



Diagnostic Assessment of Bone Marrow Aspiration Smears, Touch Imprints and Trepine Biopsy in Non-Haematological Disorders

Nitin Gupta, Ram Kumar, Arvind Khajuria

Abstract

Diagnostic Assessment of bone marrow aspirate particle smears, imprints and biopsy sections was done on 10 Non- Haematological disorders. Core needle biopsy of the bone marrow is a safe and useful procedure. It is a valuable diagnostic aid for measurement of marrow cellularity, metastatic tumours and fibrosis. Bilateral trephine biopsy was conducted wherever necessary. Touch imprints were useful for studying cell morphology, where aspiration yielded dry tap. All the three procedures of bone marrow aspiration, trephine biopsy and touch imprints were found to be complementary to each other and superiority of one method over the other depended on the specific disease process

Key Words

Non- Hematological, Trepine Biopsy, Bone Marrow Aspiration

Introduction

Marrow biopsy by surgical trephine is an older procedure than needle aspiration. It is only since the late 1950s that core needle biopsy of the bone marrow has been widely used. Since that time, it has had a considerable effect on diagnostic haematology, pathology and oncology. Wide acceptance is associated with the introduction of a simple procedure using the Jamshidi needle to improve the procedure, as well as the quality and size of specimens. The uses and advantages of needle biopsies are numerous (1-3). Metastatic deposits, degree of cellularity, fibrosis and assessment of dry taps can readily be determined. The present study is conducted to evaluate the role of bone marrow aspiration, touch imprints and trephine biopsy in order to optimize diagnostic utility of bone marrow examination which would be of immense value in better patient management

Material and method

This study has been conducted at the Post Graduate Department of Pathology, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu (J&K). All the patients referred to the Department of Pathology, Acharya Shri Chander College of Medical Sciences and Hospital, Sidhra, Jammu for diagnosis requiring bone marrow examination in non-haematological disorders were considered for participation in the study. After detailed haematological investigations, the commonly

encountered anaemias i.e iron deficiency anaemia, megaloblastic anaemia and haemolytic anaemia were not included. Only those disorders where trephine biopsy is of utility along with bone marrow aspiration were considered eligible for the study. The standard technique was employed in obtaining the samples from posterior iliac crest using a Jamshidi needle. For preparing the aspirate particle smears, about 0.25 to 0.5 ml of aspirate was obtained into a syringe and delivered onto clean glass slides and smears prepared. The biopsy imprints were made by gently touching the core on slides. The cores were then fixed in Zenkers formalin, decalcified, embedded in paraffin and 2 um thin sections made. The particle smears and biopsy touch preparations were stained by the Wright-Giemsa and the biopsy sections were stained by the Wright-Giemsa and haematoxylin and eosin methods. In addition Gomori's reticulin stain and prussian blue stain for iron were also performed

Results

Table-1 shows the distribution of Non- Haematological disorders. Metastatic tumour deposits were observed to be the most important cause of secondary bone marrow involvement by a non haematological disorder accounting for 8 out of 10 cases (80%). Out of these, 3 cases were of adenocarcinoma stomach, 2 cases were of adenocarcinoma lung, 2 cases were of prostate cancer

From the Department of Pathology ASCOMS & Hospital Sidhra, Jammu (J&K) - India

Correspondence to : Dr Ram Kumar Prof of Pathology , ASCOMS & Hospital Sidhra, Jammu

