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Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV

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Abstract

Leukemia patients co-infected with Human Immunodeficiency Virus (HIV) face unique challenges, including the risk of Immune Reconstitution Inflammatory Syndrome (IRIS) following the initiation of antiretroviral therapy (ART). Emerging evidence suggests that Body Mass Index (BMI), a measure of adiposity and metabolic health, may influence the risk and severity of IRIS in this population. This review examines the relationship between BMI and IRIS risk in leukemia patients co-infected with HIV, exploring underlying mechanisms, clinical implications, and potential interventions. IRIS pathogenesis involves dysregulated immune responses to latent pathogens, resulting in exaggerated inflammatory reactions upon ART initiation. Dysregulation of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), contributes to tissue inflammation and organ dysfunction in IRIS. Understanding the mechanisms driving IRIS is crucial for identifying potential risk factors and developing targeted interventions to mitigate its impact on leukemia patients co-infected with HIV. BMI has emerged as a potential modifiable risk factor for IRIS in leukemia patients co-infected with HIV. Obesity, characterized by elevated BMI, is associated with chronic inflammation and dysregulated immune responses, potentially predisposing individuals to exaggerated inflammatory reactions during IRIS. Conversely, underweight status may reflect compromised immune function and nutritional status, increasing susceptibility to IRIS-related complications. Recognizing the impact of BMI on IRIS risk is essential for risk stratification and treatment planning, with targeted interventions aimed at optimizing BMI potentially offering avenues to reduce the risk and severity of IRIS in this vulnerable patient population.

Keywords: *Body Mass Index, BMI, Immune Reconstitution Inflammatory Syndrome, IRIS, leukemia, HIV, co-infection, adiposity, metabolic health, inflammation*

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Introduction

Leukemia patients co-infected with Human Immunodeficiency Virus (HIV) face a complex clinical landscape characterized by the interplay of hematologic malignancy, immunosuppression, and opportunistic infections. While the introduction of antiretroviral therapy (ART) has led to significant improvements in HIV-related outcomes, it has also led to the emergence of Immune Reconstitution Inflammatory Syndrome (IRIS), a paradoxical worsening of pre-existing infections or the unmasking of subclinical infections. Understanding the factors influencing IRIS risk and severity is critical for optimizing the care of leukemia patients with HIV co-infection.[1-5] The initiation of ART in HIV-infected individuals results in immune reconstitution, leading to the restoration of pathogen-specific immune responses. However, in some cases, this immune restoration is dysregulated, resulting in exaggerated inflammatory responses and tissue damage characteristic of IRIS. IRIS manifestations can vary widely, ranging from localized inflammatory reactions to life-threatening systemic manifestations, posing significant challenges in diagnosis and management. Factors contributing to IRIS pathogenesis include the magnitude and rapidity of immune reconstitution, the type of opportunistic pathogen involved, and host factors such as genetic predisposition and immune status.[6-10]

Body Mass Index (BMI), a measure of adiposity and metabolic health, has emerged as a potential modifiable risk factor for IRIS in leukemia patients co-infected with HIV. Obesity, characterized by elevated BMI, is associated with chronic low-grade inflammation and dysregulated immune responses, which may predispose individuals to exaggerated inflammatory reactions during IRIS. Conversely, underweight status, indicative of compromised immune function and nutritional status, may increase susceptibility to IRIS-related complications. Therefore, understanding the relationship between BMI and IRIS risk is essential for risk stratification and treatment planning in this vulnerable population.[11-15] The complex interplay between BMI and IRIS risk underscores the need for comprehensive risk assessment and personalized treatment approaches in leukemia patients co-infected with HIV. While the mechanisms linking BMI to IRIS risk remain incompletely understood, elucidating these pathways may offer insights into potential interventions aimed at mitigating IRIS risk and severity. Furthermore, recognizing the impact of BMI on IRIS risk may inform clinical decision-making, with targeted interventions aimed at optimizing BMI potentially offering avenues to reduce the risk and severity of IRIS in this high-risk population.[16-20] In this review, we examine the current literature on the relationship between BMI and IRIS risk in leukemia patients co-infected with HIV, exploring underlying mechanisms, clinical implications, and potential interventions. By synthesizing existing evidence and identifying gaps in knowledge, we aim to provide insights into the complex interplay between BMI, HIV co-infection, and IRIS risk, with implications for optimizing patient care and treatment outcomes. Through multidisciplinary collaboration and targeted research efforts, we can enhance our understanding of IRIS pathogenesis and develop personalized approaches to mitigate its impact on leukemia patients with HIV co-infection.[21-25]

