

## Bone Marrow Cellularity in Paediatric Patients Assessed by Hematological Analyzer Advia 2120i: Normal Ranges and Clinical Relevance

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**Introduction.** Bone marrow cellularity (BMC) is a crucial feature of hemopoiesis, reflecting its damage, activation or malignancy. Paradoxically, no objective methods exist for measuring BMC, only subjective or semi-quantitative evaluation is available for cytology and histology. Moreover, BMC decreases with age, but age-related normal and critical values cannot be precisely defined. The same pertains to diseases that involve bone marrow, including hemopoietic tumors. Hematological analyzer Advia 2120i (Siemens AG) can be used to test cell suspension from bone marrow, returning total number of nucleated cells (BMC equivalent) and their differential counts.

**Aims.** The aim of the study is to retrospectively analyze the results of Advia 2120i tests and marrow cytology of pediatric patients in order to define normal BMC range and to identify abnormalities.

**Material and Methods.** Testing results and cytology reports were obtained from Children's Clinical University Hospital LIS, patients' clinical data – from the hospital database, complying with ethical norms. 471 tests were performed between 2011–2014 as a part of diagnostic procedure, 465 were informative. BMC was calculated as the sum of leukocytes, nucleated red blood cells and basophils. The cases were divided into 2 groups. 102 reactive samples were paired with cytological evaluation of BMC and used to define the normal range. The result was used as a reference for comparison with the rest of 363 samples (tumors prior and during therapy). MS Excel database was designed; statistical analysis was performed by using IBM SPSS v.21.

**Results.** BMC of 38 reactive samples was cytologically classified as normal, returning BMC normal 95% percentile range  $24.5\text{--}86.0 \times 10^9/\text{L}$  with median  $54.5 \times 10^9/\text{L}$ . 14 samples were considered hypocellular (range  $10.6\text{--}35.0 \times 10^9/\text{L}$ , median  $28.1 \times 10^9/\text{L}$ ) and 40 samples hypercellular (range  $38.9\text{--}162.8 \times 10^9/\text{L}$ , median  $99.5 \times 10^9/\text{L}$ ). Values below  $10.6 \times 10^9/\text{L}$  and above  $162.8 \times 10^9/\text{L}$  could be considered critical. Some decrease of cellularity with age was noted: at 0–4 years median BMC was  $86.6 \times 10^9/\text{L}$ , at 5–9 years  $67.8 \times 10^9/\text{L}$  and above 10 years  $57.7 \times 10^9/\text{L}$  (difference non-significant). BMC of samples with marrow tumors and/or chemotherapy varied from 1.0 till  $674.1 \times 10^9/\text{L}$ . When compared to the previously defined scale, 151 sample was normocellular, 146 hypocellular (75 of them critical – 20.7%) and 66 hypercellular (25 critical – 6.9%).

**Conclusions.** Hematological testing by Advia 2120i is a reliable, fast and technically uncomplicated way of evaluating BMC in bone marrow cytological material. Analyzing 102 reactive samples allowed defining normal BMC range and range of non-critical alterations in pediatric patients. Age-related changes of BMC were tentatively recognized. Critical values of BMC were found in 27.6% of 363 marrow samples with atypia or damage, thus proving the test to be of diagnostic value. Possible sampling artefacts, particularly hemodilution, should be carefully considered when interpreting results of testing bone marrow suspension.