and 1 case was of neuroblastoma. Haematological parameters provided valuable information about various disorders e.g the two cases diagnosed as tuberculosis on bone marrow examination presented initially with history of long standing fever and weakness. A normocytic mildly hypochromic anaemia with mild lymphocytosis and a persistently raised ESR >50 mm in 1st hr. were the only positive haematological findings. PCR for mycobacterium tuberculosis was confirmatory. Tear drop cells along with leukoerythroblastic blood picture in the absence of splenomegaly were observed in cases with marrow infiltration by foreign cells diagnosed on subsequent bone marrow examination. Once the baseline haematological parameters were recorded, all the 10 patients were subjected to bone marrow examination. Twin procedures of bone marrow aspiration & trephine biopsy were performed in each case and touch imprints were prepared from each trephine biopsy core specimen prior to processing. It was observed that imprint smears provided a diagnosis much earlier than the trephine biopsy specimen, which takes longer time to process. Marrow histological sections were examined for architecture, cellularity, presence of foreign cells, granulomas, marrow fibrosis. Touch imprints gave better assessment of metastatic deposits than aspiration smears in 6 out of the 8 cases and provided diagnosis earlier than trephine biopsy. The 2 cases (20%) of tuberculosis showed well defined epithelioid cell granulomas along with areas of caseous necrosis on trephine biopsy. Bilateral trephine biopsy was required in 3 cases (30%) of metastatic disease for diagnosis. Though, both bone marrow aspiration and trephine biopsy were positive in all the cases of metastatic deposits, trephine biopsy was superior to smears as it provided architectural details thus enabling typing of the metastatic malignancy and indicating its primary site. Bone marrow examination was absolutely essential in arriving at the correct diagnosis in all the 10 cases with bone marrow involvement by non-haematological disorders i.e. 8 cases of metastatic marrow deposits and 2 cases of tuberculosis. The iron content in bone marrow aspiration smears and bone marrow trephine biopsy sections using Perls' stain is shown in table 2. Our study showed that that aspirate films were more sensitive than trephine biopsy sections for the detection of haemosiderin when the biopsy specimens were decalcified in formic acid. They also provided a more accurate reflection of bone marrow iron stores, because decalcification led to an unquantifiable loss of iron.

Discussion

In our study of the Non-Haematological disorders, metastatic bone marrow disease with 8 cases was the

commonst Non- haematological disorder observed. Out of these, 3 cases were of adenocarcinoma stomach, 2 cases each of adenocarcinoma lung and prostate cancer and 1 case was of neuroblastoma. Ozkalemkas *et al* (1) in their study observed the most common non haematological malignancy involving the bone marrow to be adenocarcinoma with the primary focus in stomach in 5 cases, prostate in 3 cases and lung in 1

Table 1. Non-Haematological Disorders

Disorders	No. of patients	%age
Metastatic deposits	8	80
Tuberculosis	2	20
Total	10	100

Table 2. The Iron Content in Bone Marrow Aspiration Smears and Bone Marrow Trephine Biopsy Sections Using Perls' Stain is as Follows

Disorder	Iron stores
Metastatic deposits (n=8)	Reduced iron stores(0 to 1+) (n=2) Normal iron stores(2+ to 3+) (n =6)
Tuberculosis(n=2)	Normal iron stores 2+ (n =1) Reduced iron stores(0 to 1+) (n=1)

case. These findings are comparable to those in our study. Sabharwal *et al* (2) in their study found metastatic cancer with 3 cases to be the most common non-haematological disorder of bone marrow. Out of these, 2 cases were of squamous cell carcinoma and 1 was of adenocarcinoma. Among the non-haematological disorders, both bone marrow aspiration and trephine biopsy were complementary in all the 8 cases of metastatic deposits. While aspiration smears were observed to be most effective for studying cellular morphology, biopsy on the other hand, was helpful in assessing marrow cellularity and for diagnosing granulomatous involvement such as tuberculosis. Our findings are comparable to the study by James *et al* (3) who observed that combined procedures of aspiration and biopsy gave a higher yield and are essential in patients with suspected carcinoma. Mills (4) in his study observed that bone marrow aspiration is frequently not helpful in the diagnosis of carcinomatosis, but it is important that both aspirated and biopsy material should be examined together, since the two methods are often complementary. Bird and Jacobs (5) proposed that examination of material obtained by aspiration combined with a trephine biopsy allows for the most thorough



morphological assessment of the marrow based on 10000 examinations. Atac *et al* (6) in their study observed that marrow aspirates and biopsies were useful and complementary examinations for identifying metastatic malignancy.

Amongst the non-haematological disorders, trephine biopsy was complimentary to bone marrow aspiration for diagnosing metastatic deposits in all the 8 cases (80%) and also in diagnosing the 2 cases (20%) of tuberculosis. Ellis *et al* (7) showed that bone marrow biopsy sections were of specific diagnostic value in those cases of bone marrow metastases whose diagnoses were not apparent from bone marrow aspirate. Sabharwal *et al* (2) in their study also observed trephine biopsy to be positive in all the 3 cases of metastatic deposits. Contreras *et al* (8) observed that trephine biopsy showed evidence of tumor in 94% patients, while the aspirate was positive in only 43%. Their results pointed to the superiority of the bone marrow biopsy over the aspirate in the diagnosis of metastatic carcinoma.