Mechanisms of IRIS

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Immune Reconstitution Inflammatory Syndrome (IRIS) arises from the dysregulated restoration of pathogen-specific immune responses following the initiation of antiretroviral therapy (ART) in HIV-infected individuals. The pathogenesis of IRIS involves a complex interplay of immunological factors, opportunistic pathogens, and host immune responses. Upon ART initiation, there is a rapid and often dramatic increase in CD4+ T cell counts, leading to the restoration of immune function. However, in some cases, this immune reconstitution is dysregulated, resulting in exaggerated inflammatory responses and tissue damage characteristic of IRIS.[26-30] The dysregulated immune response in IRIS is driven by a combination of factors, including the rapid expansion of memory T cells specific to opportunistic pathogens, the release of pro-inflammatory cytokines, and the activation of innate immune cells. Memory T cells that were previously quiescent become activated upon encountering antigens from latent or subclinical infections, leading to the proliferation of pathogen-specific T cells and the production of inflammatory cytokines. This immune activation is further amplified by the release of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α), interleukin-6 (IL-6), and interferon-gamma (IFN-γ), which promote inflammation and tissue damage.[31-35]

The type and extent of immune reconstitution play a critical role in determining the manifestations and severity of IRIS. In some cases, IRIS may manifest as localized inflammatory reactions at the site of latent or subclinical infections, such as lymphadenitis, cutaneous lesions, or pulmonary infiltrates. In more severe cases, IRIS can lead to systemic inflammatory responses, resulting in multi-organ dysfunction and life-threatening complications. Host factors, including genetic predisposition, immune status, and prior exposure to opportunistic pathogens, also influence the risk and severity of IRIS.[36-38] Furthermore, the timing of ART initiation relative to the diagnosis and treatment of opportunistic infections can impact the risk of IRIS. Early initiation of ART, while beneficial for immune reconstitution and long-term outcomes, may increase the risk of IRIS by triggering an exaggerated inflammatory response before opportunistic infections are adequately controlled. Conversely, delayed initiation of ART may reduce the risk of IRIS but may also lead to prolonged immune dysfunction and increased susceptibility to opportunistic infections.[39-40]

Impact of BMI on IRIS Risk

Body Mass Index (BMI), a measure of adiposity and metabolic health, has emerged as a potential modifiable risk factor for Immune Reconstitution Inflammatory Syndrome (IRIS) in leukemia patients co-infected with Human Immunodeficiency Virus (HIV). Obesity, characterized by elevated BMI, is associated with chronic low-grade inflammation and dysregulated immune responses, which may predispose individuals to exaggerated inflammatory reactions during IRIS. Conversely, underweight status, indicative of compromised immune function and nutritional status, may increase susceptibility to IRIS-related complications. Therefore, understanding the impact of BMI on IRIS risk is essential for risk stratification and treatment planning in this vulnerable population.[41-44] Obesity is associated with alterations in systemic metabolism, adipokine secretion, and chronic inflammation, which may exacerbate immune dysregulation and inflammatory responses during IRIS. Adipose tissue-derived cytokines, such as leptin and

adiponectin, modulate immune cell function and inflammation, potentially influencing the severity of IRIS manifestations. Moreover, obesity-related metabolic disturbances, including insulin resistance and dyslipidemia, may further impair immune function and exacerbate inflammatory responses, increasing the risk of IRIS-related complications. Therefore, obesity represents a modifiable risk factor that may influence the risk and severity of IRIS in leukemia patients co-infected with HIV.[45-49] Conversely, underweight status may reflect compromised immune function and nutritional status, increasing susceptibility to IRIS-related complications. Malnutrition and immune deficiency associated with underweight status may impair immune responses and delay the resolution of opportunistic infections, leading to prolonged inflammation and tissue damage during IRIS. Additionally, underweight individuals may have reduced reserves to cope with the metabolic demands of inflammation, further exacerbating the risk of IRIS-related complications. Therefore, comprehensive assessment of BMI, along with other clinical and immunological parameters, is essential for identifying leukemia patients co-infected with HIV who are at higher risk of IRIS and guiding treatment decision-making.[50-52]

