ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 01, pp.44938-44941, January, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

THE SPECTRUM OF HAEMATOLOGICAL DISORDERS FROM BONE MARROW ASPIRATION CYTOLOGY IN A TERTIARY CARE CENTRE

Nisha Marwah, *Namita Bhutani, Sunita Singh, Rajnish Kalra, Monika Gupta and Rajeev Sen

Department of Pathology, PGIMS Rohtak, Haryana

ARTICLE INFO

Article History:
Received 24th October, 2016
Received in revised form
22nd November, 2016
Accepted 19th December, 2016
Published online 31st January, 2017

Key words:

Anaemia,
Bone marrow aspiration cytology,
Leukemia,
Megaloblastic anaemia,
Pancytopenia.

ABSTRACT

Background: Haematological disorders are quite frequent in all age groups. These have diverse modes of presentation that often require bone marrow aspiration (BMA) for both diagnosis and management. This simple and relatively safe procedure is important particularly in resource poor centres since access to adjuvant diagnostic techniques are often lacking. The present study aims to analyse the causes of haematological disorders, its spectrum, indications and interpretation of BMA findings.

Materials and Methods: This was a retrospective and prospective study carried out in Department of Pathology, Pt.BDS PGIMS Rohtak, India over a period of 16 months (January 2014 -April 2015). BMA of 879 cases of suspected haematological disorders was carried out. Records regarding the clinical indication for the procedure, peripheral blood smear reports, blood counts and significant findings on bone-marrow aspiration examination were retrieved.

Results: Majority of the patients were children aged less than 15 years (37%). Male to female ratio was 1.07:1. The main indications for BMA included: anaemia (37%), diagnosis of leukemia (30%) and pancytopenia (9%). Most (87%) of the marrow aspirates examined had definite pathological features and rest were normal marrow elements. Anaemia with erythroid hyperplasia was the most common pathology, followed by megaloblastic anaemia and microcytic hypochromic anaemias.

Conclusion: BMA is an important step and veritable tool to arrive at the confirmatory diagnosis of wide range of haematological disorders.

Citation: Nisha Marwah, Namita Bhutani, Sunita Singh, Rajnish Kalra, Monika Gupta and Rajeev Sen, 2017. "The spectrum of Haematological disorders from bone marrow aspiration cytology in a tertiary care centre", *International Journal of Current Research*, 9, (01), 44938-44941.

INTRODUCTION

Anaemia is commonly encountered worldwide, particularly in developing countries (Egesie *et al*., 2009). Haematological disorders in any age group usually present with anaemia and are quite frequent in all age groups. These have diverse modes of presentation that often require bone marrow aspiration (BMA) for both diagnosis and management The spectrum of haematological disorders is relatively different in the developing nations (Kibria *et al*., 2010). Bone marrow examination also explains the unexplained cytopenias and leukemias. It gives a more complete picture of the reaction of the haemopoietic tissue to anaemia than can be gained from peripheral blood smear (PBS) alone. Bone marrow examination is an important diagnostic tool in haematology. It is a simple and relatively safe procedure carried out routinely for the diagnosis and management of haematological and to some extent non-haematological disorders. In addition, the procedure may be necessary in staging, prognostication and evaluation of therapeutic response in some disorders (Rock and Stass, 2000). Therefore, the aim of our study was to identify the common indications for BMA cytology and the spectrum of haematological disorders commonly diagnosed using this procedure.

Corresponding author: Namita Bhutani,
Department of Pathology, PGIMS Rohtak, Haryana

MATERIALS AND METHODS

Study Site

The study was conducted at Pt.B.D. Sharma PGIMS Rohtak, Haryana, a tertiary care centre of North India.

Study Design

This was a retrospective and prospective study carried out in Department of Pathology over a period of 16 months (January 2014-April 2015). BMA of 879 cases of suspected haematological disorders was carried out. Records regarding the clinical indication for the procedure, peripheral blood smear reports, blood counts and significant findings on bone-marrow aspiration examination were retrieved.

