

Bone Marrow Aspiration Biopsy at Shaikh Zayed Hospital

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The precursors of the formed elements in the blood are produced mainly in the bone marrow which is one of the largest organs in the body. Bone marrow biopsy was initially performed by Mosler[1] in 1876 with a wooden drill in a patient suffering from leukemia. Once the technique for performing bone marrow aspiration became safe and easy, new stains were developed which helped to identify various cell lines in the bone marrow and peripheral blood.

The object of this paper is to review the results of bone marrow aspirates and biopsies performed in Shaikh Zayed Hospital over the preceding thirteen months and to evaluate the incidence of various hematological problems pertaining to our hospital patients.

MATERIALS & METHODS

The hematology department performed three hundred and eighty six bone marrows over a period of thirteen months. All aspirates were accompanied with a biopsy except when the aspirate was done as a follow up for hematologic malignancy.

Bone marrow aspirate and biopsy were performed only after obtaining a hematology consultation and when deemed necessary by the consultant. A careful history, physical examination, review of peripheral blood and necessary hematological tests were obtained prior to the procedure. The indications for performing the bone marrow were the following:-

1. Unexplained anemia with or without circulating nucleated red cells.
2. Unexplained thrombocytopenia with or without platelet abnormalities.
3. Unexplained leukopenia or leukocytosis.
4. Unexplained lymphadenopathy, splenomegaly or hepatomegaly.
5. Fever of unknown origin.
6. Likelihood of malignant neoplasm primary or malignant.
7. Monitor response to therapy.

8. Staging of Hodgkin's disease or Non Hodgkins lymphoma.
9. Focal bone pains.
10. Examination of trabecular bone in metabolic bone disease.

The bone marrow was aspirated from different sites depending on the age of the patient and the reason for performing the procedure. In children less than one year the anteromedial aspect of tibia was selected as it is ossified and is an easily accessible site. In adults and older children if only a needle aspiration was required the sternal approach or posterior superior iliac crest was used. When both needle aspirate and bone marrow biopsy were needed the posterior superior iliac crest was used.

Strict sterile precautions were obtained while performing the procedure. If hair were present (only applicable to sternal approach) the skin was shaved. The area was then cleaned with disinfectants. The local anaesthetic agent used was 1% or 2% xylocaine and skin, subcutaneous tissue and periosteum were infiltrated. Patients frequently experienced pain and a burning sensation. A fourteen or sixteen gauge aspirate needle was advanced with a slight motion till the cortex was reached when a marked ease in needle motion was felt. A 20 or 30 cc syringe was attached and suction applied after the stylus was removed. About 1 cc of marrow was removed which consisted of marrow particles suspended in blood. After the needle was removed adequate pressure was applied to ensure hemostasis.

Occasionally we were unable to obtain an aspirate for following reasons:-

- a) The needle was not in marrow space as a result it had to be repositioned or reinserted.
- b) The needle had to be rotated in its long axis to loosen marrow particles.
- c) Greater suction was needed and we used a 50 cc syringe for that.
- d) Bone marrow was truly inaspirable as seen in myelofibrosis or metastatic tumor.

Bone marrow[2] biopsy was performed at the same site as aspirate and from the same puncture sites. It helped us to assess cellularity, presence of metastatic disease and in cases of truly inaspirable marrows to make a diagnosis. We used a modified Silverman or a Jamshidi needle for the procedure[3]. Touch preparations were made and then the biopsy was fixed in Zenkers or formalin solution.

The bone marrows were stained routinely with Romanowski stains. If the patient was suffering from leukemia special stains including Periodic Acid Schiff, Sudan Black, Myelo-peroxidase and esterases were used. These stains were used to differentiate between the various types of leukemias.

RESULTS

The total number of bone marrows performed were 386. Of these 316 were marrows done on new patients. There were 70 aspirates which were done as part of follow up during treatment.

The results are tabulated in Table-I for benign hematological problems which accounted for 62% of cases.

Table 1: Diagnosis

1. Normal marrow	88
2. Hypocellular marrow	33
3. Reactive marrow	12
4. Sinusoidal blood	04
5. Erythroid hyperplasia	02
6. Anemias	11
7. Bone marrow for culture	10
8. Aplastic anemia purpura	20
9. Idiopathic thrombocytopenia	7
10. Storage diseases	2
Total:	189

Table 2.

Diagnosis	New pts.	Follow up
1. Myelodysplasia	8	
2. Multiple myeloma	11	
3. Lymphoma	11	
4. Metastatic disease	7	
5. Acute myeloid leukemia	47	30
6. Chronic myeloid leukemia	11	
7. Acute lymphocytic leukemia	30	40
8. Chronic lymphocytic leukemia	1	
9. Waldenstroms macroglobulinemia	1	
Total:	127	70

Table-2 reveals the breakdown of various malignancies reported on the bone marrow examination and this accounted for 38% of our cases (only new cases were included). Sinusoidal blood indicated that adequate marrow particles were not obtained.

An open surgical biopsy of the fractured site was obtained in one patient which revealed plasma cell myeloma as the routine aspirate was normal.

