Short communication

Bone marrow examination: An audit from tertiary care oncology institute

Abstract:

Introduction: Bone marrow aspiration and biopsy forms the foundation of diagnostic hematopathology. These outpatient procedures performed under local anaesthesia yielding accurate and timely diagnosis.

Aim: To evaluate the utility of bone marrow biopsy in the diagnosis and follow up of haematological neoplasms.

Type of study: A simple observational retrospective study design.

Period of study: 1st January 2021 to 12thSeptember 2021

Results: A total of 111 bone marrow examinations were performed during the current year till 12.09.2022. The M:Fratio is 2.08:1. Age range is from 17 to 79 years with a mean of 49.67, Median of 53. Out of 111 bone marrow examinations, 71 procedures were performed for the diagnostic purpose. Whereas 40 procedures are for follow upafter initial diagnosis, the majorityare for response assessment. Of the 71 diagnostic bone marrow procedures 53 cases had a neoplastic condition, whereas 18 cases were diagnosed with benign conditions.

Keywords: Bone marrow, diagnosis, haematological disorders, chemotherapy

Introduction

Bone marrow aspiration and biopsies forms the foundation of diagnostic hematopathology. These outpatient procedures performed under local anaesthesia. The ease of doing these procedures make them an important tool in hematopathology. These procedures can yield accurate and timely diagnosis and in skilled hands it is relatively uncomplicated to perform [1,2].

Bone marrow examination is not only an integral tool, for diagnosis of haematological disorders, but also crucialand definitive in evaluation of response assessment,effect of chemotherapy & unexplained cytopenia in solid organ neoplasms. Bone marrow procedures are performed as an outpatient and inpatient basis[3]. Most common site used isthe posterior superior iliac spine, though other sites can be used such assternum or anterior superior iliac spine in relevant scenarios.

Indications for definitive diagnosis ofSuspected leukaemia, plasma cell dyscrasias, chronic myeloproliferative or lymphoproliferative neoplasms & MDS. It is also a very important tool in response assessment in acute leukaemiaand plasma cell dyscrasias. In a

tertiary care oncology hospital, it can also help to solve the riddles of unexplained cytopenia's in solid organ neoplasms [4,5].

There are very few absolute contraindications for procedures such as bleeding diatheses, skeletal abnormalities, and local site infection. Thrombocytopenia is not an absolute contraindication for the procedure.

Post-operative bleeding is rare but the most common complication. Rarely, internal haemorrhage can occur due to injury to theinternal iliac or superior gluteal artery, when the site is the posterior superior iliac spine. Sternal aspiration is more prone to serious and life-threatening complications. Sternal punctures must not be performed in children below 12 years of age [6,7]. Haemorrhage, cardiac tamponed, or death can occur if the needle is misplaced during sternal puncture. Lastly infection of the procedural site if proper sterile technique is not used.

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A total of 111 bone marrow examinations were performed during the current year till 12.09.2022. The M:Fratio is 2.08:1. Age range is from 17 to 79 years with amean of 49.67, Median of 53. Out of 111 bone marrow examinations, 71 procedures were performed for the diagnostic purpose. Whereas 40 procedures are for follow-up, the majority are for response assessment. Of the 71 diagnostic bone marrow procedures 53 cases had a neoplastic condition, whereas 18 cases were diagnosed with benign conditions.

Demographic Characteristics

Table 1: Age distribution

Sr. No.	Age Group	Diagnostic	%	Follow-up	%	Grand Total	%
1	**0-20**	5	7.04	5	12.5	10	9.01
2	**20-40**	14	19.72	10	25	24	21.62
3	**40-60**	31	43.66	15	37.5	46	41.44
4	**60-80**	21	29.58	10	25	31	27.93
	Grand Total	71	100.00	40	100	111	100.00

Graph 1:

