Annals of International Medical and Dental Research
E-ISSN: 2395-2822 | P-ISSN: 2395-2814
Vol-7, Issue-4 | July-August, 2021
Page no- 184-190 | Section- Research Article (Pathology)

Analysis of Bone Marrow Aspiration and Trephine Biopsy in Cases of Severe Anemia

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Received: April 2021
Accepted: May 2021

Abstract

Background: Hematological disorders are quite frequent in all age group. Most of this hematological disorder first present as anemia. Bone Marrow Aspiration plays a major role in the diagnosis of its underlying cause. The aim of this study was to analyze the bone marrow aspiration and trephine biopsy findings in cases of severe anemia due to various diseases causing it like nutritional deficiency, bone marrow depression or any neoplastic proliferation of blood cells. **Methods:** This study was carried out in the Department of Pathology Govt. Medical College, Patiala. Bone marrow examination of 50 cases of suspected hematological disorders was carried out. **Results:** Of the 50 cases most of the patients were found to be in the age group of 50-69 years i.e. 21 cases (42%) followed by 10 cases (20%) in the age group of 30-49 years. In the present study, out of 50 cases there were 31 males (62%) and 19 females (38%) showing male preponderance. In the present study the maximum number of cases showed hypercellularity of bone marrow i.e. 28 cases (56%). All the cases showed megaloblastic reaction and erythroid hyperplasia. The bone marrow aspiration and biopsy findings in all cases were concordant. **Conclusion:** Bone marrow examination is an important step to arrive at the confirmatory diagnosis of many hematological disorders.

Keywords: Anemia, Aspiration, Biopsy, Bone Marrow

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INTRODUCTION

Anemia is the most common nutritional deficiency disorder in the world. It is a condition when the red blood cells do not carry enough oxygen to the tissues of the body.[1] According to the World Health Organization (WHO), there are two billion people with anemia in the world.[2] Prevalence of anemia in all the groups is higher in India as compared to other developing countries.[3] In India anemia affects an average of 50% of the population. Women are more affected with it as compared to men.[4] It is estimated that about 20% - 40% of maternal deaths in India are due to anemia and one in every two Indian women (56%) suffers from some form of anemia.[5] The high proportion of microcytic anemia and the fact that gender differences were only seen after the menarche period in women indicate that iron deficiency was the main cause of anemia.[6]

The proportion of normocytic anemia was highest in older adults, suggesting that other causes than iron deficiency might have contributed to the high prevalence of anemia in this group. Recent studies have shown the poor bioavailability of vitamin B12 in the typical Indian vegetarian diet.[7] In India, only 28% of women consume meat, fish, or eggs on a weekly basis,[8] and the iron bioavailability of the vegetarian diet is poor.[9,7] In children, iron deficiency affects cognitive and motor development and increases susceptibility to infections.[10]

Data from National Nutrition Monitoring Bureau (NNMB),[11] Indian Council of Medical Research (ICMR)[12] and District Level Household Survey (DLHS)[12] surveys have shown that prevalence of anemia is very high (ranging between 80->90%) in preschool children, pregnant and lactating women and adolescent girls. Low birth weight infants, young children and women of childbearing age are particularly at a risk of anemia. So anemia begins in childhood, worsens during adolescence in girls and gets aggravated during pregnancy.

Punjab is known as a prosperous state of India but the status of anemia among young girls and women is alarming. In Amritsar 70.57% young girls were observed to be anemic.[13] In a recent study conducted in rural population of Patiala, one of the major city of Punjab, Kaur and Kaur[14] observed that 98% of female and 56% of male subjects were anemic. It was further suggested that poor nutrition profile of the women is positively correlated with hemoglobin level among them. This figure not only projects the highest prevalence of anemia among rural girls of Patiala but also suggests that women are more prone to become anemic than men.

Bone marrow examination has been a cornerstone of hematology practice since the last six decades. Examination of peripheral blood smears in severe anemia alone does not reflect the exact nature of the disease process. A microscopic examination of bone marrow is often useful and may be critical in the work up of unexplained anemia. Bone marrow

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aspiration (BMA) alone is usually sufficient to diagnose nutritional anemias, most of the acute leukemias and Immune thrombocytopenias. Trephine biopsy does provide important diagnostic information in patients with granulomatous disease, myelofibrosis and bone marrow infiltration. A marrow trephine is particularly useful in estimating overall cellularity.