Bilateral trephine biopsy was essential in 3 cases (30%) of metastatic disease. These findings are comparable with the study of Brunning *et al* (9) who observed that bilateral trephine bone marrow biopsies should be routinely performed when searching for tumor in the bone marrow. Similarly, Menon and Buchanan (10) recommended that bilateral trephine biopsies should be performed when knowledge of the state of the bone marrow was important for clinical decision making. In our study, touch imprints gave better assessment in 6 out of 8 cases (75%) of metastatic deposits than aspiration smears and provided diagnosis earlier than trephine biopsy. In a study James *et al* (11) diagnosed 6 out of 22 cases (27.27%) of metastatic carcinoma on touch imprints. Kjurkchiev and Valkov (12) in their study also observed that the examination of touch imprints from bone marrow trephine biopsies is a rapid, reliable and sensitive method which can be used as a first step for the detection of metastases from malignant epithelial neoplasms. Lu *et al* (13) in their study observed that marrow imprint is better than bone marrow smear for evaluating cellularity. Similarly, Pasquale and Chikkappa (14) observed that biopsy imprints were positive in 19 out of 21 cases (90%) of metastatic deposits which showed that the biopsy imprint is an accurate modality for identifying non haematological tumor metastasis in the bone marrow.

The present study also attempted to comparatively evaluate the quality of Perl's staining for iron on aspiration films, imprint smears and biopsy sections. It was observed that aspirate films were more sensitive than trephine biopsy sections for the detection of haemosiderin and

also provided a more accurate reflection of bone marrow iron stores as the biopsy specimens were decalcified in formic acid. Stuart-Smith *et al* (15) also observed that the aspirate films were more sensitive than trephine biopsy sections for the detection of haemosiderin and assessment of bone marrow iron stores, because decalcification led to an unquantifiable loss of iron.

References

1. Ozkalemkas F, Ali R, Ozkocaman V, *et al*. The bone marrow aspirate and biopsy in the diagnosis of unsuspected nonhaematologic malignancy: a clinical study of 19 cases. *Bio Medical Central Cancer* 2005 ;5:144
2. Sabharwal BD, Malhotra V, Aruna S, Grewal R. Comparative evaluation of bone marrow aspirate particle smears, imprints and biopsy sections. *J Postgraduate Med* 1990;36(4):194-98
3. James D, Bearden, Gary A, Ratkin, Charles AC. Comparison of the diagnostic value of bone marrow biopsy and bone marrow aspiration in neoplastic disease. *J Clin Pathol* 1974;27:738-40
4. Mills AE. A study of the value of closed bone marrow biopsy. *South African Med J* 1976;50(48):1928-31
5. Bird AR, Jacobs P. Trephine biopsy of the bone marrow. *South African Med J* 1983;64(8):271-76
6. Atac B, Lawrence C, Goldberg SN. Metastatic tumor: the complementary role of the marrow aspirate and biopsy. *Am J Med Sci* 1991;302(4):211-13
7. Ellis LD, Jensen WN, Westerman MP. Needle biopsy of bone and marrow. An experience with 1,445 biopsies. *Archives of Internal Med* 1964; 114:213-21
8. Contreras E, Ellis LD, Lee RE. Value of the bone marrow biopsy in the diagnosis of metastatic carcinoma. *Cancer* 1972 ;29(3):778-83
9. Kjurkchiev G and Valkov I. Bone marrow touch imprints for detection of epithelial tumor metastases. *Archives of Hellenic Medicine* 1999 ;16(4):377-79
10. James LP, Stass SA, Schumacher HR. Value of imprint preparations of bone marrow biopsies in haematologic diagnosis. *Cancer* 1980 ;46(1):173-77
11. Brunning RD, Bloomfield CD, McKenna RW, Peterson LA. Bilateral trephine bone marrow biopsies in lymphoma and other neoplastic diseases. *Annals of Internal Med* 1975 Mar;82(3):365-66
12. Menon NC, Buchanan JG. Bilateral trephine bone marrow biopsies in Hodgkin's and non-Hodgkin's lymphoma. *Pathology* 1979 ;11(1):53-57
13. Lu XG, Huang LS, Xu XH, *et al*. Application of bone marrow biopsy imprint in evaluating cellularity. *J Zhejiang University* 2006; 35(3):331-35
14. Pasquale D, Chikkappa G. Comparative evaluation of bone marrow aspirate particle smears, biopsy imprints, and biopsy sections. *Am J Haematol* 1986 ; 22(4):381-89
15. Stuart-Smith SE, Hughes DA, Bain BJ. Are routine iron stains on bone marrow trephine biopsy specimens necessary? *J Clinical Pathol* 2005; 58(3): 269-72