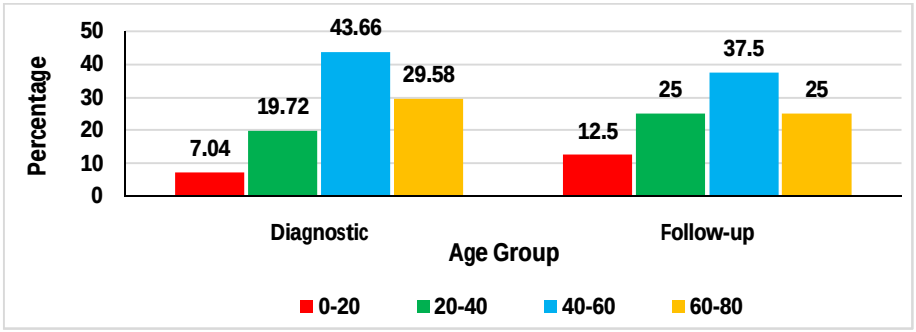
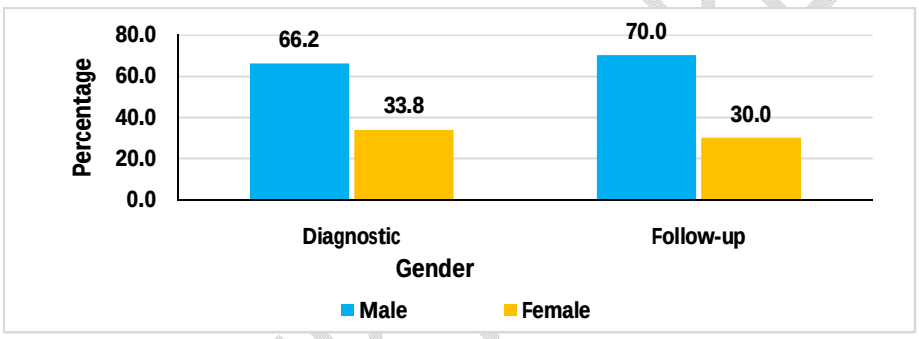


Table 2: Gender distribution

Sr. No.	Gender	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Male**	47	66.20	28	70.00	75	67.57
2	**Female**	24	33.80	12	30.00	36	32.43
	Grand Total	71	100.00	40	100.00	111	100.00

Graph 2:



Diagnostic procedures: A total of 71 procedures performed, and of those 49 casesdiagnosed with malignant conditions. Whereas 22cases were of non-malignant pathology. Majority of these cases in which some types of malignant pathological conditions were suspected, 14cases labelled as morphologically normal marrow. Four cases were diagnosed as Aplastic anaemia on bone marrow biopsy. One case was diagnosed as Mixed deficiency anaemia which presented with bicytopenia and was acase of carcinoma breast. Now, from the diagnosed malignant (49) – pathological cases, most common diagnosis was of multiple myeloma (16), followed by Acute leukaemia (13), CML (8), Involvement of bone marrow by metastatic neoplasms (3), myeloproliferative neoplasms (3), chronic lymphoproliferative neoplasms (3), and 1 case of Myelodysplastic syndrome. Acute leukaemia cases are less, probably because in many cases with high presenting Total leucocyte count, bone marrow procedure is not required, as ancillary test like flowcytometry, cytogenetics and molecular testing can be performed from peripheral blood.

Table 3: ***Diagnostic Details***

Sr.no.	FINAL DIAGNOSIS IN DIAGNOSTIC BONE MARROW PROCEDURES	NO. OF CASES	%
1	MULTIPLE MYLOMA	16	22.54
2	MORPHOLOGICALLY NORMAL MARROW	14	19.72
3	AML	9	12.68
4	CML	8	11.27
5	HYPOPLASTIC MARROW	4	5.63
6	CLPD	3	4.23
7	MYELOPROLIFERATIVE NEOPLASAM	3	4.23
8	APML	2	2.82
9	T-ALL	2	2.82
10	DLBCL-ABC TYPE	1	1.41
11	B ALL	1	1.41
12	MIXED DFICIENCY ANEMIA	1	1.41
13	MYELODYSPLASTIC SYNDROME	1	1.41
14	MYELOID HYPERPLASIA	1	1.41
15	NO OPINION	1	1.41
16	REACTIVE PLASMACYTOSIS	1	1.41
17	RELAPSE FROM COMPLETE RESPONSE IN K/C/O MM	1	1.41
18	T CELL NHL	1	1.41
19	THYMIC CARCINOMA	1	1.41
	Grand Total	71	100.00

Follow-up/ Response assessment procedures: A total of 40 procedures performed, of which 20 procedures were done for the response assessment of acute leukaemia's (viz AML, B & T ALL, and APML), followed by response assessment of multiple myeloma (15).

There were three diagnosed cases of Chronic myeloid leukaemia, routinely we don't performmarrow examinations forresponse assessmentin CMLbut these cases presented with pancytopenia, while on treatment with tyrosine kinase inhibitors. Two of them diagnosedwith Aplastic anaemia on bone marrow biopsy and one case showed marked fibrosis with marked megakaryocytic hyperplasia. There was one case of primary myelofibrosis on Tab. Thalidomide, presented with pancytopenia, marrow was fibrotic with bone marrow lymphocytosis. A case of low-grade lymphoproliferative disorder presented with unexplained cytopenia's after receiving 4# of Inj. Rituximab. This patient was diagnosed as Aplastic anaemia on bonemarrow biopsy.

