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Study of bone marrow aspirations -5 years review from a single center in Kuwait- An audit

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Abstract

We reviewed the bone marrow examination (BME) studies performed in the last five-year period with the objective to find out the findings and ascertain the role of this procedure in the diagnosis at Al Adan hospital, this public teaching hospital of the state of Kuwait in Middle East. Samples were collected after history taking and clinical examination. Blood samples analyzed for CBC parameters along with biochemical and viral markers. Bone marrow aspiration samples were collected and stained with May Grunwald Giemsa stain, trephine biopsy processed and stained with Hematoxylin & Eosin along with Perl's stain for iron and Reticulin stain. All samples were analyzed and results pooled by the team of hematopathologists. We reviewed 264 cases for BME and found ages ranging from 07 months to 95 years and 170 males and 94 females were included in the study. The array of conditions included 53% of clonal haemopoietic disorders including leukemias, Myelo Proliferative Neoplasm (MPN) , Myelo Dysplastic Syndrome (MDS), & Plasma cell disorders. 3.5% aplastic anemias, while only 5.4 % with nutritional causes and 28.5% of cases having various reactive causes; Metastatic deposits were found in 1.5% and haemophagocytosis in 3.5% of the subjects. Results were in concordance with studies conducted from developed nations. Our study concludes that bone marrow examination is crucial in diagnosis to elucidate the various etiology of afflictions of bone marrow and helps in proper management in this Middle East country.

Keywords: Bone marrow; Pancytopenia; Leukemia; Aplastic anemia; Metastatic deposits

1 Introduction

Bone marrow evaluation forms an essential part of assessment of hematological disorders in any tertiary care hospital. It has a significant role in diagnosis, staging and management of malignant hematological disorders as well as it is a valuable diagnostic tool in number of non-hematological diseases or systemic illness like pyrexia of unknown origin (PUO), storage disorders, infectious diseases etc.

Bone marrow aspirate is a reliable tool for evaluation of cellular morphology and trephine biopsy provides detailed information about bone marrow cellularity, bone architecture and overall hematopoiesis in general.

The objective of this study was to find out the results of bone marrow examination findings at Al Adan hospital. In addition, to ascertain the role of this procedure in the diagnosis of non-hematological or benign hematological diseases in our setup.

We reviewed all the bone marrow examination studies performed during the preceding five-year period at this public teaching hospital of the state of Kuwait in Middle East

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2 Material and methods

This was a retrospective study-audit conducted at the Hematology unit of the department of Clinical Laboratories in Al Adan hospital Ahmadi province of the State of Kuwait.

Peripheral blood samples were collected in EDTA and plain tubes after history taking and clinical examination of the patient in each case. Blood samples were analyzed for CBC parameters along with biochemical and viral markers.

Bone marrow aspiration samples were collected and stained with May Grunwald Giemsa stain using Wescott Stainer. Trephine biopsy samples were collected in Boins fluid, processed and stained with Hematoxylin & Eosin along with Perl's stain for iron and Reticulin stain. All samples were examined by the team of hematopathologists.

Each bone marrow report was analyzed and results were pooled in for evaluation using computer software for statistical relevance.

3 Results

A total of 260 cases were studied during the preceding five-year period. The age distribution varied from 7 months to 95 years while the gender distribution showed 170 males and 94 females. The distribution of cases based on broad disease groups as given in table 1 shows 16.9% acute leukemia, 14.2% chronic leukemia, 11.5% MPN, 3.5 % aplastic anemia, 1.5 % metastatic deposits and 28.5% reactive cases among others

Table 1 The distribution of cases based on broad disease groups

	Diagnostic group	**Numbers**	**%**
1	Acute leukemia	44	16.9
2	Chronic leukemia including NHL	37	14.2
3	Myeloproliferative Neoplasm (MPN)	30	11.5
4	Myelodysplastic syndrome (MDS)	7	2.7
5	Aplastic anemia	9	3.5
6	Immune thrombocytopenia (ITP)	12	4.6
7	Hemophagocytosis	9	3.5
8	Metastatic deposits	4	1.5
9	Myeloma/plasma cell disorder	20	7.7
10	Reactive Marrow	74	28.5
11	Erythroid hyperplasia	14	5.4
	Total cases	260	100