Clinical Implications and Interventions

The impact of Body Mass Index (BMI) on Immune Reconstitution Inflammatory Syndrome (IRIS) risk in leukemia patients co-infected with Human Immunodeficiency Virus (HIV) has significant clinical implications for risk assessment and treatment planning. Comprehensive assessment of BMI, along with other clinical and immunological parameters, is essential for identifying patients at higher risk of IRIS and guiding treatment decision-making. Healthcare providers should routinely monitor BMI as part of the comprehensive care of leukemia patients with HIV co-infection, incorporating BMI assessment into clinical evaluations and treatment protocols. Targeted interventions aimed at optimizing BMI may help reduce the risk and severity of IRIS in leukemia patients co-infected with HIV. For obese individuals, lifestyle modifications such as dietary counseling, physical activity programs, and weight management strategies may be beneficial in reducing adiposity and improving metabolic health. These interventions not only address obesity-related inflammation and dysregulated immune responses but also promote overall health and well-being. Conversely, underweight individuals may benefit from nutritional support and immune-modulating interventions aimed at improving immune function and nutritional status, thereby reducing susceptibility to IRIS-related complications.[53-56]

Furthermore, personalized treatment approaches that consider individual patient characteristics, including BMI status, HIV disease stage, and leukemia subtype, are essential for optimizing treatment outcomes and minimizing IRIS-related complications. Healthcare providers should tailor treatment plans to address the specific needs of obese and underweight patients, taking into account their metabolic health, immune status, and nutritional requirements. This may involve dose adjustments, treatment modifications, and supportive care measures tailored to the unique challenges posed by BMI status in leukemia patients with HIV co-infection. Multidisciplinary collaboration between healthcare providers, including hematologists, infectious disease specialists, nutritionists, and allied health professionals, is essential for developing comprehensive

care plans that address the complex interplay between BMI, HIV co-infection, and IRIS risk. Integrated approaches that incorporate BMI assessment, targeted interventions, and personalized treatment strategies can optimize care and improve outcomes for leukemia patients co-infected with HIV at risk of IRIS. Through multidisciplinary collaboration and patient-centered care, healthcare providers can mitigate the impact of BMI on IRIS risk and enhance the care of leukemia patients with HIV co-infection.[57-64]

Conclusion

The relationship between Body Mass Index (BMI) and Immune Reconstitution Inflammatory Syndrome (IRIS) in leukemia patients co-infected with Human Immunodeficiency Virus (HIV) underscores the importance of comprehensive risk assessment and personalized treatment approaches. Obesity and underweight status have distinct impacts on IRIS risk, with obesity associated with chronic inflammation and dysregulated immune responses, while underweight status indicative of compromised immune function and nutritional status. Recognizing the impact of BMI on IRIS risk is essential for risk stratification and treatment planning, with targeted interventions aimed at optimizing BMI potentially offering avenues to reduce the risk and severity of IRIS in this high-risk population. Healthcare providers should routinely monitor BMI as part of the comprehensive care of leukemia patients with HIV co-infection, incorporating BMI assessment into clinical evaluations and treatment protocols. Targeted interventions aimed at optimizing BMI, including lifestyle modifications, dietary counseling, physical activity programs, and weight management strategies, may help reduce the risk and severity of IRIS in this population. Furthermore, personalized treatment approaches tailored to individual patient characteristics, including BMI status, HIV disease stage, and leukemia subtype, are essential for optimizing treatment outcomes and minimizing IRIS-related complications.

References

1. Akmaljon o‘g AM, Abdullajon o‘g‘li MS, Alimardonovich MH. LEUKEMIA–TYPES, CLINICAL APPEARANCES, DIAGNOSIS AND TREATMENT. Web of Medicine: Journal of Medicine, Practice and Nursing. 2024;2(4):10-17.
2. Obeagu EI, Omar DM, Omar U. Leukaemia burden in Africa. Int. J. Curr. Res. Biol. Med. 2023; 1:17-22.
3. Obeagu EI, Gnanavel K. An Insight on Acute Myeloid Leukemia: Pediatric Perspective. Journal home page: http://www. journalijiar. com. 2022;10(03).
4. Obeagu EI, Nakyeyune S, Muhimbura E, Owunna TA, Uwakwe OS. Evaluation of haematological manifestations in patients with acute myeloid leukaemia in a tertiary hospital in Uganda. Madonna University Journal of Medicine and Health Sciences. 2022;2(3):58-63.

