

Indications and Diagnostic Utility of Bone Marrow Aspiration Cytology: A 12-year Experience at a Tertiary Health Center in Gombe, Northeastern Nigeria

Saleh Yuguda, Ahmed Iya Girei, Kasim Mohammed Pindiga, Rufai Abdu Dachi¹, Aliyu Ibrahim Lawan², Yusuf Mohammed Abdullahi²

Departments of Haematology and Blood Transfusion and ²Histopathology, Gombe State University, Gombe, Gombe State, ¹Department of Haematology and Blood Transfusion, Abubakar Tafawa Balewa University Bauchi, Bauchi State, Nigeria

Abstract

Background: Bone marrow aspiration (BMA) cytology is very important in the diagnosis and management of a wide range of both hematological and nonhematological disorders. It has several indications ranging from the evaluation of cytopenias to staging and assessment of remission in the course of management. **Aim:** The aim of the study was to determine the indications and diagnostic utility of BMA cytology at the Federal Teaching Hospital, Gombe, Gombe State, Nigeria. **Methodology:** A retrospective review of BMA cytology records performed at the department of Haematology and Blood Transfusion of the Federal Teaching Hospital, Gombe, over a 12-year period from January 1, 2006, to December 31, 2017. **Results:** A total of 596 BMAs were performed over the study period. The age ranges were from 2 months to 88 years, with a median age of 36 years. Majority of the patients were males (61%). The most common indication for the bone marrow examination was for the evaluation of recurrent anemia 32.2%, followed by presumptive diagnosis of leukemia 27.7%. Normal marrow finding constituted 4.7%, while the diagnosis was inconclusive in 4.2% of the cases. The most frequently diagnosed diseases are the nutritional deficiency anemia together accounting for about one-third of the cases (megaloblastic anemia 20.3%, combined deficiency anemia 9.9%, and iron deficiency anemia 2.5%) and leukemia. **Conclusion:** Anemia and leukemia are the most common indication for BMA, and nutritional deficiency anemia is the major BMA diagnosis in Gombe, Northeastern Nigeria.

Keywords: Anemia, bone marrow aspiration, indications, leukemia

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INTRODUCTION

Examination of the marrow through aspiration with or without biopsy is an indispensable adjunct to the diagnosis and monitoring of care for both hematological and nonhematological disorders.^[1,2] The bone marrow sample can be obtained either by needle aspiration or percutaneous trephine biopsy from the iliac crest, anterior or posterior iliac spines, the tibial tuberosity, or the sternum commonly under local anesthesia.^[1] The posterior iliac spines are the most preferred sites for marrow biopsy in adults.^[1] The procedure is relatively easy, and complications are less encountered if performed by an experienced hand under strict aseptic measures. Complications such as pain, hemorrhage, infections, and rarely arteriovenous fistulae have been reported.^[3] In addition to the cytological

examination of the marrow aspirate, other more advanced tests such as cytogenetic and immunophenotypic analyses can also be performed on the sample.^[4] There are several indications for bone marrow examination ranging from the evaluation of cytopenias to staging of both hematological and nonhematological malignancies as well as assessment of remission in the management of hematological malignancies. Currently, there is a paucity of reports of bone marrow

Address for correspondence: Dr. Saleh Yuguda,

Department of Haematology and Blood Transfusion, Gombe State University, Gombe, Gombe State, Nigeria.
E-mail: yugudas@gmail.com

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aspiration (BMA) from this part of the country. The aim of this study was to report the various indications of bone marrow examination in our center as well as the wide spectrum of diseases diagnosed.

METHODOLOGY

This was a retrospective review of BMA record registers in the Department of Haematology and Blood Transfusion of the Federal Teaching Hospital, Gombe, Gombe State, over a 12-year period from January 1, 2006, to December 31, 2017. The records of age, sex, indications, and final diagnosis were reviewed, and the data obtained were analyzed using IBM SPSS version 20.0 (Chicago, IL, USA, 2012). All the diagnoses were made based on morphology.

Protocol for bone marrow aspiration

The patient is counseled appropriately and allowed to lie on the left lateral position. Then, the posterior superior iliac spine (the preferred site in adults) is located after the patient is exposed appropriately. The skin over the posterior superior iliac spine is then cleaned with 70% alcohol or 0.5% chlorhexidine.

The skin is then infiltrated together with the subcutaneous tissue and periosteum over the selected site with 2–5 ml of 2% lignocaine and then waited for 3–5 min until anesthesia has been achieved.

