The utility of multiparametric flow cytometry for the detection of minimal residual disease in acute lymphoblastic leukemia

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The quantification of the amount of minimal residual disease (MRD) in the bone marrow (BM) of patients with acute lymphoblastic leukemia (ALL) at several points of the treatment of the disease has proven to be an important independent predictor of treatment outcome[1-5]. More recently, treatment protocols have been designed to adjust chemotherapy according to the presence or absence of MRD on day 8 or 15 of the induction therapy and at the end of induction (day 29) in order to deliver sufficient chemotherapy to cure the patient and minimize acute and long-term side effects. However, this approach is only justified in controlled clinical studies.

Flow cytometry, an essential component of the diagnostic work-up in ALL, is used to determine the cell lineage of leukemic blasts, to quantify antigen expression and to detect aberrant antigen expressions. These data are essential for the detection of abnormal cell populations in the BM in the study of MRD. It has been shown that leukemic blasts may be distinguished from normal lymphoid precursors in up to 87% of ALL cases. Moreover, if the technique is well standardized, it is able to detect one abnormal cell among 10,000 to 100,000 normal BM cells[3].

Several different panels of antibody combinations have been described with some also considering the cost-effectiveness and simplicity[1,5]. However, combinations of at least four colors are essential to give reliable results.

The following figure presents the analysis of a case of B-cell ALL. The abnormal blasts may be distinguished from the normal ones by their deficient and variable expression of CD45 (Figure 1).

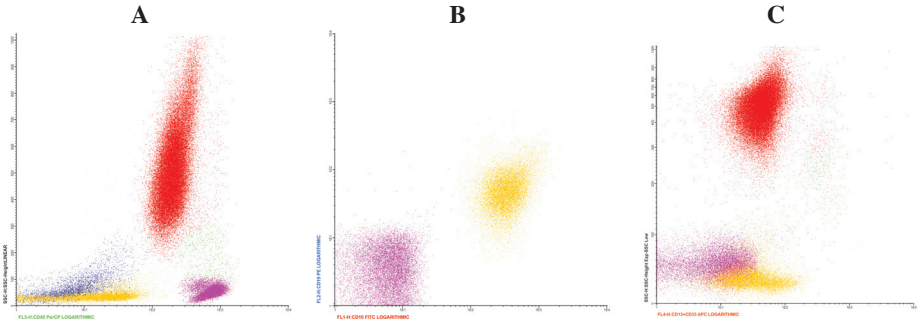

Figure 1 – Minimal residual disease study of a B-cell acute lymphoblastic leukemia case. Phenotype at diagnosis: CD45^{dim} variable, CD19^{+}, CD10^{+} and aberrant expression of CD13/CD33. Residual blasts in yellow (dim and variable expression of CD45, positive for CD19, CD10 and CD13^{+}CD33). A: CD45/SSC plot B: CD10/CD19 plot C: CD13+CD33/SSC plot

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