Bone Marrow Disease Profile in Geriatric Patients: An Institutional Experience

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Abstract Bone marrow examination is integral to the diagnosis of hematological and many non-hematologic disorders. With increase in the elderly population, rise in the incidence of age-related health conditions is being observed. There are few published studies on the disorders involving the bone marrow exclusively in the geriatric age group. We studied the bone marrow profile in the elderly age group (60 years and above) over a period of 1 year using bone marrow aspiration and biopsy. Anemia was the most frequently diagnosed entity followed by multiple myeloma and non-Hodgkin lymphoma. Cases of leukemia, primary myelofibrosis and metastatic carcinoma were also encountered. Bone marrow aspiration and biopsy were found to be complementary.

Keywords Bone marrow aspiration · Bone marrow biopsy · Elderly · Geriatrics

Introduction

Bone marrow examination is an important investigation carried out for the diagnosis and work-up of various hematological and non-hematologic disorders in patients across all age groups.

With growing number of elderly people, increased incidence of leukaemias, lymphoma, myelodysplastic syndrome (MDS), myeloproliferative neoplasms (MPNs) and multiple myeloma is being observed. This may be due to age-related changes at the DNA or protein level in various cells and tissues [1].

Bone marrow aspiration and biopsy are two important complementary techniques for bone marrow examination. Bone marrow aspiration provides cytologic details, better morphology and differential cell counts. Bone marrow biopsy provides assessment of cellularity, architecture and is not only essential for diagnosis in “dry or blood tap” but also helps to detect focal lesions [2].

Many studies have compared the findings in bone marrow aspiration and biopsy across wide age groups. No such study reflecting the geographical variation exclusively in this age group is reported from our region.

Materials and Methods

The present study was a cross-sectional observational study conducted over a period of 1 year using bone marrow aspiration and trephine biopsy.

During this period, 97 elderly patients (60 years and above) were referred for bone marrow examination to the Department of Pathology, Indira Gandhi Medical College, Shimla, a tertiary care institute in North India. Informed consent was obtained.

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Fourteen, previously diagnosed patients on treatment and follow-up, were excluded.

Bone marrow aspiration and biopsy were simultaneously taken from posterior superior iliac spine on the iliac crest using the same skin puncture site but different tract in the bone. Giemsa staining was done for aspiration and biopsy imprint smears while H&E stain was used for biopsy sections. PAS, MPO, Reticulin stains were done wherever indicated [3].

Results

A total of 83 bone marrow aspirations and 82 trephine biopsies were examined along with peripheral blood smears and biopsy imprint smears. One patient did not consent for bone marrow biopsy.

Majority of the patients (95%) were in the 60–79 years age group with a mean age of 61 years. Males comprised 56% of the study group with male: female ratio of 1.3:1.

In 69 patients (83.2%), bone marrow examination was diagnostic or provided valuable clues for the diagnosis.

Of the 69 cases, 65 cases were of hematological disorders and 4 were of non-hematological disorders. Detail of lesions diagnosed is given in Table 1.

Anemia was the most common condition comprising 29 (44.6%) cases and dimorphic anemia was the most frequent (51.7%) subtype. Most of the dimorphic anemia cases revealed megaloblastic and micronormoblastic erythropoiesis. Aspiration was diagnostic in all cases except in 3 cases of aplastic anemia which were diagnosed on biopsy.

There were 15 cases (23.1%) of multiple myeloma and 12 cases (18.5%) of non-Hodgkin lymphoma (NHL) infiltration. Among NHL, 5 cases were of small lymphocytic lymphoma, 2 each of lymphoplasmacytic lymphoma and diffuse follicular centre cell lymphoma. In 3 cases exact typing could not be done. Four (4.8%) cases of leukaemia (2 cases of acute undifferentiated leukemia, 1 case each of hairy cell leukemia and chronic lymphocytic leukemia) and 3 cases of myelofibrosis were also diagnosed (Table 1).

There were 4 cases of non-hematologic disorders—3 of metastatic deposits and one case of *Leishmania donovani* infestation.

On bone marrow aspiration, 6 cases were of “dry tap” and 5 cases of blood tap. Bone marrow biopsy was diagnostic in all these 11 cases. (Table 2).

Bone marrow aspiration findings correlated well with the bone marrow biopsy findings in 73 cases (86.9%). In 11 cases of dry/blood tap on aspiration, biopsy was diagnostic.

Among the cases with normal bone marrow study, some of the patients underwent the procedure for workup of NHL infiltration, PUO or raised ESR.

