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An attempt to establish a cutoff value for peripheral blood hematopoietic progenitor cell count to predict the viable CD34 count in multiple myeloma patients undergoing autologous peripheral blood stem cell transplantation

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Multiple myeloma (MM) is a common hematological malignancy characterized by the proliferation of abnormal plasma cells in the bone marrow, leading to immune dysfunction and bone damage. Autologous peripheral blood stem cell transplantation (aPBSCT) is a pivotal treatment for MM, extending survival rates. The success of aPBSCT relies on the composition of the mobilized peripheral blood cells, particularly the hematopoietic progenitor cells in peripheral blood (HPC_PB). In aPBSCT, viable CD34 cell count (V_CD34) which is enumerated by the flow cytometer (FC) is used to calculate the minimum stem cell yield required for a successful transplantation. Therefore, detecting the optimal HPC_PB count in relation to V_CD34 is crucial for enhancing the effectiveness of aPBSCT and also for the proper management of MM patients. To establish a cutoff value for HPC_PB using an automated hematology analyzer (AHA) as a predictor for V_CD34 in the peripheral blood of MM patients undergoing aPBSCT. This initiative aims to replace or supplement the flow cytometry (FC) facility with AHA, as AHA provides a cost-effective, user-friendly, faster, and more accessible method for assessing cellular profiles during PBSCT. This transition addresses the limitations of the FC technique, which encompass high expenses, complexity, the demand for specialized personnel, substantial sample sizes, time-intensive procedures, and restricted availability. MM patients representing males (n=23) and females (n=22) at the age of 40-65 years, admitted to the Bone Marrow Transplant Unit (BMTU) in Apeksha Hospital, Maharagama, Sri Lanka were selected for the study (n=45). The ninth day from the mobilization of the bone marrow cells was considered as the day of harvesting. The Sysmax-1000 AHA was used to enumerate HPC_PB and, V_CD34_PB was enumerated by flow cytometer (FC) BDACS Lytic ™ using already collected samples for routine testing. First, the data were separately tested for normalization, followed by correlation bivariate analysis and, Receiver Operating Characteristic (ROC) curve analysis to establish relationships and cutoff values for HPC_PB respectively. In the ROC analysis, the two groups of V_CD34_PB were defined as; Group 1 <90 cells/µL & Group 2 >=90 cells/µL.In the statistical analysis, the HPC_PB_AHA showed normal distribution while V_CD34_PB_FC did not follow it. HPC_PB possessed a significant (p=0.000) strong positive Spearman bivariate correlation (r = 0.930) with the V_CD34_PB. The cutoff value obtained for the HPC_PB is 89 cells/µL, at V_CD34_PB of 90 cells/µL with sensitivity (97.1%), specificity (99.9%), and area under the curve of 0.978 with statistically significant (p=0.022 <0.05). Accordingly, the HPC_PB_AHA could be suggested to use as a predictive marker to determine the V_CD34_PB_FC. This enables to conduct aPBSCT even in peripheral hospitals in the absence of FC by employing cost effective AHA methods. However, these initial findings should be validated by conducting more research with the increasing number of patients that includes a variety of clinical and demographic variables.

Keywords: Autologous Peripheral Blood Stem Cell Transplantation, Flow cytometer, Hematopoietic progenitor cells, Multiple Myeloma.