3.1 Acute leukemia

Table 2 The Age wise distribution is as under

S. N	**Age group**	**ALL**	**AML**
1.	0-10 years	6	0
2.	11-20 years	6	0
3.	21-30 years	3	2
4.	31-60 years	0	21
5.	61-90 years	0	5
	More than 91 years	0	1

Amongst the 44 cases of acute leukemia 15 (34.1%) had acute lymphoblastic leukemia (ALL) while 29 (65.9%) had acute myeloblastic leukemia (AML). The age distribution of acute leukemia cases is shown in table 2, which clearly demonstrates the predominance of ALL in children and AML in adults

3.2 Chronic Leukemias

Amongst the 37 cases with chronic leukemia the distribution pattern as shown in table 3 had 73% Chronic Myeloid leukemia (CML) cases and only 2.7% Chronic Lymphoid Leukemia (CLL) while 13.5% non-Hodgkin lymphomas (NHL) and 10.8% Hairy Cell Leukemia (HCL) cases.

Table 3 Type of chronic leukemia's

	Type	Number	%
1	CML	27	73
2	CLL	1	2.7
3	HCL	4	10.8
4	NHL	5	13.5

Age distribution of CML as shown in table 4 depicting predominance of cases (40.5%) in the most productive age group of 21 to 50 years.

Table 4 Age group distribution of CML

	Age in years	Numbers	%
1	Less than 20	3	8.1
2	21-50	15	40.5
3	51-70	8	21.6
4	More than 71	1	2.7

Gender wise distribution as given in table 5 shows the male predominance (67.6%) in chronic leukemias.

Table 5 Gender distribution of chronic leukemia's

	Male	Female
CML	19	8
CLL	1	0
HCL	4	0
NHL	1	4
%	67.6	32.4

It was found that 30 cases were having MPN other than CML, which included 20 cases of essential thrombocythemia (ET), 7 cases of primary myelofibrosis (PMF) and 3 cases of polycythemia vera (PV) in addition to 27 cases of CML.

Age distribution of ET shows 2 cases were having less than 30 years age at the time of diagnosis while 16 cases had age between 31 and 60 years and 2 cases had age above 61 years with equal distribution of 10 cases in each sex group of male and female.

In the case of PMF 4 were males and 3 females and they were above 60 years in 4 cases and less than 60years in 3 cases, while all the 7 cases of MDS were more than 60 years in age and were composed of six males and a single female patient.

Plasma cell disorder was detected in 20 cases and immune thrombocytopenia (ITP) was detected in 12 cases.

Metastatic deposits were found in 4 cases which included metastatic breast carcinoma, metastatic carcinoma of prostate and metastatic adenocarcinoma identified by CD markers.

4 Discussion

Pancytopenia is a common hematological finding seen in many diseases and diagnosis still remains a challenge for the hematopathologists as well as to the clinician. Accurate diagnosis is very crucial for management of patient. Bone marrow examination is a very important investigation in patients of pancytopenia and should be looked at carefully to achieve proper diagnosis. Bone marrow study evaluation was undertaken in most cases of remittent or non-resolving pancytopenia, unless blood smear examination revealed leukemic process. Overt cases of leukemias having more than 20 % blasts in peripheral blood were not subjected to bone marrow examination and they were transferred directly to the assigned malignant treatment center like Kuwait cancer control center or NBK children's hospital according to age group.

