Original Article

Bone marrow examination in geriatric patients—An institutional experience from the north Himalayan region of India

Harish Chandra[1], Arvind K. Gupta[1], Arathi K[1], Vandna Bharati[1], Neha Singh[1]

[1]*Department of Pathology and Lab Medicine, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India*

Abstract

Background: The surge of the geriatric population has led to design research studies related to health problems in this age group worldwide. Bone marrow examination which is an important diagnostic tool for various diseases may vary in geriatric population in comparison to younger groups. The present study was, therefore, conducted to study the indications and morphological features of bone marrow examination in geriatric population in north Himalayan region of India. It was also intended to study if there is any variation in these findings from elderly populations in other parts of the world. **Material and Methods:** Study was conducted in an institute situated in north Himalayan Uttarakhand state of India over a period of two years including patients above 60 years of age who underwent bone marrow examination. **Results:** Total 156 cases underwent bone marrow examination with most common indication being suspicion of lymphoma (18.5%) followed by cytopenia (17.3%). Nutritional anaemia was most common pathological diagnosis in 16.6% cases. Diagnostic discordance between aspirate and biopsy was observed in 5.7% of total cases with non-Hodgkin's lymphoma (NHL) being the most common misdiagnosis on aspirate. **Conclusion:** Nutritional anaemia particularly iron deficiency anaemia is the most common diagnosis of bone marrow examination indicating the importance of nutritional therapy in the elderly population of this region. Bone marrow biopsy proves to be an important adjunct to aspiration in precise diagnosis with minimal complications. The awareness of bone marrow findings would not only be helpful to clinicians and pathologists but also provide valuable information to the policymakers to improve the quality of health in the geriatric population of this area.

Keywords: Bone marrow, geriatrics, nutritional anaemia

Introduction

Bone marrow examination including both aspiration and biopsy is an important investigation for various haematological disorders. It is done across all the age groups ranging from infants to elderly patients. Geriatric population which is usually considered to be above 60 years of age is increasing worldwide. According to US Census Bureau, 20% of the American population will be 65 years or older by 2030.[1] The surge of geriatric population has led to design research studies related to health problems in this age group worldwide.[2,3] However, literature search shows limited data regarding indications and findings of bone marrow examination exclusively in the geriatric population.[4,5] It is considered that bone marrow indications and examination may vary in geriatric population in comparison to younger groups. In addition, the profile of bone marrow diseases in elderly population may also vary in different geographical regions to which the primary healthcare providers should be well aware of.

This study was therefore conducted to study the indications and morphological features of bone marrow examination in geriatric population in north Himalayan region of India. This study also

Address for correspondence: Dr. Harish Chandra, Department of Pathology and Lab Medicine, All India Institute of Medical Sciences, Rishikesh, Uttarakhand, India.
E-mail: drharishbudakoti31@yahoo.co.in

Received: 19-09-2019 **Revised:** 22-09-2019
Accepted: 17-10-2019 **Published:** 10-12-2019

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_792_19

How to cite this article: Chandra H, Gupta AK, Arathi K, Bharati V, Singh N. Bone marrow examination in geriatric patients—An institutional experience from the north Himalayan region of India. J Family Med Prim Care 2019;8:3931-4.

intended to explore if there is any variation in these findings from elderly populations in other parts of the world.

Material and Methods

This study was conducted in the haematology section of the pathology department of the institute situated in the north Himalayan region of India over a period of two years from 1 July 2017 to 30th June 2019. The study included all the patients above 60 years who underwent bone marrow examination (aspiration/biopsy or both) in the department after written informed consent. Patient's age, sex, bone marrow indication, clinical history, relevant laboratory and radiological investigations along with bone marrow diagnosis were noted for every case. The bone marrow aspiration was primarily done from posterior superior iliac spine and the trephine biopsy was mostly performed in the same sitting. Imprint smears were also prepared from the biopsy and all the smears (aspiration and imprints) were air-dried and stained by May Grunwald Giemsa while biopsy sections were stained by haematoxylin and eosin stain and reticulin stain. Immunohistochemistry was performed as and when required. All the data were entered in the excel sheet and statistically analysed.

