

**Analysis of hematological lesions based on peripheral smear and bone marrow correlation – 3 years observational studies in tertiary care hospital**

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**Abstract**

**Background:** A bone-marrow aspirate and biopsy is used to diagnose, confirm, and/or stage malignant and non-malignant hematologic lesions. However, it is more convenient to use peripheral blood smear (PBS) than bone marrow (BM) for various laboratory studies if the former can serve as well as the latter. Due to diagnostic difficulties by peripheral smear alone, evaluation of the bone marrow examination (BME) which include aspiration and biopsy is required for confirmation of a suspected clinical diagnosis. This study was performed to correlate between peripheral blood smear findings and those of bone-marrow aspiration in hematological lesions and to assess the diagnostic value of bone-marrow aspiration examination.

**Materials and Methods:** During a period of 3 years, both bone marrow aspiration and biopsy along with peripheral smears of 50 patients were correlated and evaluated.

**Clinical profile:** 50 patients were evaluated with complaints of fever, weakness, malaise, pallor and pyrexia of unknown origin whom PBS and BMA and BMB were done.

**Observations and Results:** Out of the total subjects studied, 50% (25/50) were males and 50% (25/50) were females. Majority were in the age group of 41-60 years, 40% (20/50), 32% (16/50) were 21-40 years of age and 8% (4/50) were below 20 years of age. As per the bone marrow aspiration and biopsy findings, 12 cases were leukemia on peripheral blood smear as well and 5 showed normal smear. Majority of case showed thrombocytopenia on PBS and on BME were increased megakaryopoiesis.

**Conclusions:** An integrated use of peripheral smear, bone marrow aspiration and biopsy are recommended to increase accuracy of diagnosis and for better management of the patient. This study shows that bone-marrow aspiration and biopsy is a valuable diagnostic tool and aids in diagnosis of various hematological

lesions combined with peripheral blood smear. In remote areas where advanced technologies can't, be reached there the importance of PBS findings plays an important role in the diagnosis of the patients.

**Keywords:** Bone Marrow Aspiration, Biopsy, Peripheral Blood Smear

### **Introduction**

Peripheral blood smear is the primary diagnostic test involved in variety of hematological and non-hematological conditions. It can help in diagnosing conditions like nutritional deficiency diseases and infectious diseases like tuberculosis, parasitic infections, and metastatic deposits and to the extent of acute leukemia, myeloproliferative neoplasm (MPN), haematolymphoid neoplasm,[1]

Bone marrow is the principal site of blood cell formation. Bone marrow examination is an important diagnostic procedure for establishing diagnosis of various hematological and non-hematological diseases. Its an important tool for follow up of patients who is undergoing chemotherapy and other medical treatment.[2] Bone marrow examination includes the process of obtaining the aspirate and solid trephine piece (biopsy) of bone marrow for laboratory analysis and diagnosis.

It is useful in the diagnosis of various hematological conditions like iron deficiency anemia, anemia of chronic disease, megaloblastic anemia, and acute leukemia. It is also important for follow-up of patients undergoing chemotherapy, bone marrow transplantation and other modalities of medical treatment.

Biopsy gives a better idea about marrow cellularity, architectural patterns, and overall hematopoiesis. Biopsy becomes important for diagnosis when there is a dry tap due to densely cellular marrow which is seen in cases of aplastic or hypoplastic anemia.

Authors suggested that Hematology/Oncology training programs to be continued for skillful PBS interpretations.[3]

The aim of our study is to analysis the co relation between PBS examination and BME and to promote more skillful PBS interpretation where it will help the clinician to avoid unnecessary procedure.

### **Materials and Methods**

A retrospective review was conducted on 50 patients, initial outpatient referrals from Aug 2021 to May 2023. Adults from age 16 to 85 were included. Patient demographics and diagnostic tests were recorded. During a period of 3 years, both bone marrow aspiration and biopsy along with peripheral smears of 50 patients were correlated and evaluated. 50 patients with anemia, fever and organomegaly were evaluated. Patients were investigated for complete blood count, and PBS examination. BMA and BMB were done simultaneously for these patients. Smears were prepared from the marrow aspirate, air-dried, and stained with Leishman's stain. The stained smears were examined for its cellularity, megakaryocytes, and presence or absence of malignant cells was also noted. The area where cell population was well spread out was chosen and at least 500 marrow cells were counted under oil immersion. The stained marrow aspiration smears were examined for cellularity, erythropoiesis, myelopoiesis, myeloid: erythroid ratio, megakaryopoiesis, plasma cells, lymphocytes, mast cells, parasites, and granulomas. Biopsy specimens were stained with hematoxylin and eosin.

### **Results**

Patient's demographics and distribution of diagnosis by peripheral blood cell type are presented in Table1 and 2 respectively. The most common diagnosis on PBS was thrombocytopenia, immature cells of myeloid series.

The bone marrow aspirate and biopsy were performed simultaneously for these 50 patients after PBS shown in Table 3 in which most common diagnosis was increased megakaryopoiesis followed by leukemias, erythroid hyperplasia, micro normoblastic anemia, multiple myeloma, Idiopathic thrombocytopenia purpura with 3 showed inadequate for opinion and few of them showed normal findings.