The present study has been conducted to analyse the etiology of severe anemia and to assess the significance of various factors like nutritional deficiency, bone marrow depression or any neoplastic proliferation in the clinical profile of patients presenting with severe anemia and to assess the diagnostic as well as prognostic value of bone marrow aspiration and trephine biopsy changes in severe anemia. The course and outcome of clinical profile of severe anemia is influenced both by the primary disease causing it and the marrow involvement.

MATERIAL AND METHODS

This study has been conducted in the department of pathology, Govt. Medical College, Patiala. 50 cases which included both indoor and outdoor patients, that presented with severe anemia were taken up for present study. Sex was no criterion for the selection of cases. Patients with hemoglobin ≤ 6gm/dl were taken up for the present study. Clinical data with reference to the mode of onset, signs and symptoms, drug intake, bone pains, hepatosplenomegaly and lymphadenopathy were recorded. The following investigations were performed and recorded in all the cases.

1. Complete hemogram which included Hb, TLC, DLC, Platelet counts, ESR, RBC count, PCV, MCV, MCH, MCHC and PBF.
2. Bone marrow aspiration.
3. Special investigations like serum proteins, serum ferritin, serum iron, Bence Jones proteins, FNAC liver/ lymph node and ultrasound abdomen were done in appropriate cases.

The needle used is Salah marrow puncture needle and the site is posterior superior iliac spine. The staining done was Leishman stain and some special stains were also used like Myeloperoxidase - PAS - Prussian blue stain (Perl's reaction).

RESULTS

All the patients were subjected to routine hematological investigations. The bone marrow aspiration followed by bone marrow biopsy were conducted at the same time in all the patients. To make a definitive diagnosis in 3 cases repeat bone marrow aspiration had to be performed because of inadequate material.

Of the 50 cases most of the patients were found to be in the age group of 50-69 years i.e. 21 cases (42%) followed by 10 cases (20%) in the age group of 30-49 years. In the present study, out of 50 cases there were 31 males (62%) and 19 females (38%) showing male preponderance.

Table 1:Age Distribution In 50 Cases Of Severe Anemia

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Variables	n(%)
Age group in years	
<10	2(4)
10-29	7(14)
30-49	10(20)
50-69	21(42)
70-79	9(18)
>80	1(2)
Gender	
Male	31(62)
Female	19(38)

In the present study the maximum number of cases showed hypercellularity of bone marrow i.e. 28 cases (56%).

Table 2: Bone Marrow Cellularity

Celluarity	n(%)
Hypercellular	28(56)
Normocellular	19(38)
Hypocellular	3(6)

All the cases showed megaloblastic reaction and erythroid hyperplasia. The bone marrow aspiration and biopsy findings in all cases were concordant.

Table 3:Bone Marrow Findings In Megaloblastic Anemia

Findings	Aspiration n(%)	Biopsy n(%)
Cellularity		
Hypercellular	16(88.88)	16(88.88)
Normocellular	2(11.11)	2(11.11)
Reaction		
Megaloblastic	18(100)	18(100)
Erythropoiesis		
Erythroid Hyperplasia	18(100)	18(100)
Myelopoiesis		
Giant metamyelocytes+	16(88.88)	16(88.88)
Giant metamyelocytes-	2(11.11)	2(11.11)

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Megakaryopoiesis Megakaryocytes increased Megakaryocytes normal	 12(66.66) 6(33.33)	 12(66.66) 6(33.33)

Table 4:bone marrow findings in iron deficiency anemia

Findings	**Aspiration n(%)**	**Biopsy n(%)**
Cellularity Hypercellular	 4(100)	 4(100)
Reaction Micronormoblastic	 4(100)	 4(100)
Erythropoiesis Erythroid Hyperplasia	 4(100)	 4(100)
Myelopoiesis Normal	 4(100)	 4(100)
Megakaryopoiesis Megakaryocytes increased Megakaryocytes normal	 1(25) 3(75)	 1(25) 3(75)

DISCUSSION

Bone marrow examination is useful in the diagnosis of various causes of severe anemia. The two most important techniques used for the diagnosis of hematological disorders are bone marrow aspiration and trephine biopsy which are complementary to each other. The spectrum of various causes of severe anemia is very wide. Examination of the bone marrow is one of the most important diagnostic pillar in diagnosing hematological disorders. A total of 50 cases of severe anemia were included in the present study. Patients with Hb ≤ 6gm/dl of all age groups were taken up for the study. Based on the clinical history, findings and various haematological parameters, diagnosis was arrived at in each case.