DISCUSSION

The daily rate of production of the formed elements is about three billion red cells, two and a half billion platelets and one and a half billion granulocytes per kilogram of body weight. The production rate of these cells is highly variable depending on the demand by the body. It varies anywhere from near zero to several times the body weight. A new born has active hemopoiesis in all the bones and by adulthood the active marrow is confined to the axial skeleton and proximal portion of the extremities.

The examination of bone marrow is one of the most important aspect in the diagnosis and management of various hematological illnesses and conditions. They may affect the bone marrow in a characteristic manner and may help in corroborating the diagnosis.

A great many of these infections and non hematological neoplastic disease have characteristic bone marrow pictures and this simple procedure can save the patient time, money and risks of surgical biopsy.

The bone marrow aspirate in older children and adults were done either from the sternum or iliac crest.

The sternal approach[45] was used by us when a biopsy was not required. The advantages are manifold.

- The area is easily accessible especially in obese patients.
- Good hemostasis can be obtained with direct pressure.
- Aspirate is more cellular from this area[6].
- Good area to do aspirates as part of follow up in leukemia cases.

The iliac crest was used as the site for bone marrow aspirate and biopsy in the majority of patients. This site is associated with minimal complications as there are no significant underlying structures. A bone marrow biopsy can also be performed at the same time. The indications for performing the biopsy were the following:-

- a. To assess cellularity.
- b. Presence metastatic disease.
- c. In a truly inaspirable bone marrow.

We have divided our aspirates into benign disorders which account for approximately sixty percent of our cases. The malignant disorder were diagnosed thirty percent of cases in total percent cases.

On reviewing our diagnosis we found that bone marrow aspirate was normal in twenty seven percent of our cases. These included patients who had bone marrow done as part of routine staging procedures for hematologic malignancies or as follow up. One of our patients had a normal marrow when clinically she had multiple myeloma, an open surgical biopsy from a fractured site had to be performed. This was the only case of multiple myeloma where two marrow specimens failed to yield that diagnose.

Aplastic anemia is an uncommon disease in the Western World. The death rate is reported from 2.4 to 13 per million in various studies[1]. The incidence of aplastic anemia in our case population was 6.3%. This is very high and it is most likely due to indiscriminate use of drugs e.g. chloramphenicol. Careful history taking revealed that greater than ninety percent patients had taken medicines for various problems. One patient who was known to have aplastic anemia for four years developed acute lymphoblastic leukemia and was sent for bone marrow transplant. Hypocellular marrow was seen frequently. These plant included quite a few cases of diabetes, renal failure, infections and were probably anemia of chronic disease. Bone marrow was not done frequently for nutritional disorders causing anemia as they were diagnosed on morphology, serum iron & TIBC. The procedure was only done when the diagnosis was in doubt.

Cultures for salmonella and tuberculosis were done from aspirates when requested by consultants. There were two incidental findings of malarial parasites which were seen in aspirates when patients presented with fever and no identifiable cause could be identified. Peripheral smear in retrospect also did not reveal the parasites. Cultures for salmonella were positive in three cases. In one of these patient blood culture was negative.

The incidence of hematologic malignancies diagnosed on bone marrow accounted for 40.2% of our cases[8]. This is very high and one of the reasons is that our institute has become one of the major referral centers.

The incidence of acute leukemia in our series was

quite high about 24.3%. Of these 61% of case were acute myeloid leukemia. Most of the patients were young adults average age varying from seven to fifty years. There were only four patients above the age of fifty. Diagnosis was made on routine H & E staining in the majority of cases although special stains were done in all leukemia cases. Acute lymphoblastic leukemia was seen in 30 minutes percent cases and the disease was mainly seen in children and young adults. Follow up marrows were done frequently to assess response to treatment.

Bone marrow for chronic myeloid leukemia was performed routinely however we could not do chromosome analysis. The indications for performing a repeat aspirate were when we suspected the patient of going into acute leukemia, myelofibrosis or accelerated phase.

Three out of the eleven cases of chronic myelofibrosis went into acute leukemia. Two patients went into blast crisis and died. showed myelofibrosis as seen on our biopsy of patients. specimens. Median age four patient was thirty five years. We are treating two cases of CML.

Lymphomatous involvement was seen both on aspirate and biopsies in patients diagnosed with lymphomas with positive marrow involvement was helpful in determining prognosis and staging of disease especially in intermediate and high grade lymphomas.

There were three patients who presented clinically with classical signs and symptoms of multiple myeloma including anemia, high ESR, lytic lesions. Bone marrow examination revealed metastatic carcinoma[7]. The various carcinomas seen in our bone marrow biopsies were prostate carcinoma, renal cell carcinoma, gastric carcinoma and breast carcinomas.

Multiple myeloma was diagnosed in eleven cases. These were diagnosed primarily on bone marrow examination as the other tests revealed were equivocal findings. Immuno electrophoresis at present is not available in Lahore.

We have had no complications even though our patients had severe neutropenia thrombocytopenia. There was no abscess formation, infection or hematoma formation although these complication have been reported. Thus bone marrow is a relatively simple procedure with minimal complications and a high yield.

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