Results

Out of the total 721 bone marrow examination performed over the study period, cases above 60 years of age were 156 constituting 21.6% of total cases. The male-female ratio was 1.7:1 with the mean age of 66.2 ± 5.03 years (median of 65) and ranging from 60 to 84 years. Out of the total 156 cases bone marrow, biopsy was not available of 10 cases either due to patient's denial or due to technical difficulty. Table 1 shows the indications of bone marrow examination in the study. It shows that most common indication for bone marrow examination in geriatric population was suspicion of lymphoma (18.5%) followed by cytopenia (17.3%). Table 2 shows various diagnosis that was made on the samples while doing bone marrow examination (aspirate/trephine/both). It shows that normocellular marrow (24.3%) was the most common diagnosis followed by nutritional anaemia (16.6%) including iron deficiency anaemia, megaloblastic anaemia or combined deficiency anaemia. Total two cases were inadequate for diagnosis as bone marrow aspirate was haemorrhagic and trephine biopsy was not performed due to patient's reluctance. Table 3 shows the cases showing discordance between aspirate and biopsy. It shows that diagnostic discordance was observed in 5.7% of total cases with non-Hodgkin's lymphoma (NHL) being the most common diagnosis missed on aspirate. The aspirate was inadequate/haemorrhagic for diagnosis in total 13 cases while biopsy in a single case.

Table 1: Indications for bone marrow examination in geriatric population

Indications	Number of cases (percentage of total cases)
Suspicion of lymphoma	29 (18.5%)
Bicytopenia/pancytopenia	27 (17.3%)
Suspicion of multiple myelomas/plasma cell dyscrasia	26 (16.6%)
Chronic myeloproliferative neoplasm	24 (15.3%)
Aplastic/hypoplastic anaemia	10 (6.4%)
Follow-up/staging of a known case of lymphoma	9 (5.7%)
Follow-up case of multiple myelomas	8 (5.1%)
Metastatic malignancy	8 (5.1%)
Refractory anaemia	6 (3.8%)
Myelodysplastic syndrome	3 (1.9%)
Acute leukaemia	3 (1.9%)
Others (idiopathic thrombocytopenic purpura, bone marrow amyloidosis, infection)	3 (1.9%)
Total	156

Table 2: Diagnosis of bone marrow examination

Diagnosis	Number of cases (percentage)
Normocellular marrow	38 (24.3%)
Nutritional anaemia	26 (16.6%)
Iron deficiency anaemia	18
Megaloblastic anaemia	5
Combined deficiency anaemia	3
Myeloproliferative neoplasm	23 (14.7%)
Chronic myeloid leukaemia	18
Myelofibrosis	3
Chronic myelomonocytic leukaemia	1
Essential thrombocytosis	1
Non-Hodgkins lymphoma	17 (10.8%)
Multiple myelomas/plasma cell dyscrasia	17 (10.8%)
Acute leukaemia	6 (3.8%)
Aplastic anaemia	5 (3.2%)
Metastasis	6 (3.8%)
Idiopathic thrombocytopenic purpura	3 (1.9%)
Myelodysplastic syndrome	2 (1.2%)
Reactive lymphocytosis/plasmacytosis and eosinophilia	4 (2.5%)
Leishmanisis	1 (0.6%)
Relapse	6 (3.8%)
Chronic lymphoid leukaemia	1
Follicular lymphoma	1
Multiple myelomas	4
Inadequate	2 (1.2%)
Total	156

Discussion

It has been estimated that the global burden of disease due to elderly population comprises about 23% of the total disease burden.[6] Bone marrow examination is considered to be an essential diagnostic tool in the work up of large number of haematological as well as non-haematological diseases. However, bone marrow findings may vary in geriatric from the general population as with ageing erythropoietin production may be decreased or there may be blunted response to growth factors due to loss of telomeric DNA from haematopoietic progenitor cells.[7,8]

