Journal of Muhammad Medical College
Website: jmmc.mmc.edu.pk

Original Article

# Pattern of malignant hematological disorders using bone marrow aspirate and biopsy at tertiary care hospital, Karachi.

Mehwish Sajjad[1], Shaheen Kouser[2], Taha Khan[3], Zaen Al Abideen[4], Hira Qadir[5].Mehreen Mehmood

1: Lecturer, Dow International Medical College, Dow University of Health Sciences

2: Assistant Professor, Department of Pathology, Dow International Medical College, Dow University of Health Sciences, Consultant Pathologist, Dr Eshrat-ul-ebad khan Institute of Blood diseases

3: MBBS (Final year undergraduate student) Dow International Medical College, Dow University of Health Sciences

4: Consultant Pathologist, Dr Eshratulebad khan Institute of Blood diseases, Dow University of Health Sciences

5: Assistant Professor, Department of Pthology, Dow International Medical College, Dow University of Health Sciences.

6: Assistant Professor, Department of Pathology, Dow International Medical College, Dow University of Health Sciences, Consultant Pathologist, Dr Eshrat-ul-ebad khan Institute of Blood diseases.

***=corresponding author**
**Mehwish.sajjad@duhs.edu.pk**

**Abstract**

**Introduction:** Bone marrow aspirate and biopsy is an invasive method for identification, staging, and pursuing tumors. Current study designed to determine the frequency of malignant hematological disorders using bone marrow aspirate and biopsy at Dr. Ishrat ul Ebad Khan Institute of Blood Diseases (DIEKIBD).

**Objectives:** To determine the frequencies of various hematological disorders using bone marrow aspiration and trephine biopsy examination

**Methodology:** In this retrospective study, 333 patients presenting at DIEKIBD during January 2019 to December 2020 were included. All these patients underwent bone marrow examination and the reports were retrieved from the department records.

**Result:** It was observed that about 80 (24%) of the bone marrow examinations were done for staging in which 8 (2.4%) were not illustrated any primary diseases involvement while 72 cases (21%) contained primary diseases. Among non-malignant conditions, iron deficiency anemia, megaloblastic anemia and mixed deficiency anemia were the most frequent, while acute lymphoblastic leukemia, acute myeloid leukemia and chronic myeloid leukemia were the most prevalent malignant hematological disorders.

**Conclusion:** Pathological analysis of Bone Marrow via Aspirate and Trephine biopsy is a widespread approach in diagnosing, staging and prognosis of neoplastic as well as non-neoplastic hematological disorders. Bone Marrow biopsy examination analysis has a significant value in the diagnosis and staging of malignant conditions than non-malignant disorder as in our study prevalence of malignant conditions were more than non-malignant diseases.

**Key words:** Bone Marrow Biopsy, Blood Disorder, Malignant Hematological Diseases.

**Introduction:**

Bone marrow examination has a significant place among hematological investigation. It helps in the demonstration of ultimate diagnosis of many hematological and non-hematological diseases. Hematological disorders have a diverse pattern of malignant and non-malignant diseases.[1] This study was aimed to assess the spectrum of blood disorders principally the malignant hematological disorders diagnosed on bone marrow examination. Bone marrow examination include bone marrow aspiration and bone marrow biopsy.[2] Bone marrow aspiration help in the investigation of anemia, pancytopenia, suspected leukemia or myeloma, neutropenia, thrombocytopenia etc. On the other hand bone marrow biopsy indicated in the leukemia suspicion, myeloproliferative disorders, myelodysplasia, aplastic anemia, malignant lymphoma, myeloma, second-

ary carcinoma, splenomegaly or pyrexia of unknown cause.[3] Bone marrow examination significantly help in diagnosis and staging of malignancies.[4] It also helps in detection of infection and storage diseases. It also detects chromosomal abnormalities and help in the identification of metastatic non-hematopoietic carcinomas that have involved the bone marrow.[5]

Briefly, there are many conditions where bone marrow examination provide diagnostically important details which would not be possible otherwise.[6] Although, bone marrow aspiration and biopsy is an invasive procedure and technique that has a major effect in final diagnosis. The purpose of current study was to identify the etiological spectrum of disorders as assessed on bone marrow aspiration and biopsy. First findings were categorized into malignant and non-malignant disease and then frequency of malignant diseases were calculated.

**Objectives:**

To determine the frequencies of various hematological disorders using bone marrow aspiration and trephine biopsy examination

**Methodology:**

This retrospective study, after approval by Institutional Review Board committee of Dow University of health sciences, was conducted at DIEKIBD from Jan 2019 to Dec 2020. For the study record of those patients who underwent bone marrow biopsy and aspiration were retrieved form department database. Only patients having complete record including consent, history, description of illness including its extent and progress and findings of general and systemic clinical examination were considered. Files showing incomplete records were excluded and finally record of 333 patients including bone marrow examination reports comprised of both aspiration and biopsy found eligible for the current study. In bone marrow sampling, local anesthesia with 1% xylocaine was applied over posterior iliac spine which is the most preferred site. Salah Bone Marrow Aspiration Needle was used for aspiration that is followed by biopsy. Biopsy was obtained by using trephine needle to obtain a biopsy core. Aseptic techniques were used during the whole procedure. In our study, we illustrated the spectrum of malignant and non-malignant disorder, their ages, gender and clinical indications. Data was analyzed on SPSS to conclude the frequencies of diversified hematological disorders.