Discussion

With increasing population of elderly, nearly 23% of the total global burden of disease is attributable to disorders in people aged 60 years and older [1]. Little published literature is available regarding bone marrow profile exclusively in geriatric patients.

With increasing age, bone marrow becomes progressively concentrated axially in the central skeleton with

Table 1 Disorders diagnosed on bone marrow examination using bone marrow aspiration and/or bone marrow biopsy

Serial no.	Bone marrow diagnosis			Number of cases N = 83(%)
1.	Hematological disorders N = 65 (78.4%)	Anemia	Dimorphic	15 (18%)
		N = 29	Normocytic normochromic	6 (7.2%)
			Megaloblastic	5 (6%)
			Aplastic	3 (3.6%)
			Multiple myeloma	15 (18%)
			Non-Hodgkin lymphoma	12 (14.8%)
			Leukaemias	4 (4.8%)
			Primary myelofibrosis	3 (3.6%)
			Increased eosinophils and precursors	1 (1.2%)
			Bone marrow necrosis	1 (1.2%)
2.	Non-hematological disorders N = 4 (4.8%)	Bone marrow metastasis	Adenocarcinoma	2 (2.4%)
			Squamous cell carcinoma	1 (1.2%)
			<i>Leishmania donovani</i> infection	1 (1.2%)
3.	Normal study			14 (16.8%)

Table 2 Diagnosis on biopsy in dry and blood tap

Biopsy diagnosis	Dry tap (n = 6)	Blood tap (n = 5)
Primary myelofibrosis	1	2
Aplastic anemia	1	2
Multiple myeloma	1	1
NHL infiltration	1	–
Acute leukemia	1	–
Bone marrow necrosis	1	–

reduced cellularity though blood cell counts do not decrease significantly [4]. Aging has been associated with loss of telomeric DNA from hematopoietic progenitor cells leading to reduced replication as well as blunted response of stem cells to growth factors [5]. Erythropoietin production may be inhibited or interaction with erythropoietin receptors may be reduced [6].

Anemia was most common with dimorphic (megalo-blastic and micronormoblastic) anemia being the most frequent subtype which can be attributed to nutritional deficiency. Gaskell et al. [7] found anemia prevalence of 40% among hospital admissions close to our observation (44.6%). In Third US National Health and nutritional examination survey, nutritional deficiency accounted for one-third cases of anemia in elderly [8].

Bone marrow aspiration was diagnostic in most cases of anemia except 3 cases of aplastic anemia, which were diagnosed on bone marrow biopsy. Aspiration provides better cytomorphology of erythroid precursors essential for diagnosis. Manion et al. [9] advocated that in elderly patients with anemia, biopsy should be performed to confirm or exclude myelodysplasia or hematologic malignancy.

In cases of multiple myeloma, 80% positive correlation was seen between bone marrow aspiration and biopsy though lower than that of Toi et al. [10] (88.8%). Manion et al. [9] found that bone marrow biopsy was helpful in dry/blood tap cases as compact clusters of plasma cells without stroma are identified and help in diagnosis.

In cases with non-Hodgkin lymphoma infiltration, 60% concordance was found. Three cases were diagnosed only on biopsy and one on aspiration only emphasizing the fact that both the procedures should be done for staging in cases of NHL.

We diagnosed primary myelofibrosis in 3 (3.6%) patients on bone marrow biopsy as aspiration was dry/blood tap. We did not find any case of myelodysplastic syndrome in our study. Manion et al. [9] found higher incidence of MDS and MPNs in comparison to our study.

With aging, abnormal clones of haematopoietic cells proliferate due to oxidative stress and disturbed cytokine

production and are prone to leukemic transformation. This leads to increased incidence of malignant hematologic disorders [11].

Metastasis to bone marrow was observed in 3 (3.6%) cases. Our findings support that bone marrow examination is still an important tool to diagnose unsuspected non-hematologic malignancy.

Leishmania donovani infestation was observed in a 74 years male patient who presented with PUO. He belonged to Kinnaur region of Himachal Pradesh, endemic for visceral leishmania. Age related frailty is associated with increased morbidity hence both the procedures should be done simultaneously changing the position of the needle after one procedure. Bone marrow biopsy is a safe procedure with a complication rate of 0.05% [11].

We also reiterate that bone marrow aspiration and trephine biopsy are complementary techniques and should be combined together in the workup of elderly patients with hematologic and non-hematologic disorders. Longer duration of study with more number of cases is required to draw conclusions.

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Compliance with Ethical Standards

Conflict of interest All authors declare that they have no conflict of interest.

Ethical Standard All procedures performed in the study were in accordance with the ethical standards of the institutional research committee.

Informed Consent Informed consent was obtained from all patients.

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