	No.	%
<b>Gender</b>		
Male	25	50.0
Female	25	50.0
<b>Age group</b>		
<= 20 yrs.	4	8.0
21 - 40 yrs.	16	32.0
41 - 60 yrs.	20	40.0
61+ yrs.	10	20.0
<b>Total</b>	<b>50</b>	

Table 1

On correlation between PBS and BMF which is shown in table 2 shows around 95% are matching while 5% are not matching with PBS finding.

PERIPHERAL SMEAR	BONE MARROW FINDINGS (BMA+BMB)	MATCHING %
Thrombocytopenia (21)	Increased megakaryopoiesis (18) Megakaryocytic hyperplasia(1) ITP (1) Multiple myeloma (1)	100.0%
Leukaemia (12)	AML (10) ALL (2)	100.0%
Pancytopenia (4) Macrocytic hypochromic	Megaloblastic hyperplasia (4)	100.0%
Normal (5)	Normal (4) Increased megakaryopoiesis (1)	80.0%
Microcytic Hypochromic (2)	Micronormoblastic anemia (2)	100.0%
Shift to left (2)	CML (2)	100.0%
Plasma cell hyperplasia (1)	Multiple Myeloma (1)	100.0%
Rouleux formation (1)	Multiple Myeloma (1)	100.0%
Leukocytosis (1)	Erythroid Hyperplasia (1)	0%
Normocytic Normochromic (1)	Increased megakaryopoiesis (1)	0%
TOTAL: 50	50	95.0%

Table 2

## Discussion

We observed a spectrum of hematological lesions in our institute. In the present study out of 50 hematological lesions maximum number of cases was of leukemia (acute and chronic). Correlation was achieved in 47 out of 50 cases. Maximum correlation was observed in thrombocytopenia followed by leukemia.

To interpret findings of PBS is an important skill for clinicians—especially hematologists. However, clinicians may order PBS examination sometimes may not be as useful in common anemia diagnosis and even lead to order additional inappropriate tests[3].

Bone marrow aspirate and biopsy is an important procedure for diagnosis of benign and malignant hematological diseases. BME is also useful for patient undergoing chemotherapy and for bone marrow transplant. Currently bone marrow aspirate and biopsy are done at the same time and same site and helps in obtaining more material for help in diagnosis and thus complementary for each other.[4]

In our study out of the total subjects studied, 50% (25/50) were males and 50% (25/50) were females. Majority were in the age group of 41-60 years, 40% (20/50), 32% (16/50) were 21-40 years of age and 8% (4/50) were below 20 years of age shown in table 1.

In table 2 majority of case showed 21 thrombocytopenia on PBS which on BME (which include Bone marrow aspirate and Biopsy) showed with 18 cases increased megakaryopoiesis, with 1 each of megakaryocytic hyperplasia, Immune thrombocytopenic purpura, and multiple myeloma.

As per the peripheral smear findings 12 cases were leukemia which on BME was acute myeloid leukemia and acute lymphoid leukemia. On PBS 4 cases were pancytopenia with macrocytic hypochromic which showed megaloblastic hyperplasia on BME.

As there were 5 normal PBS the clinician wanted to do BME as there were no improvement in patient with their clinical symptoms and were not diagnosed yet. For this reason, BME was done for those 5 patients. Out of 5 normal PBS, 4 BME showed normal findings with 1 showed increased megakaryopoiesis which does not match with PBS findings.

2 cases of Shift to left were seen on PBS which showed CML on BME while other 2 showed Microcytic hypochromic on PBS and on BME it was micro normoblastic anemia.

There were 1 case each of plasma cell hyperplasia, rouleaux formation, leukocytosis and normocytic normochromic on PBS. For plasma cell hyperplasia and rouleaux formation the BME showed multiple myeloma but for leukocytosis and normocytic normochromic BME showed erythroid hyperplasia and increased megakaryopoiesis which does not match with the PBS findings.

In our study where both PBS and BME was done, we have seen that the correlation between PBS and BME is 95% which goes towards to say that PBS is sufficient to diagnosis in most of the cases whereas in few cases we need BME to confirm further diagnosis.

This retrospective study was done to prove that PBS can help diagnose cases of benign hematological lesions whereas in malignant cases we might need to do BME for further confirmation of our diagnosis. Therefore, PBS is the gold standard and primary test to be done before doing BME.

However, there are certain exceptions by the study authors where the diagnosis was better on bone marrow biopsy specimen in Hodgkin disease and TB granuloma and metastasis of non-hematological malignancy.

As in this advanced age of flow cytometry and molecular diagnosis is taking place, there are remote places where

these technologies will not be available, in these places PBS and BME correlation findings become utmost importance for the clinician to rely upon.

### **Conclusion**

An integrated use of peripheral smear, bone marrow aspiration and biopsy is recommended to increase accuracy of diagnosis and for better management of the patient. We observed a good correlation of PBS and BMF in our institute. Both BMA & BMB complement each other with aspiration smears diagnosis and biopsies helpful for histological diagnosis as cellularity, fibrosis and architectural patterns are better visualized. This study shows that bone-marrow aspiration and biopsy is a valuable diagnostic tool and aids in diagnosis of various hematological lesions combined with peripheral blood smear. Although combined simultaneous procedures of BMA and BMB are needed for confirmatory and final diagnosis[2], skillful PBS examination can help as a guide for further workup and management especially in places where advanced set-up is not available

Further we want to state that since our sample size is small, further work-up with large sample size is needed for more comprehensive analysis.

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