With a boring movement, the bone marrow needle is passed perpendicularly into the cavity of the bone. When the bone has been penetrated, the stillette is removed, and a 5 or 10 ml syringe is attached to aspirate 0.3 ml and make 7–10 smears immediately. Without coming out of the skin, the stillette is reintroduced and then another site on the bone is chosen, and a boring motion is commenced again for biopsy. The stillette is then removed once you feel a resistance and continue boring until you isolate a core. Gently rock the needle horizontally and vertically and then the needle is removed slowly.

An introducer is then used to dislodge the isolated core onto a slide to make an imprint by gently rolling the core on slides. The core biopsy is then transferred into formaline solution. All slides are labeled appropriately.

RESULTS

A total of 596 BMAs were performed over the study period. Figure 1 shows the number of BMAs performed per year during the study period. The age ranges were from 2 months to 88 years, with a median age of 36 years (quartile range of 20–53 years). Males (61%) constituted the majority of the patients. Table 1 shows the indications for the bone marrow examination with evaluation of various degrees of cytopenias accounting for the majority (anemia 32.2%, pancytopenia 5.4%, thrombocytopenia 4.7%, and bicytopenia [anemia and thrombocytopenia] 3.2%) followed by leukemia, 27.7% (165/596).

Table 2 shows the frequencies of diagnoses made from the BMA cytology. The most frequently diagnosed diseases are

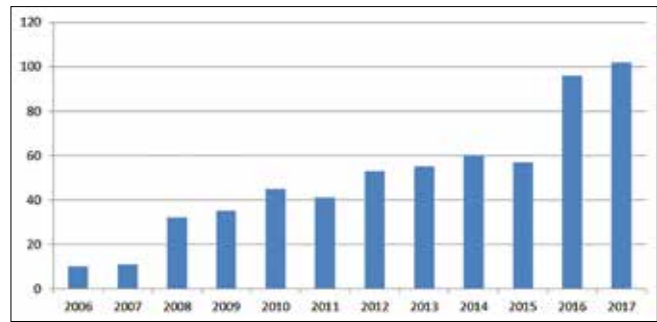


Figure 1: Twelve-year distribution of bone marrow examination in FTH Gombe

Table 1: Indications for bone marrow examination at FTH Gombe (2006-2017)

Indication	Frequency (%)
Recurrent anemia	192 (32.2)
Suspected leukemia	165 (27.7)
Persistent splenomegaly	49 (8.2)
Pancytopenia	32 (5.4)
Thrombocytopenia	28 (4.7)
Suspected multiple myeloma	24 (4.0)
Suspected Vitamin B12 deficiency	24 (4.0)
Persistent anemia in retroviral disease	19 (3.2)
Bicytopenia (anemia and thrombocytopenia)	19 (3.2)
Lymphoma	17 (2.9)
Remission assessment	10 (1.7)
Suspected metastatic cancer with persistent anemia	9 (1.5)
PUO	5 (0.8)
Thrombocytosis	2 (0.3)
Polycythemia	1 (0.2)
Total	596 (100.0)

FTH: Federal teaching hospital, PUO: Pyrexia of unknown origin

the nutritional deficiency anemia constituting about one-third of the cases (megaloblastic anemia 20.3% [121], combined deficiency anemia 9.9% [59], and iron deficiency anemia 2.5% [14]). Normal marrow finding constituted 4.7% (28), while the diagnosis was inconclusive in 4.2% (25) of the cases. Table 3 shows the various frequencies of the diagnoses based on the age groups.

DISCUSSION

BMA is an indispensable adjunct to the diagnosis and monitoring of care for hematological disorders.^[1] Satisfactory samples of bone marrow can usually be aspirated from the sternum and tibial tuberosity in children and from iliac crest or the iliac spines in adults. This study reports the experience of Federal Teaching Hospital Gombe, Gombe State, Northeastern Nigeria, over a 12-year period. The upward trend observed in the number of BMAs done annually throughout the period could be explained by the availability of the specialist hematologists in FTH Gombe as there was only one hematologist in 2006 and three as at the end of 2017. This could also be explained by the awareness among doctors in the region which led an

increase in hematologic referrals being the second center with functional hematology clinical services department in the entire Northeastern region of the country during this period.

