Original Research Article

Bone marrow aspiration as the initial diagnostic tool in the diagnosis of leukemia - A case study

Priyanka Poonam[1*], N.K. Bariar[2]

[1]Tutor, Department of Pathology, Patna Medical College, Patna, India
[2]HOD, Associate Professor, Department of Pathology, Patna Medical College, Patna, India
[*]Corresponding author email: **ppdoc83@gmail.com**

International Archives of Integrated Medicine, Vol. 5, Issue 4, April, 2018.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 02-04-2018 **Accepted on:** 09-04-2018
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Priyanka Poonam, N.K. Bariar. Bone marrow aspiration as the initial diagnostic tool in the diagnosis of leukemia - A case study. IAIM, 2018; 5(4): 126-130.

Abstract

Generally patients suffering from leukemia complain of very vague symptoms of low grade fever for 2-3 months, weight loss, loss of appetite, fatigue, recurrent infections, petechiae in the body. Thus high index of suspicion and proper diagnosis is needed. The patients who attend tertiary care centre with above symptoms should be initially diagnosed by doing complete blood count, peripheral blood smear examination followed by bone marrow aspiration and its examination. It provides high quality visualization of cell morphology and enables differential count. A total of 1793 patients attended Department of Pathology in the tertiary care centre for bone marrow examination. Of this majority of cases were diagnosed with erythroid hyperplasia with megaloblastic reaction. 152 cases were diagnosed with leukemias. There were 66 cases of ALL, 46 cases of AML, 35 cases of CML, 3 cases of CLL and 2 cases of CEL. Few cases of Multiple Myeloma, plasma cell dyscrasias and immune thrombocytopenic purpura were diagnosed. In this study, we have analysed the incidence of different types of leukemia in different age groups and their presenting sign and symptoms.

Key words

Bone marrow aspiration, Leukemia, Cytochemistry.

Abbreviations used

BMA-Bone marrow aspiration, ALL-Acute Lymphoblastic leukemia, AML-Acute Myeloid leukemia, CML-Chronic myeloid leukemia, CLL-Chronic lymphoid leukemia, CEL-Chronic eosinophilic

leukemia, MPO-Myeloperoxidase, NSE-Non-specific esterase, PAS-Periodic Acid Schiff, BM-bone marrow

Introduction

Leukemias are the neoplastic proliferations of hemopoietic cells [1]. Acute leukemias are the neoplasms with more than 20 percent blasts in the peripheral blood and bone marrow [1]. In CML, bone marrow is usually 100 percent cellular with maturing granulocytic precursors [2]. CLL is characterized by greater than 30 percent marrow infiltration by lymphocytes [1].Bone marrow aspiration is simple, safe, and relatively painless procedure [3]. BMA provides cytological evaluation of cells that have been aspirated and smeared. It enables evaluation of cell morphology and differential count [1]. ALL and AML must be differentiated for proper treatment, at first based on the morphology of blasts. In ALL, lymphoblasts have condensed nuclear chromatin, inconspicuous nucleoli and scant agranular cytoplasm [2] (**Figure – 1**). In AML, Myeloblasts have delicate nuclear chromatin, 2-4 nucleoli and more voluminous cytoplasm that contain fine azurophilic, peroxidase positive granules (**Figure – 2**). In this study, we have analysed frequency of various leukemias like ALL, AML, CML, CLL in different age groups and their clinical presentation who attended tertiary referral centre for BMA (**Figure – 3, 4**).

Materials and methods

This was a prospective study for 4 years starting from January 2014 to December 2017 at the Department of Pathology, Patna Medical College, Patna, India. All cases of leukemia were included in the study that came for bone marrow aspiration. The initial diagnosis of leukemia was based on clinical features, complete blood count, peripheral blood smear examination and cytological examination of cells that had been aspirated from bone marrow. This was followed by cytochemistry and immunophenotyping for confirmation of diagnosis. This was a descriptive study describing the frequency of different types of leukemias in various age groups of patients. Patients presenting with non-specific symptoms like fever for 2-3 months, loss of appetite, weight loss, petechiae, and recurrent infections were included in the study.

Figure – 1: ALL - BM is hypercellular with lymhoblasts having scant cytoplasm and nuclei slightly larger than those of small lymphocytes, condensed nuclear chromatin, small nucleoli. Lymphoblasts completely effacing normal tissue architecture.

