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Assessment of Diagnostic Values and Comparative Evaluation of Bone Marrow Aspiration and Bone Marrow Clot Section in Various Hematological Disorders

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Abstract: ***Introduction: Bone marrow examination has become an indispensable adjuvant to diagnose the diseases of blood & other body system. Bone marrow examination included Bone marrow aspiration, clot section & Bone marrow biopsy. Aspiration & clot section if done simultaneously yield a good diagnostic material, which will be more accurate for diagnosis. Method: Under all aseptic precaution & local anaesthesia Bone marrow aspirate obtained from posterior superior iliac spine, 4 - 6 slides were made from Bone marrow aspirate & stained with Leishman & Giemsa. Remaining aspirate kept on slide to form clot. This clot fixed in 10% formalin & processed in histopathology as a routine tissue. Sections were made from clot & stained with Haematoxylin & Eosin & with special stained whenever required. Result: Here we present 3 cases. Case 1: 12 year female with complaints of acute onset of fever & breathlessness. Findings: CBC - Within normal limit. PS & Bone marrow aspiration - Infection related reactive cellular changes in Bone marrow (Hemophagocytosis) Bone marrow clot section on ZN staining confirmed diagnosis of Tuberculosis. Case 2: 44 year male with known case of Internal haemorrhoids with per rectal bleeding. PS & CBC: - Pancytopenia. Bone marrow aspiration: - Diluted marrow. Bone marrow clot section: - Increase in fat: cell ratio showing features of aplastic anaemia. Bone marrow biopsy was inadequate in this case. Showing only single trabeculae. Case 3: 55 year male with history of fever, weight loss and generalized weakness. PS & CBC: - Pancytopenia. Bone marrow aspiration: - Diluted marrow. Bone marrow clot section: - Grade 2 myelofibrosis, which was later confirmed on Bone marrow biopsy. Conclusion: A complementary technique (Bone marrow clot section) from bone marrow aspirate helps to rule out differential & early diagnosis.***

Keywords: CBC - Complete blood count, PS - Peripheral smear, BMA - Bone marrow aspiration, BMBx - Bone marrow biopsy.

1. Introduction

Bone marrow supplies mature hematopoietic cells for circulating blood in a steady - state as well as in respond to increased physiologic or pathologic demands. [1]

Therefore bone marrow examination is valuable in the diagnosis of certain hematological and non - hematological conditions and has been a cornerstone of hematology practice. [2]

Bone marrow examination includes Bone marrow aspirate, bone marrow biopsy, touch imprints and clot section. [3, 4]

Bone marrow aspirate smears are used primarily for the assessment of differential count, (M: E) myeloid erythroid ratio, maturation status and morphological details. In addition, biopsy is usually performed to study architecture of marrow and to look for cellularity, fibrosis in conditions like lymphoma, myeloma, metastatic tumour or granulomas, where the involvement can be focal. [5]

The blood that is obtained along with the bone marrow aspirate is usually discarded though it can be used to prepare a clot section, similar to cell block that is extensively used in cytological practices. Bone marrow aspirate clot technique is not being frequently utilized in clinical practice though it has been described in literature. Very few studies have assessed its role in diagnosis and follow up in various hematological diseases. [6, 7]

In present study we highlights the utility of BMC section through 3 clinical cases, clinical findings and hematological parameters were evaluated. Diagnostic efficacy of bone marrow clot section was assessed and compared with that of bone marrow aspiration. Biopsies were done whenever needed and taken as gold standard.

2. Material and Methods

This was cross - sectional observational study, undertaken in a tertiary care centre of central India during the month of January 2022.

Bone Marrow Aspirate Procedure: Patient was given left or right lateral decubitus position. The posterior superior iliac spine was located. Under all aseptic conditions and local anaesthesia with 2% lignocaine, 0.5 to 1 ml of BMAs were obtained from posterior superior iliac spine (PSIS).4 - 6 smears were made from bone marrow aspirate & stained with Leishman & Giemsa.

Image 1: Material used for BMA, BMC and BM Bx

Bone Marrow Clot Section Procedure: After preparing 4 - 6 smears from bone marrow aspirate, remaining aspirate kept on slides and allowed to form clot, then this clot was fixed in 10% formalin and sent to histopathology section for further processing. Clot is processed like other tissues in histopathology. Section were made from clot and stained with H&E stain, or other special stain as per requirement. The slides were examined and reported.