Data Collection & Analysis

A specially designed and well-structured proforma was used in data collection. Information extracted from the records included: age, sex, indications for BMA, and the final diagnosis from BMA cytology over the stated period. The data obtained was analyzed using SPSS17.0. Data was presented in simple tables and descriptive statistics using Chi Square were used as appropriate. The level of significance was set at 5% ($p< 0.05$)

Ethical Consideration

Ethical approval was obtained from the Ethics and Research Committee of the institute before the commencement of the study.

RESULTS

A total number of 879 patients were included in this study aged between 7 months to 90 years. The majoriry of patients were children aged less than 15 years (37%), 455 (52%) were males and 424 (48%) were females with (M:F=1.07:1). Table 1 and 2 shows the age and sex distribution of the patients.

Table 1. Age distribution of patients

Age group	No. of patients	Percentage
< 15 Years	318	37 %
15-30 Years	258	29 %
31-45 Years	123	14 %
> 45 Years	180	20 %
Total	879	100 %

Table 2. Sex distribution of cases

Sex	No. of patients	Percentage
Males	455	52 %
Females	424	48 %
Total	879	100 %

Though, in most of the cases bone marrow was hypercellular, we did come across normocellular marrows as well (Table 3). Eighty seven percent (763) of the marrow aspirates had definite pathological features while 13% (116) had normal marrow elements (Table 4).

Table 3. Cellularity of the bone marrow in the aspirate smears

Marrow cellularity	No. of cases	Percentage
Hypercellular	536	61 %
Normocellular	237	27 %
Hypocellular	106	12 %
Total	879	100 %

Table 4. Proportion of normal and abnormal bone marrow features

Bone marrow features	No. of cases	Percentage
Pathological marrow	763	87 %
Normal marrow	116	13 %
Total	100	100 %

The main indications for BMA included anaemia (37%), diagnosis of leukemia (30%) and pancytopenia (9%). The indications for BMA cytology varied significantly in both sexes. Other indications for BMA cytology occurred in various proportions (Table 5).

Table 5. Indications for bone marrow aspiration

Indication	No. of cases	Percentage
Anaemia	325	37 %
Bicytopenia	44	5 %
Hepatosplenomegaly	18	2 %
Diagnosis & management of leukemia	263	30 %
Lymh node enlargement	35	4 %
Pancytopenia	79	9 %
Persistent fever	44	5 %
Staging of lymphoma	27	3 %
Thrombocytopenia	44	5 %
Total	879	100 %

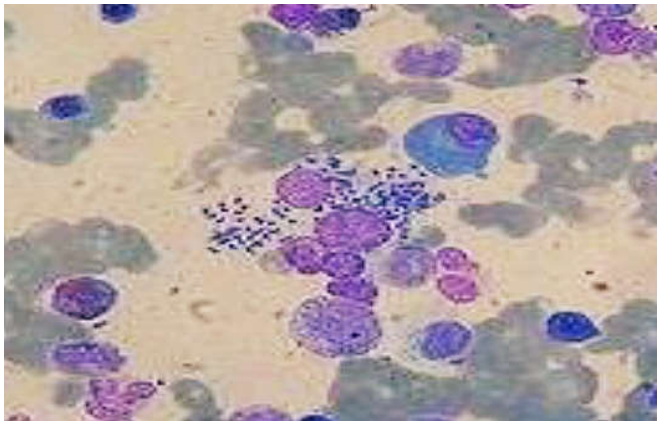

Figure 1. Photomicrograph showing ld bodies (1000X)

