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Study of megakaryocytic morphology by digital morphometry in bone marrow biopsy specimens in hematological diseases

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Introduction & Background: Megakaryocytes are unique and dynamic cells which produce platelets by cytoplasmic fragmentation. They are affected in a variety of hematological conditions. A defect in any stage of megakaryocytopoiesis can lead to dyspoietic megakaryocytes or thrombocytopenia. This mandates the need to assess them qualitatively and quantitatively. Digital morphometric analysis can be used to precisely quantify the megakaryocytic morphology with respect to area, nuclear size, nuclear cytoplasmic ratio, nuclear roundness factor, nuclear contour ratio.

Material and Methods: Hematoxylin & Eosin (H&E), Immunohistochemistry (IHC) stained sections of bone marrow biopsies were evaluated for megakaryocyte morphology and computer assisted digital morphometry. High resolution photomicrographs were taken for all cases and a minimum of 10 megakaryocytes were evaluated for each case. The cytoplasmic and nuclear delineation was done manually and precise measurements of cell area, perimeter, nuclear size, shape, nucleus to cytoplasm ratio and important indices were evaluated by computer assisted digital morphometry and correlated.

Results: 170 Bone marrow biopsies were studied which included myeloproliferative neoplasms (MPN) namely chronic myeloid leukemia, Polycythemia Vera, Essential thrombocytosis and Myelofibrosis; Idiopathic thrombocytopenic purpura, Myelodysplastic syndrome, megaloblastic anemia, plasma cell neoplasms and remission marrows post chemotherapy. Statistically significant morphological differences were seen in various hematological groups with regards to cell count, morphology, N:C ratio, nuclear and cytoplasmic perimeter, nuclear and cytoplasmic roundness. IHC (Anti CD 61) was useful in highlighting the megakaryocytes which were missed on H&E especially in MPN's.

Conclusion: Megakaryocytes show significant quantitative and qualitative variations in various haematological disorders, especially myeloproliferative neoplasms. Objective evaluation and classification of megakaryocytes in these disorders may be useful in arriving at an early and a more accurate diagnosis. The morphometric parameters need to be reinforced and validated by a larger study to objectively classify the megakaryocytes.

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