 2018;25(3):361-376.
81. Ngcobo S, Scheepers S, Mbatha N, Grobler E, Rossouw T. Roles, barriers, and recommendations for community health workers providing community-based HIV Care in Sub-Saharan Africa: a review. AIDS Patient Care and STDs. 2022;36(4):130-144.
82. Obeagu EI, Ogu RIO, Ngwoke AO. Psychosocial Impact of Aplastic Anemia Diagnosis in HIV Patients: A Narrative Review. Elite Journal of Public Health, 2024; 2 (7): 35-46
83. Obeagu EI, Akinleye CA. Stabilizing Hemoglobin Levels: A Vital Aspect of Blood Transfusions in HIV Management. *Elite Journal of Haematology, 2024; 2(9):* 1-8
84. Obeagu EI, Akinleye CA. Promoting Fertility: Blood Transfusions and Reproductive Health in HIV-Positive Individuals. *Elite Journal of Haematology, 2024; 2(9):* 9-16

Citation: Obeagu EI, Iheanacho MC. Genetic Factors Influencing Aplastic Anemia in the Context of HIV. Elite Journal of Health Science, 2024; 2(9): 143-155

85. Obeagu EI, Akinleye CA. Minimizing Treatment-Related Depression: Blood Transfusions and Mental Health Support in HIV Care. Elite Journal of Public Health, 2024; 2 (7): 16-24

86. Obeagu EI, Akinleye CA. Promoting Social Integration: Blood Transfusions and Improved Social Well-being in HIV Patients. Elite Journal of Public Health, 2024; 2 (7): 25-34

87. Obeagu EI, Akinleye CA. Optimizing Physical Endurance: Blood Transfusions in HIV and the Improvement of Exercise Capacity. Elite Journal of Medicine, 2024; 2(9): 1-9