Citation: Obeagu EI. Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV**.** Elite Journal of Immunology, 2024; 2(5): 1-10

5. Yang JJ, Park TS, Wan TS. Recurrent cytogenetic abnormalities in acute myeloid leukemia. Cancer Cytogenetics: Methods and Protocols. 2017:223-245.
6. Gong JY, Zhang ZH, Zhang W, Wang HJ, Feng XF, Zhou J, Zhu GQ. Coexistence of recurrent chromosomal abnormalities and the Philadelphia chromosome in acute and chronic myeloid leukemias: report of five cases and review of literature. Molecular Cytogenetics. 2020; 13:1-9.
7. Obeagu EI, Obeagu GU. The Impact of Body Mass Index (BMI) on Immune Function in Leukemia Patients Living with HIV: A Review. Elite Journal of Immunology. 2024;2(4):73-92.
8. Obeagu EI. Understanding Body Mass Index Variations and Clinical Outcomes in Leukemia Patients with HIV. AIDS: A Review. Elite Journal of Health Science. 2024;2(4):59-72.
9. Obeagu EI. Exploring the Impact of Body Mass Index on Quality of Life in Leukemia Patients Living with HIV: A Review. Elite Journal of Haematology, 2024; 2 (5).:39-54.
10. Naran K, Nundalall T, Chetty S, Barth S. Principles of immunotherapy: implications for treatment strategies in cancer and infectious diseases. Frontiers in microbiology. 2018; 9:405758.
11. Obeagu EI, Elamin EA, Obeagu GU. The Impact of BMI on Treatment Outcomes in Leukemia Patients with HIV: A Review. Elite Journal of Haematology, 2024; 2 (4).:23-35.
12. Obeagu EI, Obeagu GU. The Impact of Obesity on Overall Survival in Leukemia Patients Living with HIV: A Review. Elite Journal of Laboratory Medicine. 2024;2(4):26-45.
13. Obeagu EI, Obeagu GU. The Nexus Between Obesity and Leukemia Progression in HIV-Positive Individuals: A Review. Elite Journal of Haematology. 2024;2(4):180-98.
14. Vorri SC, Christodoulou I, Karanika S, Karantanos T. Human immunodeficiency virus and clonal hematopoiesis. Cells. 2023;12(5):686.
15. Pasco JA, Holloway KL, Dobbins AG, Kotowicz MA, Williams LJ, Brennan SL. Body mass index and measures of body fat for defining obesity and underweight: a cross-sectional, population-based study. BMC obesity. 2014; 1:1-7.
16. Aronne LJ. Classification of obesity and assessment of obesity-related health risks. Obesity research. 2002;10(S12):105S-115S.
17. Orgel E, Genkinger JM, Aggarwal D, Sung L, Nieder M, Ladas EJ. Association of body mass index and survival in pediatric leukemia: a meta-analysis. The American journal of clinical nutrition. 2016;103(3):808-817.
18. Lichtman MA. Obesity and the risk for a hematological malignancy: leukemia, lymphoma, or myeloma. The oncologist. 2010;15(10):1083-1101.
19. O'Sullivan J, Lysaght J, Donohoe CL, Reynolds JV. Obesity and gastrointestinal cancer: the interrelationship of adipose and tumour microenvironments. Nature reviews Gastroenterology & hepatology. 2018;15(11):699-714.
20. Mubtasim N, Moustaid-Moussa N, Gollahon L. The complex biology of the obesity-induced, metastasis-promoting tumor microenvironment in breast cancer. International journal of molecular sciences. 2022;23(5):2480.