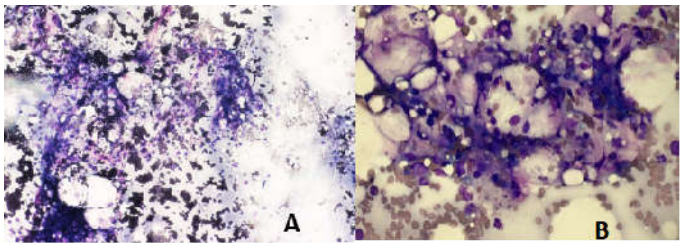

Figure 2. Gelatinous transformation of marrow (a- low power, b- high power view)

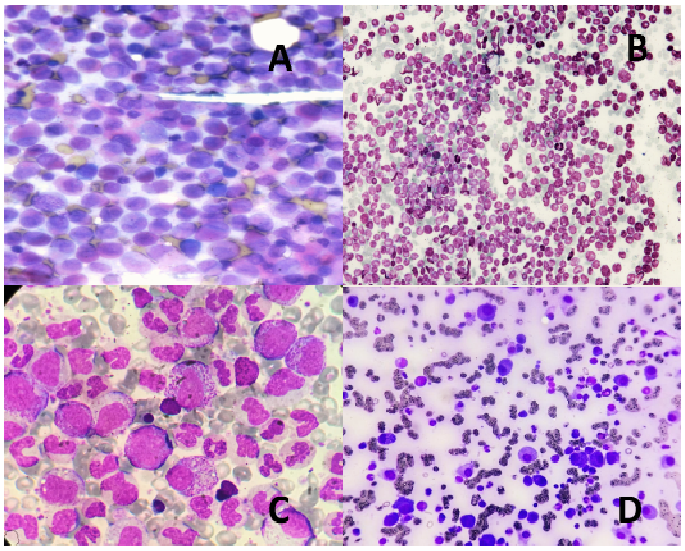

Figure 3. Photomicrograph showing a- AML, b-all, c-CML and d –plasma cell myeloma

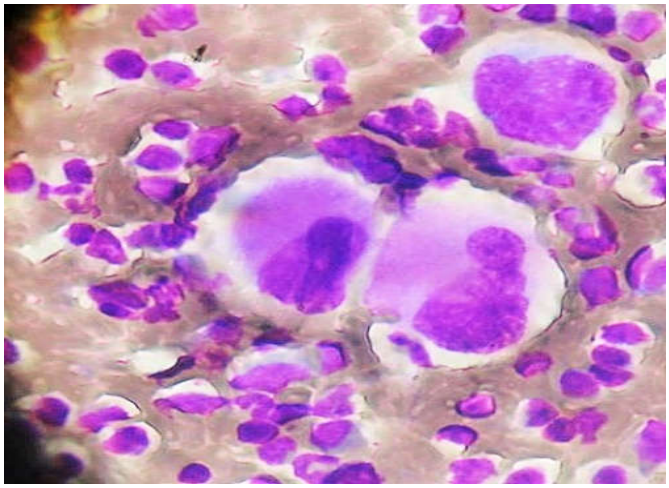

Figure 4. Case of ITP showing increased number of Megakaryocytes (1000X)

Anaemia with erythroid hyperplasia was the most common entity diagnosed in our study. Out of 149 cases of erythroid hyperplasia, 79 cases showed few micronormoblasts and 70 cases showed mild megaloblastoid changes but their number was not significant. Hence, they were grouped under erythroid hyperplasia. Megaloblastic anaemia (13%) was more common than microcytic anaemia (12%). Infective pathology (1%) included all the cases with normal to slightly hypercellular marrow with increased myeloid : erythroid (M:E) ratio and cells of myelopoiesis showing shift to left. Clusters of LD bodies were also seen in 2 cases (Figure 1). In all cases of hypoplastic anaemia, the marrow was hypocellular and all 3 lineages of cell were suppressed. BMA findings were correlated with PBS which also showed pancytopenia (Figure 2). Myelodysplastic syndrome (MDS) was diagnosed in 5 % cases with increased erythroid series of cells with megaloblastic changes and dyserythropoiesis. The differential diagnosis of megaloblastic anaemia was commented in each of these cases as clinical correlation with biochemical and other parameters are required to diagnose. Acute leukemia was seen in 94 cases (11%). Out of this, 56 cases (59.5%) were AML and 38 cases (40.4%) were ALL. There were 14 cases of multiple myeloma. Though the diagnosis was given as multiple myeloma (Figure 3), biochemical, radiological and clinical correlation was recommended in each case. Idiopathic thrombocytopenic purpura (ITP) was diagnosed in 5 % (35) cases (Figure 4). The spectrums of haematological disorders commonly diagnosed with BMA cytology are summarized in Table 6.