**Results:**

A total number of 333 number of patients underwent in bone marrow examination includes biopsy and aspiration. Age ranges from 7 months to 98 years; with a mean age of 39.06 years. Common age group (72 cases) was between 7months to 20 years; where 6 were non-malignant and 66 were malignant followed by 21 to 30 years, with 61 cases, where 56 were malignant and 5 were nonmalignant. 57 cases were from age group between 31-40 years; 9 were nonmalignant and 48 were malignant. Chi square test showed differences to be statistically insignificant at p-value of 0.425. Majority of patients were male 208 (62.64%) and females were 125 (37.53%).

**Table 1 Age-wise distribution of Hematological disorders in relation to different age intervals**

| Age | Hematological Disorders | | | p value |
|---|---|---|---|---|
| | Non-malignant | Malignant | Total | |
| 7 months-20 years | 6 | 66 | 72 | 0.425 |
| 21-30 years | 5 | 56 | 61 | |
| 31-40 years | 9 | 48 | 57 | |
| 41-50 years | 8 | 38 | 46 | |
| >50 years | 13 | 84 | 97 | |
| Total | 41 | 292 | 33 | |

Most patient were suggested bone marrow biopsies after work up of anemia, pancytopenia and blasts on CBC, fever of unknown origin, hepatomegaly, splenomegaly and staging and to assess the disease status. Among 333 bone marrow evaluation, 80 were suggested for marrow staging, post chemotherapy response and to rule out the involvement of bone marrow with primary diseases like Kaposi sarcoma, Ewing sarcoma, myeloproliferative disorder and lymphoproliferative disorders. 8 cases presented with normal bone marrow whereas 81 cases illustrate bone marrow involvement with primary diseases. Metastases in bone marrow were observed in seven cases which were from prostate, vertebrae, primary B cell CNS lymphoma, Plasma cell tumor of sacrum and mediastinal tumor. Out of 333 cases, 39 cases were non-malignant hematological disorders, in which 12 cases showed reactive changes secondary to reactive process or drug induced followed by Iron deficiency anemia (7) and infection (6). Spectrum of malignant diseases was shown in table (1). Acute lymphoblastic leukemia has revealed highest number of 63 cases among malignant hematological disorder in which 18 cases were of T cell, 17 were of B cell, 25 cases of ALL

observed remission and 3 showed relapses. Acute Myeloid leukemia exhibited 41 cases in which remission and relapses were observed in 8 and 6 cases, respectively. Chronic Myeloid leukemia depicted 40 cases in which 12 were in chronic phase, 2 in blast phase

**Table 2: Spectrum of non-malignant and malignant disorder**

| Disorder | | n |
|---|---|---|
| Non-malignant hematological disorder | Secondary changes due to drugs | 12 |
| | Iron deficiency anemia | 7 |
| | Infection | 6 |
| | Megaloblastic anemia | 5 |
| | Aplastic anemia | 5 |
| | Mixed nutritional deficiency | 3 |
| | Autoimmune hemolytic anemia | 2 |
| | β thalassemia variant | 1 |
| Malignant hematological disorder | Acute lymphocytic leukemia | 63 |
| | Acute myeloid leukemia | 41 |
| | Chronic myeloid leukemia | 40 |
| | Multiple Myeloma | 15 |
| | B cell non-Hodgkin lymphoma | 15 |
| | Chronic lymphoid leukemia | 10 |
| | Plasma cell disorders | 7 |
| | Mets to bone | 7 |
| | Myelodysplastic syndrome | 4 |
| | Hodgkin's lymphoma | 4 |
| | Myeloproliferative | 3 |
| | Myelofibrosis | 2 |
| | T cell non-Hodgkin lymphoma | 1 |
| Bone marrow for staging | No involvement of Bone marrow from primary disease | 72 |
| | Normal morphology | 8 |

and 1 in monocytic, 1 in accelerated phase and 2 cases of eosinophilic leukemia. Multiple Myeloma were observed in 15 cases in which 2 cases showed remission. Non-Hodgkin's lymphoma exhibited 15 B cell non Hodgkin lymphoma in which 5 were mantle cell lymphoma, 5 were follicular lymphoma and 1 T cell non Hodgkin lymphoma.