In the present study maximum number of patients were observed in the age group of 50 – 69 years i.e 21 patients (42 %) followed by 10 patients (20%) in the age group of 30-49 years. In the study conducted by Lalitha et al[15] (2018), maximum number of patients were in the age group of 46- 60 years i.e 37/112 (33%) followed by 26/112 (23.2 %) patients in the age group of 31-45 years. The result of the present study were comparable to the studies conducted by Lalitha et al[15] (2018). However the result of the present study was in contrast to the study conducted by Metikurke et al[16] (2013) in which maximum number of patients were found in the age group of 21-30 years (25%).

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The present study showed male preponderance which was comparable to the studies conducted by Singh et al[44] (2015) and Sharma et al[17] (2017). In the present study maximum number of patients showed hypercellular bone marrow i.e 28 cases (56%). This result was comparable to the study conducted by Metikurke et al[16] (2013) in which the maximum number of patients with hypercellular bone marrow were recorded in 30/58 cases (51.72%) .

CONCLUSION

Thus to conclude, bone marrow aspiration and biopsy using standard fixation and embedding procedures generally complement each other in the work up of patients with severe anemia; while the aspiration smears are primarily useful for cytological diagnosis, biopsy sections are mainly helpful to identify histological features like architectural patterns, extent of involvement, fibrosis and granulomatous conditions.

REFERENCES

1. Anemia. Available from: https://www.who.int/water_sanitation_health/diseases-risks/diseases/anemia/en/
2. WHO, UNICEF, and UNU, Iron Deficiency Anemia: Assessment, Prevention and Control, A Guide for Programme Managers, WHO, UNICEF, UNU, Geneva, Switzerland, 2001. Available from: http://www.who.int/nutrition/publications/micronutrients/anemia_iron_deficiency/WHO_NHD_01.3/en/index.html.
3. DeMaeyer E, Adiels-Tegman M. The prevalence of anemia in the world. World Health Stat Q. 1985;38(3):302-16.
4. Malhotra P, Kumari S, Kumar R, Varma S. Prevalence of anemia in adult rural population of north India. J Assoc Physicians India. 2004;52:18-20.
5. National Family Health Survey (NFHS-III), 2005-2006. Available from :http://www.nfhsindia.org/pdf/India.pdf
6. Pasricha SR, Black J, Muthayya S, Shet A, Bhat V, Nagaraj S et al. Determinants of Anemia Among Young Children in Rural India. Pediatrics 2010;126(1):e140-49.
7. Shridhar K, Dhillon PK, Bowen L, Kinra S, Bharathi AV, Prabhakaran D et al. Nutritional profile of Indian vegetarian diets--the Indian Migration Study (IMS). Nutr J. 2014;13:55.
8. Alvarez-Uria G, Naik PK, Midde M, Yalla PS, Pakam R. Prevalence and Severity of Anemia Stratified by Age andGender in Rural India. Hindawi Publishing Corporation 2014;1-5.
9. Thankachan P, Muthayya S, Walczyk T, Kurpad AV, Hurrell RF. An analysis of the etiology of anemia and iron deficiency in young women of low socioeconomic status in Bangalore, India. Food Nutr Bull. 2007;28(3):328-36.
10. Baker RD, Greer FR. Diagnosis and prevention of iron deficiency and iron-deficiency anemia in infants and young children (0-3 years of age). Pediatrics. 2010;126(5):1040-50.
11. National Nutrition Monitoring Bureau. NNMB Micronutrient Survey. National Institute of Nutrition, Hyderabad, 2002. Available from : http://nnmbindia.org/NNMBREPORT2001-web.pdf
12. Gonmei Z, Toteja G S. Micronutrient status of Indian population. Indian J Med Res 2018;148(5):511-21.
13. Sidhu S, Kumari K, Uppal M. Prevalence of anemia among adolescent girls of schedule. caste community of Punjab. Anthropologist 2005; 7(4):265-67.
14. Kaur IP, Kaur S. A comparison of nutritional profile and prevalence of anemia among rural girls and boys. Journal of Exercise Science and Physiotherapy. 2011;7(1):11-18.
15. Lalitha SM, Asha T, Priyanka AA. Bone marrow study in tertiary care hospital, ELURU-ASRAM. Journal of Basic and Clinical Research 2018;5(1):1-6.

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16. Metikurke SH, Bhavika R. Correlation of bone marrow aspirate, biopsies and touch imprint findings in pancytopenia. Journal of Hematology. 2013;2(1):8-13.
17. Sharma N, Bhatia PK, Kaul KK, Sharma S, Sharma M. A clinicohematological study of pancytopenia: An experience of a tertiary care teaching hospital, Jammu, India. Indian Journal of Pathology and Oncology. 2017;4(4):632-7.

Source of Support: Nil, Conflict of Interest: None declared

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