DISCUSSION

The bone marrow is one of the body's largest organs, constituting 4.5% of the total body weight and weighs 3375 grams in an average 75 kg individual (Reich, 1946). It is the principal site of haematopoiesis. The haematopoietic bone marrow is organized around the vasculature of the bone cavity. Its main function is to supply mature haematopoietic cells for circulating blood in a steady state as well as to respond to increased physiological or pathological demands. BMA is a cytologic preparation of bone marrow cells obtained by aspiration of marrow and a smear of the cells. It is used to diagnose, confirm, and/or stage haematologic malignancies. It helps to evaluate cytopenias, thrombocytosis, leukocytosis, anaemias, and iron status. It is also a diagnostic tool in non-haematological disorders such as storage disorders and systemic infections. The spectrum of haematological disorders is very wide. It is an ambulatory procedure performed under local anaesthesia with minimal morbidity. It is a safe and useful test in reaching the final diagnosis. The present study determines the indications and diagnostic value of BMA cytology examination. This study like other studies have shown that BMA cytology can be carried out in all age groups. The age range (7 months to 90 years) as well as the sex ratio of subjects undergoing BMA evaluation is similar to that reported in other studies (Pudasaini *et al*., 2012; Gayathri and Rao, 2011; Ahmed *et al*., 2011). In our study, the most common age group undergoing BMA was paediatric population (less than 15 years) and the age of the patients ranged from 7 months to 90 years. The male to female ratio was 1.07:1. In a study done by Niazi *et al*, the majority of the patients were from the age group 1- 30 years (Niazi and Raziq, 2004). The diagnostic efficacy of BMA cytology in arriving at a definitive diagnosis in our study is quite high (98.2%) and comparable to those of similar studies (Egesie *et al*., 2009). Egesie *et al* were able to identify the causes of anaemia in majority (96.8%) of the cases reviewed (Egesie *et al*., 2009). Thus, this suggests that BMA is an important diagnostic tool. However, in few cases of suspected haematological diseases, no pathology was found on examination of the bone marrow aspirate. Some non-haematological conditions may present with haematological manifestations, thus suggesting some limitations of this procedure.

The most common indications for BMA in this study were anaemia followed by diagnosis and management of leukaemia and pancytopenia. Similarly, Damulak *et al*. (2012), and Tripathy *et al*. (2013) also reported anaemia as the commonest indication for BMA cytology in their studies, but contrast studies by Pudasaini *et al*. (2012) and Bashawri *et al*. (2002), showed pancytopenia, diagnosis and management of leukemia as the two most common indications for this procedure. Mahabir *et al*. (2013) reported that the role of BMA in thrombocytopenic patients is to exclude other haematological diseases like leukaemia in children and myelodysplastic syndrome in adults. This was corroborated in a survey in which 74% of Paediatric haematologists were of the view that bone marrow examination is necessary in acute childhood ITP, and the main reason cited was the need to exclude other haematological disorders such as leukaemia, dysmyelopoietic syndrome and aplastic anaemia. In our study, a clinical suspicion of ITP was the indication for BMA in 5% of cases. Erythroid hyperplasia was seen in 149 cases (17%). Similar results were observed in studies done by Jha *et al*. (19.6%) and Khodke *et al*. (14%) independently (Jha *et al*., 2008; Khodke *et al*., 2001). Megaloblastic anaemia was 2nd common diagnosis in the present study as well as in studies done by Niazi *et al* and Jha *et al*. (Niazi and Raziq, 2004; Jha *et al*., 2008). In a study done by Gayathri *et al*, megaloblastic anaemia was the commonest cause of pancytopenia and was the commonest finding in BMA (Gayathri and Rao, 2011). The increasing incidence of megaloblastic anaemia reflects the higher prevalence of nutritional deficiency in our country. Microcytic anaemia was observed in 12% cases. However, in a study done by Ahmad *et al*, 23.8% cases were diagnosed as iron deficiency anaemia (Ahmed *et al*., 2011). Furthermore, evaluation of nutritional anaemia showed that mixed nutritional deficiencies occurred more commonly than isolated or single nutrient deficiency. This finding is similar to that reported by Egesie *et al* (2009). Thus, bone marrow examination could be