**Discussion:**

Bone marrow aspiration and biopsy is one of the beneficial tools for making the ultimate diagnosis of most of the hematological disorders (7). It is one of the invasive
technique performed routinely in hematology (8). After this procedure bleeding, infection or any other complication are rarely reported (2). In this study 208 patients (62.4%) were males and 125 (37.5%) were female. Age ranges from 7 months to 98 years in which a maximum of 70 cases (21%) was in between 7 months to 20 years of age group (9). In a study conducted in Ghana mean age was 32 years of age[17]. Nearly partial examinations 80 (24%) were conducted on patients already diagnosed cases with Hodgkin's lymphoma, Non-Hodgkin's lymphoma, Kaposi sarcoma, amongst which 8 (2.4%) were not involved in primary illness whereas 72 subjects (21.62%) constituted underlying illness(10). Current study shows that among the non-malignant hematological pathologies, combined deficiency anemia, Iron deficiency anemia and megaloblastic anemia were more frequent. The frequent etiology under megaloblastic anemia was folate deficiency and vitamin B12 deficiency. Infection is the second most frequent non-hematological disorder. Aplastic and Autoimmune hemolytic anemia were also found but definite underlying mechanism is not apparent (11).
More malignant disorders were diagnosed in our study compared to the study conducted by Salam et al[15]. Acute lymphocytic leukemia and Acute myeloid leukemia were the most frequent hematological malignancies reported, followed by Chronic myeloid leukemia. A similar study reported by Zeeshan[6] which reported acute lymphoblastic leukemia as the commonest hematological malignancy among 24.76% of the studied bone marrow examined cases, with which is consistent with our study; a more recent study also reported a high prevalence of acute leukemia than chronic leukemia (6, 12). Most frequent among acute leukemias were acute lymphocytic leukemia followed by acute myelogenous leukemia, while among chronic conditions, chronic myelogenous leukemia was followed by chronic lymphocytic leukemia (9.25%).
This research helped to overview numerous malignant and non-malignant Hematological disorders in patients visiting to DIEKIBD, Dow University Hospital, Ojha.

**Conclusion:**

Pathological analysis of Bone Marrow via Aspirate and Trephine biopsy is a widespread approach in diagnosing, staging and prognosis of neoplastic as well as non-neoplastic hematological disorders. Acute and Chronic Malignant varieties like AML, ALL and CML are most frequent, followed by CLLL. More studies will need to elaborate on the use of bone marrow biopsy in clinical use.

**Conflict of interest.**

None.

**Source of Funding:**

None.

**References:**

1. Rindy LJ, Chambers AR. Bone Marrow Aspiration And Biopsy. StatPearls. Treasure Island (FL)2021.
2. Stensby JD, Long JR, Hillen TJ, Jennings JW. Safety of bone marrow aspiration and biopsy in severely thrombocytopenic patients. Skeletal radiology. 2021;50 (5):915-20.
3. Hajiabdolbaghi M, Ataeinia B, Ghadimi F, SeyedAlinaghi S, Badie BM, Dadras O, et al. Bone Marrow Aspiration/ Biopsy in the Evaluation of Fever of Unknown Origin in Patients with AIDS. Infectious disorders drug targets. 2021;21(3):394-8.
4. Kumar V, Bhatia A, Madaan GB, Marwah S, Nigam AS. Role of Bone Marrow Examination in the Evaluation of Infections: Clinico-Hematological Analysis in a Tertiary Care Centre. Turk patoloji dergisi. 2020;36(1):17-22.
5. Lee SH, Kim CG, Kwon J, Lee KH, Han HS, Roh SY, et al. Comparison of Bleeding, Hematoma, Pain, and Discomfort After Bone Marrow Examination With or Without Sandbag Compression. Asian nursing research. 2021;15 (2):150-6.
6. Zeeshan R, Irshad B, Aslam MA, Khan MT, Bhatti HW, Chaudhary NA. A Spectrum of Hematological Disorders in Children with Pancytopenia Based on Bone Marrow Examination in a Tertiary Care Hospital. Cureus. 2019;11(7):e5124.
7. Tschautscher MA, Jevremovic D, Buadi FK, Lacy MQ, Gertz MA, Dispenzieri A, et al. Utility of repeating bone marrow biopsy for confirmation of complete response in multiple myeloma. Blood cancer journal. 2020;10 (10):95.
8. Bienzle D. Bone Marrow Examination: Why, How, and What to Expect from the Pathologist. The Veterinary clinics of North America Equine practice. 2020;36(1):35 -52.
9. Desalphine M, Bagga PK, Gupta PK, Kataria AS. To evaluate the role of bone marrow aspiration and bone marrow biopsy in pancytopenia. Journal of clinical and diagnostic research : JCDR. 2014;8(11):FC11-5.
10. Gupta R, Setia N, Arora P, Singh S, Singh T. Hematological profile in pyrexia of unknown origin: role of bone marrow trephine biopsy vis-a-vis aspiration. Hematology. 2008;13(5):307-12.
11. Young NS. Aplastic Anemia. The New England journal of medicine. 2018;379(17):1643-56.
12. Mattsson M, Sandin F, Kimby E, Hoglund M, Glimelius I. Increasing prevalence of chronic lymphocytic leukemia with an estimated future rise: A nationwide population-based study. American journal of hematology. 2020;95(2):E36-E8.