Abstract

Bone Marrow Restitution by Measurement of IRF and IPF in Children

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Febrile neutropenia is a severe complication of chemotherapy and bone marrow transplant. Monitoring or prediction of the end of neutropenia has serious medical and economic consequences. We have tested whether parameters measured by Sysmex XE 2100 (HPC, IPF, H-IPF, IRF and HFR) could be used for bone marrow restitution monitoring and/or prediction.

During five months we recorded 42 episodes in 32 children treated for leukaemia or solid tumour. Episodes were divided into categories: high-risk febrile neutropenia (HR FN; N=23, 54.8%), low risk febrile neutropenia (LR FN; N=10, 23.8%), peripheral blood stem cells collection (PBSCC; N=5, 11.9%) and autologous BMT (auto BMT; N=4, 9.5%). Only episodes with HR and LR FN without G-CSF were evaluated (N=28).

The analysis of certain parameter-quantity-time series during an episode was aimed at the detection of a time-point when neutrophils start to rise and its prediction using standard as well as potential predictors. Monocytes in peripheral blood are often used as standard parameter for monitoring of bone marrow restitution. We have tested, whether HPC, IPF, H-IPF, IRF and HFR could be also used for such a monitoring and/or prediction. Thus we correlated the trends in selected blood count parameters with the trends in neutrophil and monocyte counts.

In the analysis we focused on computation of time-shift between the breakpoint of “tested predictor” (the day when direction of time series changes) and the breakpoint of neutrophil counts. The mean value and confidence interval of this time-shift was used for evaluation, if a certain parameter could be used as a predictor of neutrophil count increase and thus bone marrow restitution. The longer time shift and the lower variability, the better prediction value of the parameter.

The relationship between time series of tested parameters (HPC, HPC%, RETI, IRF %, HFR, H-IPF%, IPF%) and neutrophils was analyzed and compared to commonly used relationship between neutrophils and monocytes; the analysis was also categorized according to severity of febrile neutropenia.

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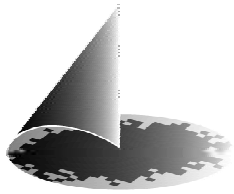

The results of analysis confirmed, that increase in monocytes count can predict increase in neutrophils and thus the end of neutropenia and clinical improvement in both HR and LR FN (LR+HR: p=0,01; LR:p=0,04; HR:p=0,18). We also found that increase in reticulocytes correlates well with the neutrophils count trends, however not in a statistically significant way (LR+HR: p = 0,12; LR: p= 0,14; HR: p= 0,35). Interesting was the correlation between increase of IRF and neutrophils mainly in HR FN and preceding increase in neutrophil counts by IPF increase. These trends, however, were not statistically significant mainly due to the small number of evaluated episodes (Wilcoxon test was used for comparison of time-shift between neutrophils “break-point” and “break-point” of selected parameters). “Break-points” of IRF and IPF time series also precede neutrophil count $0,2x10^9$/l by 3 days. This difference is statistically significant.

We speculate, that IRF and IPF could be used as adjunctive parameters for monitoring and perhaps also prediction of bone marrow restitution in children with febrile neutropenia. We will continue with the study to gain higher numbers of evaluated episodes and thus more representative and valid results.