used effectively in most cases to determine the cause of anaemia. This study has also shown that the acute leukaemias (11%) were the most frequently diagnosed haematological malignancy from BMA examination in our centre. Out of these, 56 cases (59.5%) were Acute Myeloid Leukaemia (AML) and 38 cases (40.4%) were Acute Lymphoblastic Leukaemia (ALL). Other series have also shown that acute leukemia is the commonest haematological malignancy and AML is more common than ALL (Egesie *et al*., 2009; Kibria *et al*., 2010; Gayathri and Rao, 2011; Jha *et al*., 2008). Leukemias can present with peripheral pancytopenias also.

However, many patients present in fibrotic and postproliferative stage of the disease. The fibrotic stage often presents with anaemia and thrombocytopenia due to accompanying splenomegaly. The white blood cell count, can be low, normal or elevated. As fibrosis becomes more severe, the patients' cytopenias worsen (Bick, 1995). In this study, 8 cases that showed pancytopenia on peripheral smear examination, revealed haematological malignancy on bone-marrow aspiration. Other malignancies in this study were MDS (5%) and multiple myeloma (1.5%). Other series showed the incidence of multiple myeloma ranging from 0.94% to 4.1% (Kibria *et al*., 2010; Gayathri and Rao, 2011; Jha *et al*., 2008; Laishram *et al*., 2008) and MDS ranging from 2% to 7.9% (Kibria *et al*., 2010; Gayathri and Rao, 2011; Jha *et al*., 2008; Khodke *et al*., 2001). Anaemias in malignancies are of three types: hypoproliferative, haemolytic and anaemia due to blood loss. Hypoproliferative type is the most common form of anemias in malignancies and are due to impaired mobilization of reticuloendothelial iron, ineffective erythropoiesis and reduced survival of erythrocytes. Occult malignancies are the most common causes of anaemia of chronic disease in adults. Marrow reveals normal to increased iron stores with normal erythroid precursors. It is associated with normocytic normochromic blood picture with normal red blood cell indices.

Aplastic anaemia was seen in 37 cases (4.3%). It is recommended that both aspiration and trephine biopsy be done simultaneously in cases of pancytopenia especially if hypoplastic or aplastic anaemia is suspected though aspiration smears are superior for morphological details. Bone marrow biopsy provides a more reliable index of cellularity and reveals bone marrow infiltration, fibrosis and granulomas (Jha *et al*., 2008). Compared to our study, 19%, 29% and 14% cases of hypoplastic anaemia were seen in other studies (Gayathri and Rao, 2011; Jha *et al*., 2008; Khodke *et al*., 2001). Infective pathology was seen in 14 cases (1.5%) out of which leishmaniasis was seen in two case (0.2%). Similar finding were seen in a study done by Santra *et al*. (2010). Other studies showed 2.82%, 1.2% and 0.67% of leishmaniasis (Kibria *et al*., 2010; Niazi and Raziq, 2004; Jha *et al*., 2008) but the maximum number of cases (14%) were seen in a study done by Khodke *et al*. (2001). Recent advances in the treatment of haematologic malignancies have been paralleled by renewed interest on the part of pathologists and haematologists in methods of obtaining and preparing bone marrow for diagnostic studies.