Bone marrow clot section procedure

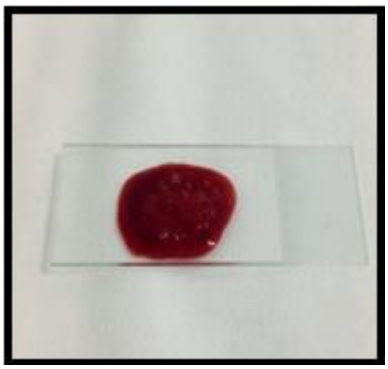

Image 2: Bone marrow clot

Image 3: Fixation

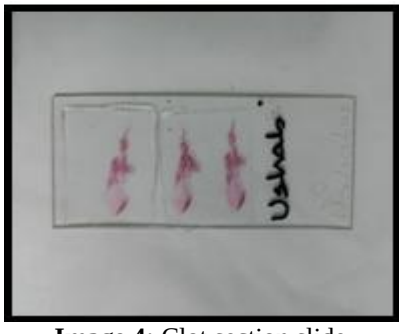

Image 4: Clot section slide

3. Result

In order to exemplify the clinical applicability of the described technique, samples of bone marrow clot at the time of the diagnosis of three different patients attended in the Hematology Service of the tertiary care centre of Central India will be presented.

In all three patients, both the diagnosis and follow - up assessment were based only on bone marrow aspirate clot technique, which was later on confirmed on bone marrow biopsy.

Case 1 - 12 year female with complaints of acute onset of fever & breathlessness.
HRCT - features of ARDS, bony lytic lesion in multiple vertebrae, ? Milliary T. B., ?? Malignancy.
PS - Bicytopenia with neutrophilic leukocytosis.
BMA - Infection related reactive cellular changes in Bone marrow (Hemophagocytosis). BMC section - well formed granuloma with epitheloid cells and on ZN stain - numerous AF bacilli. Biopsy was not performed in this case as patient and relative were not willing for biopsy.

Case 2 - 44 year male with known case of internal haemorrhoids with per rectal bleeding.
PS & CBC - Pancytopenia.
BMA - Diluted marrow. and BMC section: - Aplastic anemia, while Bone marrow biopsy was inadequate. .

Case 3 - 55 year male with history of fever, weight loss and generalized weakness.
PS & CBC - Pancytopenia.
BMA - Diluted marrow and BMC section - Grade 2 myelofibrosis, which was later confirmed on Bone marrow biopsy.

Case 1: Milliary T. B.

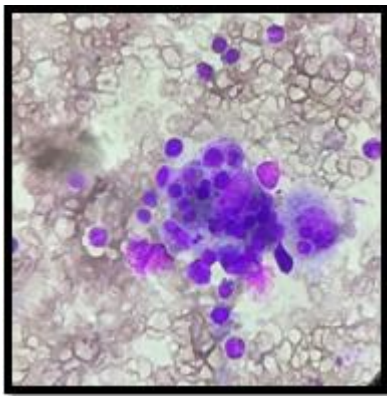

Image 5: BMA showing phagocytosis of lymphocytes and red blood cells. (Leishman's stain 100x)

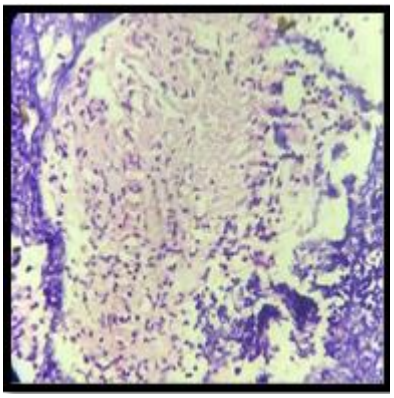

Image 6: BMC section showing Well formed granuloma with epitheloid cell. (H and E stain 100x).

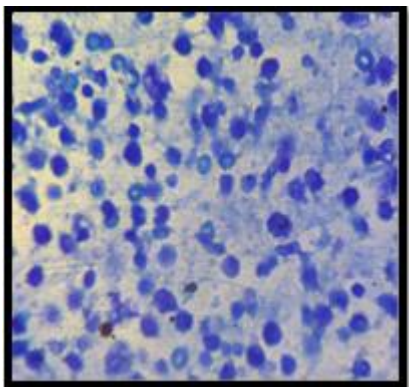

Image 7: BMC section showing numerous Acid Fast bacilli (ZN stain 100x)

Case 2 - Aplastic anaemia

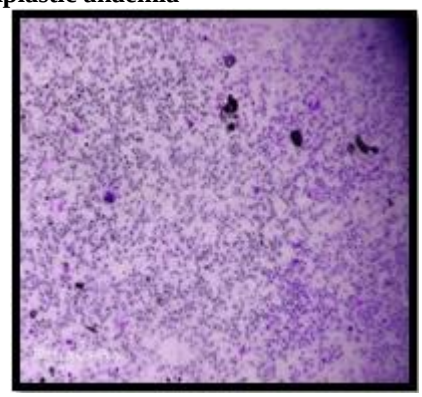

Image 8: BMA showing diluted marrow. (H and E stain 40x)