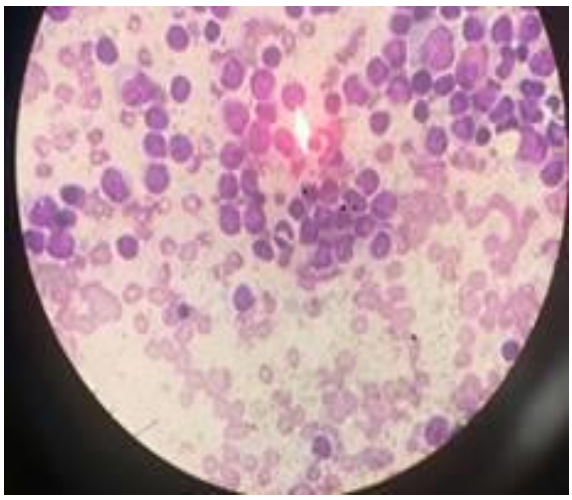


Figure – 2: AML - Myeloid blasts occupy >20% of cells in the BM. Myeloblasts have delicate nuclear chromatin,2-4 nucleoli and more voluminous cytoplasm than lymphoblasts.c Cytoplasm contains peroxidase positive azurophilic granules.

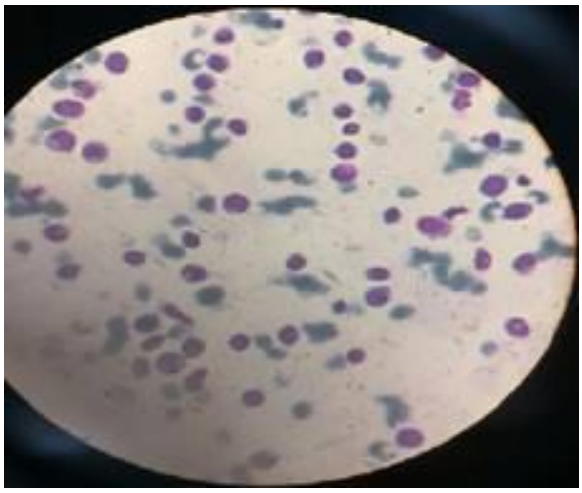


Figure – 3: CML - BM Is 100% cellular with mature granulocytic precursors, slight increase in eosinophilic precursors are also seen. Myelocytes are in increased number.

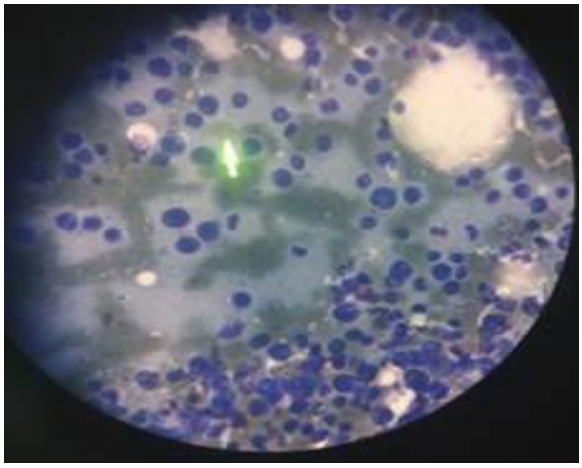
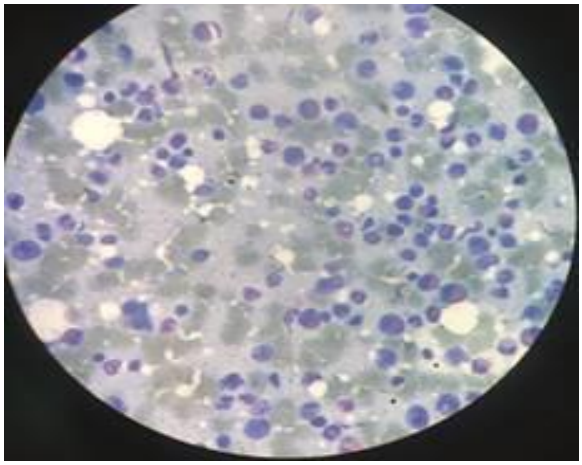


Figure – 4: CEL - BM Is hypercellular. Myeloid hyperplasia of eosinophilic precursors. Blast cells are >5% in BM.



BMA was done using Salah's and Klima's needle [3]. Sternum and posterior iliac crest are the preferred sites in adults [3]. The upper end of tibia is preferred in new born, infants and children less than 1 year of age [3].

After drying in the air, the films are immediately fixed in acetone free methyl alcohol for 20 minutes and stained by Leishman, May-Grunwald or Giemsa stain [3]. Reporting on bone marrow includes cellularity, types of erythropoiesis, type of leucopoiesis, and myeloid erythroid ratio.

Results

Total number of patients attending tertiary care centre for BMA were 1793. Of these152 cases were diagnosed as leukemia. There were 66 cases of ALL of which 60 cases were of age group <20 years and 6 cases were of age group>20 years. Next is AML, a total of 46 cases of which 25 belonging to age group 40-70 years and 21 belong to age group 10-30 years. 3 cases of CLL belong to age group >50 years. There were a total of 35 cases of CML of which 15 cases belong to age group 30-60 years and 20 cases belong to age group 10-30 years. Only 2 cases of CEL were reported in age group 25-50 years age group. Diagnosis was based on cytological evaluation of bone marrow smears. Cytochemistry and immunophenotyping was done for confirmation. Majority of cases were reported as erythroid hyperplasia with megaloblastic reaction. Few cases were diagnosed as multiple myeloma and plasma cell dyscrasias (**Table – 1**).