Citation: Obeagu EI. Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV**.** Elite Journal of Immunology, 2024; 2(5): 1-10

21. Ifeanyi OE. Acute Leukaemia: A Sudden Killer to Human Beings. EC Emergency Medicine and Critical Care. 2020;4(6):154-67.
22. Obeagu EI, Babar Q. Acute Myeloid Leukaemia (AML): The Good, the Bad, and the Ugly. Int. J. Curr. Res. Med. Sci. 2021;7(7):29-41.
23. Obeagu EI, Obeagu GU. GATA-1 and Hematopoietic Stem Cell Dysfunction in HIV-Related Hematological Malignancies: A Review. Elite Journal of Haematology, 2024; 2 (4).:105-22.
24. Obeagu EI, Obeagu GU. GATA-1 and HIV-Associated Myelodysplastic Syndromes: Pathogenesis and Treatment Strategies. Elite Journal of Medicine. 2024;2(4):1-8.
25. Obeagu EI, Mbabazi A, Obeagu GU, Muhimbura E, Igwe MC, Owunna TA, Okafor CJ, Jakheng SP. Evaluation of Platelets And Some Inflammation Markers Of Patients With Acute Myeloid Leukaemia In A Tertiary Hospital In Uganda. Madonna University journal of Medicine and Health Sciences ISSN: 2814-3035. 2022 Oct 1;2(3):78-84.
26. Obeagu EI, Obeagu GU. Early Infant Diagnosis: Shielding Infants from HIV Transmission. Elite Journal of Health Science. 2023;1(1):12-22.
27. Obeagu EI, Obeagu GU. Securing Health: The Role of Early Infant Diagnosis in Preventing HIV in Newborns. Elite Journal of Public Health. 2023;1(1):12-22.
28. Obeagu EI, Obeagu GU. Protecting Generations: Early Infant Diagnosis's Role in Preventing HIV Spread. Elite Journal of Public Health. 2023;1(1):1-11.
29. Yang JJ, Park TS, Wan TS. Recurrent cytogenetic abnormalities in acute myeloid leukemia. Cancer Cytogenetics: Methods and Protocols. 2017:223-245.
30. Obeagu EI, Obeagu GU. Early Infant Diagnosis: Fortifying Efforts to Stop HIV in Newborns. Elite Journal of HIV. 2024;2(3):27-41.
31. Obeagu EI, Ubosi NI, Obeagu GU, Akram M. Early Infant Diagnosis: Key to Breaking the Chain of HIV Transmission. Elite Journal of Public Health. 2024;2(1):52-61
32. Obeagu EI OG. Empowering Health Systems: Early Infant Diagnosis's Impact on Preventing HIV in Newborns. Elite Journal of Public Health. 2023;1(1):23-33.
33. Obeagu EI, Obeagu GU. Strengthening Laboratory Systems for Ensuring Accurate Diagnoses in Mother-to-Child Transmission (MTCT) Prevention Programs in Uganda: A Narrative Review. Annals of Medicine and Surgery:10-97.
34. Das K, Tan P. Molecular cytogenetics: recent developments and applications in cancer. Clinical genetics. 2013;84(4):315-325.
35. Zahid MF, Malik UA, Sohail M, Hassan IN, Ali S, Shaukat MH. Cytogenetic abnormalities in myelodysplastic syndromes: an overview. International journal of hematology-oncology and stem cell research. 2017;11(3):231.
36. Obeagu EI. A Review of Challenges and Coping Strategies Faced by HIV/AIDS Discordant Couples. Madonna University journal of Medicine and Health Sciences. 2023 ;3(1):7-12. https://madonnauniversity.edu.ng/journals/index.php/medicine/article/view/91.
37. Obeagu EI, Obeagu GU. An update on premalignant cervical lesions and cervical cancer screening services among HIV positive women. J Pub Health Nutri. 2023; 6 (2). 2023;

Citation: Obeagu EI. Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV**.** Elite Journal of Immunology, 2024; 2(5): 1-10

141:1-2. links/63e538ed64252375639dd0df/An-update-on-premalignant-cervical-lesions-and-cervical-cancer-screening-services-among-HIV-positive-women.pdf.