Even in the absence of a final diagnosis, Bone Marrow Examination can help clinicians in correct approach to the diagnosis and management of the patient. Devitt KA, Lunde JH, Lewis MR (1) found 64% of the pancytopenia cases had clonal hematopoietic disorders. Most common were myeloid processes; 26% of patients had acute myeloid leukemia and 17% had myelodysplasia. Less common were lymphoid neoplasms such as non-Hodgkin lymphoma (6%), hairy cell leukemia (5%) and precursor B acute lymphoblastic leukemia (4%). Among non-clonal cases, the most common specific diagnoses were aplastic anemia (5%), megaloblastic anemia (2%) and human immunodeficiency virus (HIV)-related changes (2%) from the above North American study. Elizabeth P. Weinzierl, Daniel A. Arber, (2) also found similar results again from studies conducted in North American population. The studies from Indian subcontinent like Datta et al (3) found primary bone marrow hematological malignancies (leukemia, lymphoma & Multiple Myeloma (MM)) to be the most common cause of pancytopenia (39.1%) in the state (Tripura) of North East India. This experience is even different from that of Raphael et al (4). who found megaloblastic anemia to be the commonest etiology (41.2%) of pancytopenia in the state of Meghalaya, another nearby north-eastern state mostly tribal inhabited. Gayathri and Rao (5) also found megaloblastic anemia had been the commonest cause (74% cases) of pancytopenia. But in a study in another north-eastern Indian state, Manipur and the investigators found that hypoplastic anemia had been the most common cause (22%) followed by megaloblastic anemia and myelodysplastic syndrome (18% each). Incidence of megaloblastic anemia is less probably because of the non-vegetarian dietary habits of the nearly 100% population in North East India, while Sahay S, Ramesh ST (6) found 51.8% of the cases of pancytopenia were attributed to combined nutritional deficiency from the study of central Indian population by Ojha et al (7). Nafil et al (8) found vitamin B12 deficiency in 32.2% cases, acute leukemia in 23.7% and aplastic anaemia in 15.2% to be the main causes of pancytopenia in the study from Morocco. Jha et al (9) found the commonest cause of pancytopenia was hypoplastic bone marrow seen in 29% followed by megaloblastic anemia in 23.64% and hematological malignancy in 21.62% in a study from Nepal. In the study from Saudi Arabia, Hanan et al (10) found 38.4% cases were caused by infection, cancer cases 26.4%, autoimmune 11.2%, end stage renal disease (ESRD) 10.4%, megaloblastic anemia due to vitamin B12 deficiency 8% and aplastic anemia 1.6%. Govindaraj et. al. (11) from India reported commonest cause of pancytopenia was megaloblastic anaemia (44%) followed by mixed nutritional anemia (20%), hypersplenism (12%), aplastic anemia (10%), acute Leukemia (6%), myelodysplastic syndrome (2%) and uncommon causes like Dengue fever (4%) and hemolytic anemia (2%). Keisu M, Ost A (12) found neoplastic diseases as the most common cause of pancytopenia followed by hypoplastic anemia in the Swedish study population. In our study we found 53% of clonal haemopoietic disorders, 3.5% aplastic anemias, while only 5.4 % with nutritional causes and 28.5% cases having various reactive causes to infectious or metabolic insult. We found 28.5% of cases to have reactive marrow like the study from Saudi Arabia where Qahtani FSA & Syed NN (13) found 42% cases with normal bone marrow. It could be attributed to the bone marrow evaluation done as part of fever investigation or as part of baseline work up before starting treatment with risk of marrow suppression. In children the most prevalent bone marrow finding was acute lymphoblastic leukemia while it was acute myeloid leukemia in adults as found by Weinzierl EP & Arber DA while Sreejesh et al (14) recorded 11.34%acute leukaemia and 7.98% storage disorders in the paediatric bone marrows done over 285 children below 1-year age. The age of patients included in our study ranged from 7 months to 95 years while other studies like Melina et al (15) the age group varied from 6 to 78 years.

Non-malignant hematological diseases like haemophagocytosis (3.4%) and idiopathic thrombocytopenic purpura (ITP) (4.5%) were diagnosed mainly in children and results are comparable with others as reported by Bashawri LA (16) from KSA.

5 Conclusion

Results of our study is more in concordance with studies conducted from developed nations rather than from developing country like Indian subcontinent, which may be attributed to the differing living standards and nutritional status prevalent in different parts of the world. The present study concludes that along with detailed physical examination, primary hematological investigations and bone marrow examination is crucial in diagnosis and to elucidate the various etiology of afflictions of bone marrow and thus it helps in proper management of the patients in this Middle East country.

Compliance with ethical standards

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Disclosure of conflict of interest

No conflict of interest.

Author's Contribution

- Concept and design: Dr Sunny, Dr Hanan
- Definition of intellectual content: Dr Sunny, Dr Hanan
- Analysis of data and Manuscript writing: Dr Sunny, Dr Hanan
- Review and correction: Dr Lamis, Dr Sunny, Dr Hanan
- Collection of data: Dr Sunny, Dr Lamis, Dr Fady

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