Table – 1: CD markers of blasts.

Type of Leukemia	CD Markers of blasts
ALL	Leukemic blasts almost always express pan B-cell markers CD19 and CD10 for precursor B ALL cells. Precursor T ALL Cells express CD 1,2,5 and CD 7 [2]
AML	CD-34,CD-33 [2]
CML	PHILADELPHIA chromosome positive demonstrates molecular fusion of BCR and ABL genes [1]
CLL	tumor cells express pan B cell markers CD19 and 20,23,5 [2]

Discussion

In my study, it was observed that different types of leukemias have bimodal presentation in different age groups. Majority of cases of ALL presented in age group <20 years and few cases in age group >20 years. The highest incidence of ALL is in children between1-5 years [1]. 60% of AML cases present between age group 40-70 years and 40% present between age group 10-30

years.40% of CML cases present between 30-60 years and 60% between age group 10-30 years. Most of CLL cases present in >50 years of age. Frequency of CEL was minimum.

Most of the patients complaint of non-specific symptoms like fever on and off, loss of weight, loss of appetite, fatigue, petechiae. Although ALL and AML are immuophenotypically and genotypically distinct, they usually present with very similar clinical features like abrupt onset**,** fatigue, fever, petechiae, ecchymoses, gum bleeding, bone pain, generalized lymphadenopathy and hepatosplenomegaly [2].Massive splenomegaly was present in patients suffering from CML.CML patients present with weakness, weight loss, and massive splenomegaly [2].Only 50-60% cases of CLL presented with hepatosplenomegaly [2].
Complete blood count of patients with acute leukemia shown decreased hemoglobin, white blood cell count were markedly elevated, decreased platelet count. Differential count on the smear revealed >40%blasts.Absolute lymphocytosis $>10x10^9$/L is the hallmark of CLL.>90% cells in the peripheral blood are mature lymphocytes in classical CLL [1]. In CML patients, there were marked leukocytosis with total leukocyte count $>30\text{-}500x10^9$/L. In CEL patients, leukocytosis with raised eosinophil count $>1.5x10^9$/L was found.

AML is characterized by a clonal proliferation of myeloid precursors with a reduced capacity to differentiate into more mature cellular elements [4]. In CML there is unregulated growth of myeloid cells in the bone marrow, proliferation of mature granulocytes and their precursors [5]. The hallmark of CML is Philadelphia chromosome [Ph!][t9:22][q34;q11][1].

BMA forms the cornerstone of diagnosis and management of leukemia. BMA and smears examination enables cytological evaluation of cell morphology and differential count [1].

Finally cytochemistry and immunophenotyping are done for confirmation of diagnosis. Blasts in AML are MPO, sudan black and NSE positive whereas blasts in ALL are PAS positive and acid phosphatase positive [1].

Conclusion

In my study for the period of 4 years from January 2014 – December 2017, a total of 1793 patients attended tertiary care centre for BMA. Most of them were diagnosed with erythroid hyperplasia with megaloblastic reaction.152 cases were of different types of leukemia. ALL was most common among younger age group whereas CML and CLL were common among older age group. AML was common among adults.

Almost all of patients presented with non-specific constitutional symptoms. Massive splenomegaly was seen in CML patients. Diagnosis of leukemia was done initially by complete blood count, peripheral blood smear examination and bone marrow examination. It should be followed by cytochemistry and immunophenotyping for confirmation. So, high index of suspicion is needed if patient is presenting with constitutional symptoms for 2-3 months and not responding to treatment. Thus BMA forms initial diagnostic tool for diagnosis of patients suffering from leukemia.

References

1. Singh T. Atlas and Text of Hematology; 2nd edition, Avichal Publishing Company, 2017, p. 20, 133, 136, 137, 145, 185, 214, 194.
2. Kumar, Abbas, Fausto; Robbins and Cotran Pathologic Basis of disease, 7th edition, Saunders, 2004, p. 670, 672, 674, 692, 694.
3. Chakraborty P. Practical Pathology, 2nd edition, New Central Book Agency, 2010, p. 79, 80, 81.
4. Anastas J, Larson A Richard, Connor F Rebecca. Clinical manifestations, pathological features and diagnosis of acute myeloid leukemia. Literature review current through 2014.

5. Kantarjain H, Cortes J. Chronic myeloid leukemia. Niederhuber JE, Armitage JO, Dorohow JH [edr] Abeloff' Clinical oncology, 5th edition, Philadelphia, USA, 2013.