Table 2: Bone marrow aspiration cytology diagnoses at FTH Gombe (2006-2017)

Diagnosis	Frequency (%)
Benign conditions	
Megaloblastic anemia	121 (20.3)
Combined deficiency anemia	59 (9.9)
Reactive marrow/hypersplenism	42 (7.0)
Aplastic anemia/marrow hypoplasia	56 (9.4)
Iron deficiency anemia	14 (2.3)
Immune thrombocytopenic purpura	9 (1.5)
Malignant conditions	
Acute lymphoblastic leukemia	63 (10.6)
Acute myeloid leukemia	49 (8.2)
Chronic myeloid leukemia	41 (6.9)
Chronic lymphoid leukemia	36 (6.0)
MDS	16 (2.7)
Multiple myeloma	15 (2.5)
Lymphoid infiltration in NHL	11 (1.8)
Marrow metastasis	5 (0.8)
Primary myelofibrosis	4 (0.7)
Essential thrombocythemia	1 (0.2)
Polycythemia vera	1 (0.2)
Normal	28 (4.7)
Inconclusive/inadequate	25 (4.2)
Total	596 (100)

MDS: Myelodysplastic syndrome, NHL: Non-Hodgkin lymphoma, FTH: Federal teaching hospital

The study revealed a male predominance, and this finding is similar to what was reported by Dachi *et al.* in Bauchi, Awwalu *et al.* in Zaria, Northwestern Nigeria, and Egesie *et al.* in Jos, North-Central Nigeria.^[5-7] The age range and the mean age of the study participants in this study agree to what was reported in many studies, both within and outside Nigeria.^[5-9] The reason for the wide age range can be due to the fact that blood cell formation starts *in utero* and continues throughout the life of an individual, and so disease conditions can come anytime in the lifetime of an individual.

Evaluation of recurrent anemia necessitating blood transfusion is the major indication for BMAs in this study. This agrees with the reports of Dachi *et al.* in Bauchi, Northeastern Nigeria; Awwalu *et al.* in Zaria, Northwestern Nigeria, Damulak and Damen in Jos, North-Central Nigeria; and Gohil and Rathod, in Gujarat, India.^[5,6,9,10] This is in contrast to Elmadhoun's finding of pancytopenia as the major indication for BMA.^[11] This difference could be explained by the type and severity of the disease at the time of presentation as some conditions can present with unicytopenia as recurrent anemia and some bicytopenias such as anemia and thrombocytopenia or pancytopenia, and it is only the bone marrow examination that finally determines the diagnosis.

The frequently encountered nutritional anemia in this study was megaloblastic anemia, and this finding is in tandem with what was obtained in Bauchi, a neighboring state, as well as in Gujarat, India, and Nairobi, Kenya.^[5,9,12] However, Bedu-Addo *et al.* in Ghana reported lymphoproliferative disorder as the most common BMA diagnosis,^[8] while both Weinzierl and

Table 3: Frequencies of bone marrow aspiration cytology diagnosis based on age groups at FTH Gombe (2006-2017)

Diagnosis	Age groups									Total
	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	
Megaloblastic anemia	6	11	28	17	21	25	7	4	2	121
Acute lymphoblastic leukemia	24	21	10	6	1	0	1	0	0	63
Combined deficiency anemia	2	14	13	15	6	5	3	1	0	59
Marrow hypoplasia/aplastic anemia	4	5	9	13	12	8	4	1	0	56
Acute myeloid leukemia	9	18	4	1	2	9	5	1	0	49
Reactive marrow/hypersplenism	8	12	5	6	6	3	2	0	0	42
Chronic myeloid leukemia	0	7	8	10	11	2	2	1	0	41
Chronic lymphoid leukemia	0	0	0	2	8	11	13	1	1	36
Normal	3	2	1	6	3	5	6	1	1	28
Inconclusive/inadequate	7	5	1	0	4	1	3	1	3	25
Myelodysplastic syndrome	0	0	0	0	2	4	7	1	2	16
Multiple myeloma	0	0	0	0	3	8	3	1	0	15
Iron deficiency anemia	0	0	4	2	3	4	0	1	0	14
Lymphoid infiltration in NHL	2	2	1	2	1	2	1	0	0	11
Immune thrombocytopenic purpura	2	3	0	2	1	0	1	0	0	9
Marrow metastasis	0	0	0	1	1	2	1	0	0	5
Myelofibrosis	0	0	0	1	1	1	0	1	0	4
Essential thrombocythemia	0	0	0	0	0	0	1	0	0	1
Polycythemia rubra vera	0	0	0	0	3	1	0	0	0	1
Total	68	102	87	88	91	97	67	23	18	596