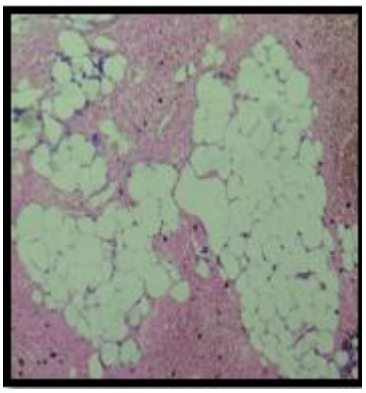

Image 9: BMC showing increasing in fat: cell ratio (H and E stain 40x)

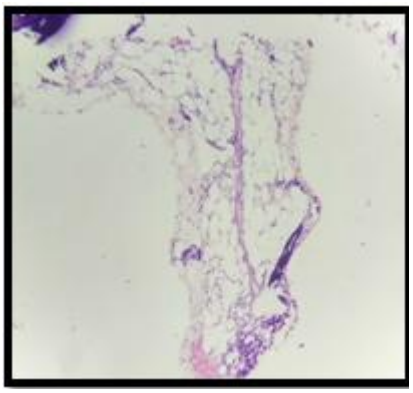

Image 10: Inadequate BM Bx biopsy showing only single trabeculae. (H and E stain 40x)

Case 3 - Myelofibrosis

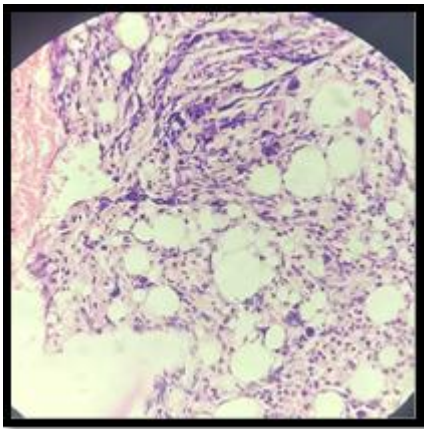

Image 11: BMC showing fibrosis. (H and E stain 40x)

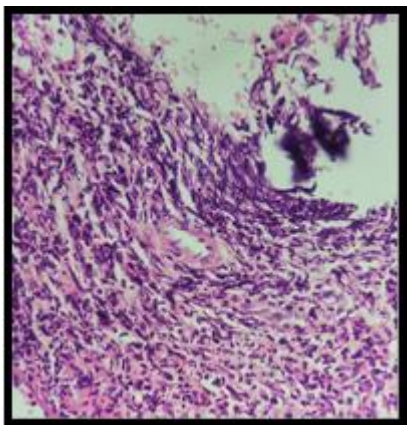

Image 12: BMbx showing fibrosis around blood vessel. (Hand E stain 40x)

4. Discussion

The purpose of this work is to compare efficacy of bone marrow aspiration smears and to assess the role of paraffin embedded cell block of bone marrow aspirates in bone marrow examination.

Conventional trephine bone marrow biopsies have bone trabeculae, requiring material decalcification before histological processing which was time consuming. Time and the utilized chemical agent can damage the tissue either a lot or less, leading to quality loss in the cell analysis of different staining.

Bone marrow aspirate clot (BMC) is an alternative to this methodology because it does not need decalcification. The clot section allows the same kind of histological evaluation as bone marrow biopsy, except for the analysis of architectural relationship between parenchyma/bone. The hematopoietic tissue is enriched in the clot exam, allowing adequate cuts. Therefore, BMC represents a simpler technique without the need of additional analgesia but local anesthesia, in which a quick bone marrow aspirate offers the possibility of not only morphological evaluation but also anatomopathological analysis equivalent to BMB, speeding up the diagnosis and improving the patient's comfort.
It is difficult to anticipate which patients will be diagnosed by the clot sections, and which will need trephine biopsy, it is advisable to perform BMC as an adjuvant procedure along with BMA and BM Bx to increase the diagnostic yield.

Examination of marrow clot sections in conjunction with the complete blood count, marrow aspirate smears and trephine biopsy is necessary to improve the diagnostic yield of these procedures.

5. Conclusion

BMC, a complementary technique along with BMA, helped in early diagnosis (as no decalcification required) than BM Bx, as morphological features on BMC section were almost similar to that of BM Bx and helpful in planning further investigations and management of patients specially in condition where marrow aspirate was diluted or unable to get bone marrow biopsy**.**

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