Table 3: Discordance between bone marrow aspirate and biopsy

Bone marrow aspirate diagnosis	Bone marrow biopsy diagnosis	Number of cases
Inadequate	Multiple myelomas	3
	Chronic myeloproliferative neoplasm	2
	Normocellular marrow	2
	Non-Hodgkins lymphoma	4
	Reactive lymphocytosis	1
	Acute leukaemia	1
Normocellular marrow	Metastasis	1
	Non-Hodgkins lymphoma	4
Increased megakaryocytes	Normocellular marrow	1
Erythroid hyperplasia	Non-Hodgkins lymphoma	1
	Residual chronic lymphocytic leukaemia	1
Multiple myeloma	Inadequate	1

It was observed in this study that suspicion of NHL was the most common indication for bone marrow examination. This observation varies from other studies where cytopenia is considered to be the most common indication for bone marrow examination in the geriatric population.[5] However, in this study, maximum number of these cases turned out to be normocellular on bone marrow examination. This clearly indicates the importance of bone marrow examination even if there is high clinico-radiological suspicion of NHL. Suspicion of multiple myeloma and myeloproliferative neoplasms was another common indication for bone marrow examination in this study. This observation varies in general population where acute leukaemia and lymphoma are considered to be more common indications for bone marrow examination. Apart from normocellular marrow, the most common pathological diagnosis that was observed in this study was nutritional anaemia with iron deficiency anaemia being the most common anaemia. This suggests that geriatric population in this north Himalayan region suffers commonly from iron deficiency anaemia. Another study from India has also observed dimorphic anaemia due to megaloblastic and micronormoblastic erythropoiesis as the most common diagnosis on bone marrow in geriatric population.[4] However, megaloblastic or dimorphic anaemia was less common than iron deficiency in this study which may be due to dietary habits of the population in this area. Thus, the observed findings would be of immense help to the physicians practising primary care in this area for the proper management of anaemia in elderly patients. This would also be useful in avoiding irrelevant diagnostic work ups and unnecessary financial burden on the patients. In addition, the primary care physicians who are the first contact persons with the general population may also be helpful in avoiding further complications of anaemia by simply preventing iron deficiency. Apart from dietary deficiency, western literature reports that medications (salicylic acid, oral anticoagulants), gastrointestinal bleeds due to carcinoma are other important causes of iron deficiency anaemia in elderly.[9] Manion *et al.* in their study from USA observed myelodysplastic syndrome (MDS) as the most common specific diagnosis in patients above 85 years of age on bone marrow biopsy.[5] Previously also it has been reported that minor dysplastic changes are frequently observed on bone marrow aspirate in elderly patients without haematological diseases.[10] However, this study observed that minimal dysplasia and diagnosis of MDS on bone marrow was observed in only 2 cases (1.2%) while another study from India did not observe any case of MDS in elderly population.[4] This shows the variation of specific bone marrow diagnosis in geriatric population in different regions of the world. A number of methods can be used to assess frailty in older patients with haematological malignancies, including the cardiovascular health study frailty screening measure, the FRAIL (fatigue, resistance, ambulation, illnesses and loss of weight) questionnaire, the clinical frailty scale and the Gérontopôle Frailty Screening Tool.[11] In addition, it has also been reported that efficacy of tyrosine kinase inhibitors is independent of age.[11]

Chronic lymphocytic leukaemia (CLL) which is common in old age was not observed in this study as diagnosis was based on peripheral smear examination and flow cytometry. The bone marrow examination was required in only single case for its follow-up. Similar findings have also been observed in previous study where bone marrow biopsy was done in only 2 cases of CLL for follow-up and staging.[5]

Another important feature that was observed in this study was that there were significant number of cases (13 cases) which were inadequate on bone marrow aspiration but specific diagnosis was provided on biopsy [Table 3]. This suggests that bone marrow aspiration should be combined with biopsy to arrive at a final diagnosis. Although, previously it has been suggested that in geriatric patients there may be increased morbidity from bone marrow biopsy due to age-related frailty but data related to it is minimal.[5] In this study also all the 146 elderly patients in whom bone marrow biopsy was done, none of the case showed any significant complication.