NHL: Non-Hodgkin lymphoma, FTH: Federal teaching hospital

Arber and Bashawri in the USA and Saudi Arabia showed leukemia as the most commonly diagnosed condition.^[13,14] The reason for nutritional anemia being the most common diagnosis is not surprising taking the economic situation of Northeastern Nigeria as malnutrition is highly prevalent in developing countries such as Nigeria, and the Northeastern part of the country is the second-most affected region owing to low literacy rate and high poverty profile as reported in the Nigeria Poverty Profile report 2010 and National Literacy Survey 2010 coupled with the Boko Haram insurgency that has ravaged the region.^[15,16] This has led to the emergence of many internally displaced persons and reduction in agricultural and economic activities, hence the high tendency of micronutrient deficiency.^[17] The findings of normal BMA in this study are similar to what was found in Bauchi and lower than the values reported in India, Ghana, and Zaria.^[5,6,8,9]

Limitation of the study

The major limitation of this study is that the diagnoses were based on morphology.

CONCLUSION

Evaluations of anemia and leukemia are the most common indications for BMA, and nutritional deficiency anemia is the major BMA diagnosis in Gombe, Northeastern Nigeria.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Bain BJ, Bates I, Laffan MA, Lewis MS. Practical Haematology. 11th ed. Churchill Livingstone Inc. Philadelphia USA. 2012. p. 116-30.
- Mahajan V, Kaushal V, Thakur S, Kaushik R. A comparative study of bone marrow aspiration and bone marrow biopsy in hematological and non-hematological disorders- an institutional experience. *JACM* 2013;14:133-5.
- Berber I, Erkurt MA, Kuku I, Kaya E, Kutlu R, Koroglu M, *et al.* An unexpected complication of bone marrow aspiration and trephine biopsy: Arteriovenous fistula. *Med Princ Pract* 2014;23:380-3.
- Bain BJ. Bone marrow aspiration. *J Clin Pathol* 2001;54:657-63.
- Dachi RA, Mustapha FG, Yuguda S, Kagu MB, Gwaram AA, Bwala P. Bone marrow aspiration cytology in Abubakar Tafawa Balewa Teaching Hospital Bauchi, Bauchi State: Indications and diagnostic utility. *Annals Afr Med Res* 2019;2:16-9.
- Awwalu S, Hassan A, Dogara LG, Musa AU, Waziri AD, Babadoko AA. Bone marrow aspiration (BMA) in Zaria: A 3 year retrospective review. *Bio Med J* 2016;3:54-5.
- Egesie OJ, Joseph DE, Egesie UG, Ewuga OJ. Epidemiology of anaemia necessitating bone marrow aspiration cytology in Jos. *Niger Med J* 2010;50:61-3.
- Bedu-Addo G, Ampem AY, Bates I. The role of bone marrow aspiration and trephine samples in haematological diagnosis in patients referred to a teaching hospital in Ghana. *Ghana Med J* 2013;47:74-8.
- Gohil M, Rathod K. Bone Marrow Aspiration Cytology Study in a Tertiary Care Center, Gujarat, India. *Int J Sci Stud* 2018;5:11-4.
- Damulak O, Damen J. Diagnostic outcome of Bone marrow aspiration in a new centre in Nigeria. *Global Adv Res Jnl Med Med Sci* 2012;1:166-71.
- Elmadhoun WM, Noor SK, Bushara SO, Almobarak AO, Husain NE, Ahmed MH. Bone marrow aspiration in north Sudan: The procedure, indications and the diagnostic value. *Int J Health Sci (Qassim)* 2015;9:434-9.
- Okinda NA, Riyat MS. Bone marrow examination findings at Aga Khan University Hospital, Nairobi. *East Afr Med J* 2010;87:4-8.
- Weinzierl EP, Arber DA. Bone marrow evaluation in new-onset pancytopenia. *Hum Pathol* 2013;44:1154-64.
- Bashawri LA. Bone marrow examination. Indications and diagnostic value. *Saudi Med J* 2002;23:191-6.
- Federal Republic of Nigeria: Poverty Indicators. Nigeria Poverty Profile. ReportNo.:2.6;2010. Available from: <https://reliefweb.int/sites/reliefweb.int/files/resources/b410c26c2921c18a6839baebc9b1428fa98fa36a.pdf>. [Last accessed on 2020 Jan 12].
- National Bureau of Statistics. The Nigeria National Literacy Survey 2010. Report No.: 3.4; 2010. Available from: <http://www.nigerianstat.gov.ng/pdfuploads/National%20Literacy%20Survey,%202010.pdf>. [Last accessed on 2020 Jan 12].
- Afolabi A. The insurgency and socio-political economy in Nigeria. *Int J Dev Econ Sustain* 2015;3:61-74.