38. Omo-Emmanuel UK, Chinedum OK, Obeagu EI. Evaluation of laboratory logistics management information system in HIV/AIDS comprehensive health facilities in Bayelsa State, Nigeria. Int J Curr Res Med Sci. 2017;3(1): 21-38.DOI: 10.22192/ijcrms.2017.03.01.004
39. Obeagu EI, Obeagu GU. An update on survival of people living with HIV in Nigeria. J Pub Health Nutri. 2022; 5 (6). 2022;129. links/645b4bfcf3512f1cc5885784/An-update-on-survival-of-people-living-with-HIV-in-Nigeria.pdf.
40. Forghieri F, Nasillo V, Bettelli F, Pioli V, Giusti D, Gilioli A, Mussini C, Tagliafico E, Trenti T, Cossarizza A, Maffei R. Acute myeloid leukemia in patients living with HIV infection: several questions, fewer answers. International Journal of Molecular Sciences. 2020;21(3):1081.
41. Engsig FN, Hansen AB, Omland LH, Kronborg G, Gerstoft J, Laursen AL, Pedersen C, Mogensen CB, Nielsen L, Obel N. Incidence, clinical presentation, and outcome of progressive multifocal leukoencephalopathy in HIV-infected patients during the highly active antiretroviral therapy era: a nationwide cohort study. The Journal of infectious diseases. 2009;199(1):77-83.
42. Adebamowo CA, Casper C, Bhatia K, Mbulaiteye SM, Sasco AJ, Phipps W, Vermund SH, Krown SE. Challenges in the detection, prevention, and treatment of HIV-associated malignancies in low-and middle-income countries in Africa. JAIDS Journal of Acquired Immune Deficiency Syndromes. 2014;67:S17-26.
43. Offie DC, Obeagu EI, Akueshi C, Njab JE, Ekanem EE, Dike PN, Oguh DN. Facilitators and barriers to retention in HIV care among HIV infected MSM attending Community Health Center Yaba, Lagos Nigeria. Journal of Pharmaceutical Research International. 2021;33(52B):10-19.
44. Odo M, Ochei KC, Obeagu EI, Barinaadaa A, Eteng UE, Ikpeme M, Bassey JO, Paul AO. TB Infection Control in TB/HIV Settings in Cross River State, Nigeria: Policy Vs Practice. Journal of Pharmaceutical Research International. 2020;32(22):101-119.
45. Obeagu EI, Eze VU, Alaeboh EA, Ochei KC. Determination of haematocrit level and iron profile study among persons living with HIV in Umuahia, Abia State, Nigeria. J BioInnovation. 2016; 5:464-471. links/592bb4990f7e9b9979a975cf/DETERMINATION-OF-HAEMATOCRIT-LEVEL-AND-IRON-PROFILE-STUDY-AMONG-PERSONS-LIVING-WITH-HIV-IN-UMUAHIA-ABIA-STATE-NIGERIA.pdf.
46. Ifeanyi OE, Obeagu GU. The values of prothrombin time among HIV positive patients in FMC owerri. International Journal of Current Microbiology and Applied Sciences. 2015;4(4):911-916. https://www.academia.edu/download/38320140/Obeagu_Emmanuel_Ifeanyi_and_Obeagu__Getrude_Uzoma2.EMMA1.pdf.
47. Izuchukwu IF, Ozims SJ, Agu GC, Obeagu EI, Onu I, Amah H, Nwosu DC, Nwanjo HU, Edward A, Arunsi MO. Knowledge of preventive measures and management of HIV/AIDS

victims among parents in Umuna Orlu community of Imo state Nigeria. Int. J. Adv. Res. Biol. Sci. 2016;3(10): 55-65.DOI; 10.22192/ijarbs.2016.03.10.009