Metastasis was observed in eight cases with the most common metastasis being from prostatic adenocarcinoma. There was a single case of metastatic carcinoma which was missed on aspirate but the biopsy revealed a small cluster of metastatic adenocarcinoma. This again highlights the importance of biopsy and it is suggested that it should be done bilaterally on posterior superior iliac spine to avoid missing the metastatic cells. Singh *et al.* concluded that age-associated increase in metastasis is associated with bone marrow vascular niche and can be managed by targeting angiocrine signals.[12]

A single case of leishmaniasis was also observed in a 61-year-old male even though it is considered to be non-endemic in this region. Therefore, Leishmania donovani bodies should also be vigilantly searched in the bone marrow in geriatric population even in clinically unsuspected cases from non-endemic areas. It is important that family medicine and primary care practitioners should also search for leishmaniasis in differential diagnosis

even in non-endemic areas. Previous studies have meticulously described the common, uncommon and atypical features of bone marrow examination in cases of leishmaniasis from non-endemic regions.[13]

Conclusion

Bone marrow examination is an important diagnostic modality in geriatric population in evaluating haematological and non-haematological diseases even in clinically unsuspected cases. Nutritional anaemia particularly iron deficiency anaemia is the most common diagnosis on bone marrow examination indicating the importance of nutritional therapy in the elderly population of this region. Bone marrow biopsy proves to be an important adjunct to aspiration in precise diagnosis with minimal complications. The awareness of bone marrow findings would not only be helpful to clinicians and pathologists but also provide valuable information to the policymakers to improve the quality of health in the geriatric population of this area.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Hamidi M, Joseph B. Changing epidemiology of the American population. Clin Geriatr Med 2019;35:1-12.
2. Ortiz-Barrios LB, Granados-Gracia V, Cruz-Hervert P, Moreno-Tamayo K, Heredia- Ponce E, Sanchez-Gracia S. The impact of poor oral health on the oral health related quality of life (OHRQoL) in older adults: The oral health status through a latent class analysis. BMC Oral Health 2019;19:141.
3. Mathew AS, Shilpa H. Geriatric dysphonia: Etiological analysis in a rural hospital in India. Indian J Otolaryngol Head Neck Surg 2019;71:218-24.
4. Gulati A, Mandal T, Kaushal V, Kaushik R, Thakur S. Bone marrow disease profile in geriatric patients: An institutional experience. Indian J Hematol Blood Transfus 2018;34:540-3.
5. Manion EM, Rosenthal NS. Bone marrow biopsies in patients 85 years or older. Am J Clin Pathol 2008;130:832-5.
6. Chromienne C, McCann S, Green T, Hagenbeek S, Lacombe C, Guenova M, *et al.* Age and aging in blood disorders. EHA theme of the year 2013-14. Haematologica 2013;98:831-2.
7. Eisenstaedt R, Penninx BW, Woodman RC. Anemia in the elderly: Current understanding and emerging concepts. Blood Rev 2006;20:213-26.
8. Berkahn L, Keating A. Hematopoiesis in the elderly. Hematology 2004;9:159-63.
9. Stauder R, Valent P, Theurl I. Anemia at older age: Etiologies, clinical implications, and management. Blood 2018;131:505-14.
10. Girodon F, Favre B, Carli PM, Nash N, Desbiolles N, Tatou E, *et al.* Minor dysplastic changes are frequently observed in the bone marrow aspirate in elderly patients without haematological disease. Clin Lab Haematol 2001;23:297-300.
11. Breccia M, Palandri F, Luciano L, Benevolo G, Bonifacio M, Caocci G, *et al.* Identification and assessment of frailty in older patients with chronic myeloid leukemia and myelofibrosis, and indications for tyrosine kinase inhibitor treatment. Ann Hematol 2018;97:745-54.
12. Singh A, Veeriah V, Xi P, Labella R, Chen J, Romeo SG, *et al.* Angiocrine signals regulate quiescence and therapy resistance in bone metastasis. JCI Insight 2019;4. pii: 125679. doi: 10.1172/jci.insight.125679.
13. Chandra H, Chandra S, Kaushik RM. Visceral leishmaniasis with associated common, uncommon, and atypical morphological features on bone marrow aspirate cytology in nonendemic region. J Trop Med 2013;2013:861032.