Conclusion

Bone marrow examination is an important investigation to arrive at the confirmatory diagnosis of haematological disorders. The study provides a valuable insight into the causes of anaemia or pancytopenia in our country. The procedure remains a veritable tool in the diagnoses and management of a wide range of haematological and some non-haematological diseases. It also explains the causes for various haematological findings such as anaemia and pancytopenia, especially in a resource poor centre like ours.

REFERENCES

Ahmed SQ, Khan OU, Zafar N. 2011. Utilization of bone marrow examination in a secondary care hospital. *JRMC*, 15: 40-41.

Bashawri LA. 2002. Bone marrow examination. Indication and diagnostic value. *Saudi Med J*., 23(2): 191-196.

Bick RL. 1995. Anemia of malignancy. *Adv Exp Med Biol*., 369:195-200.

Damulak OD. and Damen JG. 2012. Diagnostic outcome of bone marrow aspiration in a new centre in Nigeria. *Glo Adv Res J Med Sci*., vol. 1(7): 166-171.

Egesie OJ, Joseph DE, Egesie UG, Ewuga OJ. 2009. Epidemiology of anemia necessitating bone marrow aspiration cytology in Jos. *Niger Med J*., 50:61-1.

Gayathri BN. and Rao KS. 2011. Pancytopaenia: A clinico hematological study. *J Lab Physician*, 315-320.

Jha A, Sayami G, Adhikari RC, Panta D, Jha R. 2008. Bone marrow examination in cases of pancytopenia. *J Nepal Med Assoc*., 47:12-7.

Khodke K, Marwah S, Buxi G, Yadav RB, Chaturvedi NK. 2001. Bone Marrow Examination in Cases of Pancytopenia. *JIACM*, 2:55-9.

Kibria SG, Islam MDU, Chowdhury ASMJ, Ali MY, Haque MR, SM Mustanzid, *et al*. 2010. Prevalence of Hematological Disorder: A Bone Marrow Study of 177 Cases In A Private Hospital At Faridpur. F*aridpur Med. Coll. J*., 5:11-3.

Laishram S, Shimray R, Sharma AB, Pukhrambam G, Singh AM, Sharma LDC. 2008. Neoplastic lesions in the bone marrow: A 10 year study in a teaching hospital. *JIACM*, 9:175-8.

Mahabir VK, Ross C, Poporic S, Sur ML, Bourgeois J, Lim, *et al*. 2013. A blind study of bone marrow examination in patients with Primary Immune Thrombocytopaenia. *Eur J. Haematol*., 90(2): 121-126.

Niazi M. and Raziq FI. 2004. The incidence of underlying pathology in pancytopenia- an experience of 89 cases. *JPMI*, 18:76-9.

Pudasaini S, Prasad KBR, Rauniyar SK, Shrestha R, Gautaam K, Pathak R *et al*. 2012. Interpretation of bone marrow aspiration in haematological disorders. *Journal of Pathology of Nepal*, 2: 309-312.

Reich C. 1946. A clinical atlas of sternal bone marrow. Chicago: Abbott Laboratories.

Rock WA Jr, Stass SA, eds. 2000. Handbook of Hematologic Pathology. New York, NY: Marcel Dekker, Inc., 1-26.

Santra G. and Das B K. 2010. A cross-sectional study of the clinical profile and aetiological spectrum of pancytopenia in a tertiary care centre. *Singapore Med J*., 51:806-12.

Tripathy S. and Dudani S. 2013. Comparative Evaluation of Simultaneous bone marrow aspiration and trephine biopsy. Experience from routine Haematology practice. *Indian Journal of Clinical Practice*, Vol 24: NOS 5.

****