48. Chinedu K, Takim AE, Obeagu EI, Chinazor UD, Eloghosa O, Ojong OE, Odunze U. HIV and TB co-infection among patients who used Directly Observed Treatment Short-course centres in Yenagoa, Nigeria. IOSR J Pharm Biol Sci. 2017;12(4):70-75. links/5988ab6d0f7e9b6c8539f73d/HIV-and-TB-co-infection-among-patients-who-used-Directly-Observed-Treatment-Short-course-centres-in-Yenagoa-Nigeria.pdf
49. Oloro OH, Oke TO, Obeagu EI. Evaluation of Coagulation Profile Patients with Pulmonary Tuberculosis and Human Immunodeficiency Virus in Owo, Ondo State, Nigeria. Madonna University journal of Medicine and Health Sciences. 2022;2(3):110-119.
50. Nwosu DC, Obeagu EI, Nkwocha BC, Nwanna CA, Nwanjo HU, Amadike JN, Elendu HN, Ofoedeme CN, Ozims SJ, Nwankpa P. Change in Lipid Peroxidation Marker (MDA) and Non enzymatic Antioxidants (VIT C & E) in HIV Seropositive Children in an Urban Community of Abia State. Nigeria. J. Bio. Innov. 2016;5(1):24-30. links/5ae735e9a6fdcc5b33eb8d6a/CHANGE-IN-LIPID-PEROXIDATION-MARKER-MDAAND-NON-ENZYMATIC-ANTIOXIDANTS-VIT-C-E-IN-HIV-SEROPOSITIVE-CHILDREN-IN-AN-URBAN-COMMUNITY-OF-ABIA-STATE-NIGERIA.pdf.
51. Ifeanyi OE, Obeagu GU, Ijeoma FO, Chioma UI. The values of activated partial thromboplastin time (APTT) among HIV positive patients in FMC Owerri. Int J Curr Res Aca Rev. 2015; 3:139-144. https://www.academia.edu/download/38320159/Obeagu_Emmanuel_Ifeanyi3__et_al.IJCRAR.pdf.
52. Britton KA, Massaro JM, Murabito JM, Kreger BE, Hoffmann U, Fox CS. Body fat distribution, incident cardiovascular disease, cancer, and all-cause mortality. Journal of the American College of Cardiology. 2013;62(10):921-925.
53. Patnaik MM, Tefferi A. Cytogenetic and molecular abnormalities in chronic myelomonocytic leukemia. Blood cancer journal. 2016;6(2):e393-.
54. Obiomah CF, Obeagu EI, Ochei KC, Swem CA, Amachukwu BO. Hematological indices o HIV seropositive subjects in Nnamdi Azikiwe University teaching hospital (NAUTH), Nnewi. Ann Clin Lab Res. 2018;6(1):1-4. links/5aa2bb17a6fdccd544b7526e/Haematological-Indices-of-HIV-Seropositive-Subjects-at-Nnamdi-Azikiwe.pdf
55. Omo-Emmanuel UK, Ochei KC, Osuala EO, Obeagu EI, Onwuasoanya UF. Impact of prevention of mother to child transmission (PMTCT) of HIV on positivity rate in Kafanchan, Nigeria. Int. J. Curr. Res. Med. Sci. 2017;3(2): 28-34.DOI: 10.22192/ijcrms.2017.03.02.005
56. Aizaz M, Abbas FA, Abbas A, Tabassum S, Obeagu EI. Alarming rise in HIV cases in Pakistan: Challenges and future recommendations at hand. Health Science Reports. 2023;6(8):e1450.

Citation: Obeagu EI. Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV**.** Elite Journal of Immunology, 2024; 2(5): 1-10

57. Daugherty PJ. Review of logistics and supply chain relationship literature and suggested research agenda. International Journal of Physical Distribution & Logistics Management. 2011;41(1):16-31.
58. Annaloro C, Airaghi L, Saporiti G, Onida F, Cortelezzi A, Deliliers GL. Metabolic syndrome in patients with hematological diseases. Expert Review of Hematology. 2012;5(4):439-458.
59. Shanmuganathan N, Hiwase DK, Ross DM. Treatment of chronic myeloid leukemia: assessing risk, monitoring response, and optimizing outcome. Leukemia & lymphoma. 2017;58(12):2799-2810.
60. Hileman CO, Funderburg NT. Inflammation, immune activation, and antiretroviral therapy in HIV. Current Hiv/aids reports. 2017; 14:93-100.
61. Obeagu EI. The Relationship Between Body Mass Index and Cytogenetic Abnormalities in Leukemia Patients with HIV: A Review. *Elite Journal of Haematology, 2024; 2(6):* 1-15
62. Obeagu EI. Body Mass Index Changes During Remission and Relapse in Leukemia Patients Living with HIV: A Review. Elite Journal of Laboratory Medicine, 2024; 2(5): 32-40
63. Obeagu EI. Body Mass Index and Risk of Leukemic Transformation in HIV-Positive Patients with Chronic Lymphocytic Leukemia: A Review. Elite Journal of Medicine, 2024; 2(6): 22-31
64. Obeagu EI. Obesity and Treatment-Related Neurotoxicity in Leukemia Patients with Advanced HIV/AIDS: A Review. Elite Journal of Health Science, 2024; 2(5):31-39

Citation: Obeagu EI. Body Mass Index and Risk of Immune Reconstitution Inflammatory Syndrome in Leukemia Patients Co-infected with HIV**.** Elite Journal of Immunology, 2024; 2(5): 1-10