Table 4:

Sr. No.	RESPONSE ASSESSMENTIN FOLLOW-UP MARROW EXAMINATION	NO. OF CASES	%

1	MORPHOLOGICAL REMISSION (AL)	17	42.50
2	VERY GOOD PARTIAL RESPONSE (MM)	9	22.50
3	HYPOPLASTICC MARROW	4	10.00
4	PARTIAL RESPONSE (MM)	3	7.50
5	RELAPSE	2	5.00
6	BONE MARROW LYMPHOCYTOSIS	1	2.50
7	BONE MARROW NECROSIS	1	2.50
8	COMPLETE RESPONSE(MM)	1	2.50
9	COMPLETE RESPONSE WITH INCOMPLETE COUNTRECOVERY (AL)	1	2.50
10	PROGRESSION TO MYELOFIBROSIS	1	2.50
	Grand Total	40	100.00

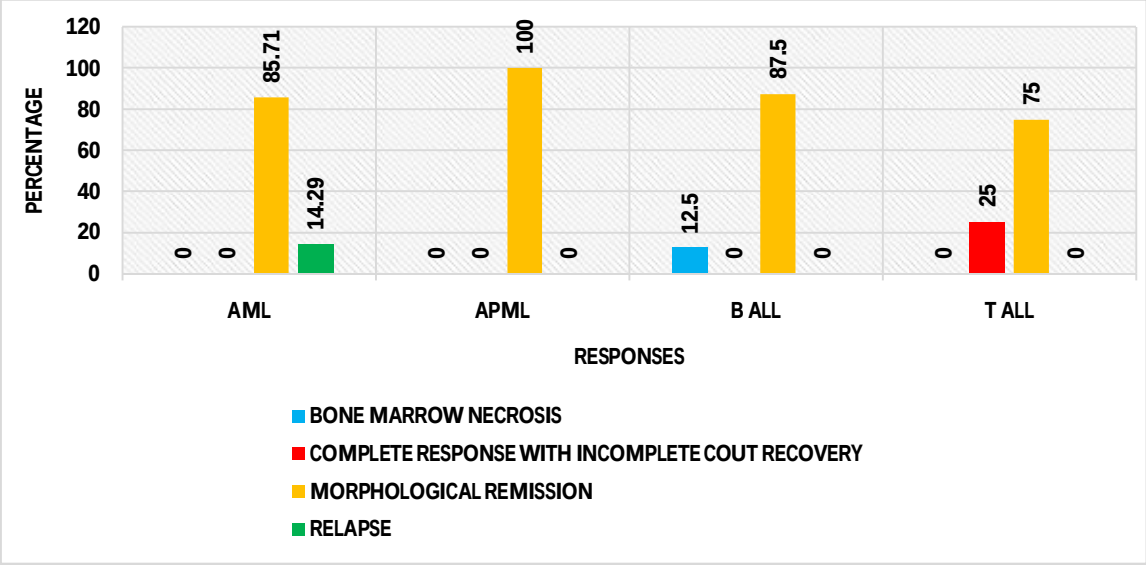
Table 5:

Sr. No.	RESPONSE IN MULTIPLE MYELOMA	NO. OF CASES	%
1	VERY GOOD PARTIAL RESPONSE	9	60.00
2	PARTIAL RESPONSE	3	20.00
3	COMPLETE REPSONE	1	6.67
4	HYPOPLASTIC MARROW	1	6.67
5	RELAPSE	1	6.67
	Grand Total	15	100.00

Table 6:

Sr. No.	RESPONSE ASSESSMENT IN ACUTE LEUKEMIA	AML	%	APML	%	B ALL	%	T ALL	%	Grand Total	%
1	BONE MARROW NECROSIS	-	0	-	0.00	1	12.50	-	0.00	1	5.00
2	COMPLETE RESPONSE WITH INCOMPLETE COUNT RECOVERY	-	0	-	0.00	-	0.00	1	25.00	1	5.00
3	MORPHOLOGICAL REMISSION	6	85.71	1	100.00	7	87.50	3	75.00	17	85.00
4	RELAPSE	1	14.29	-	0.00	-	0.00	-	0.00	1	5.00
5	Grand Total	7	100	1	100.00	8	100.00	4	100.00	20	100.00

Graph 6:

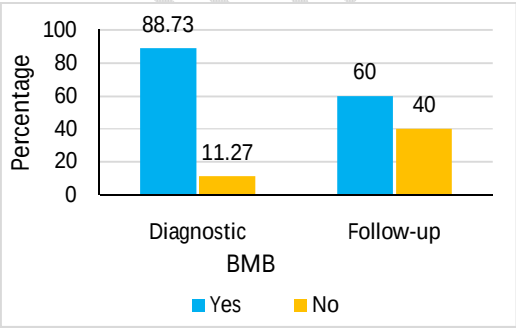


Ancillary testing: Bone marrow procedure serve as a primary tool for providing biological samples for ancillary testing including flowcytometry, cytogenetic and molecular studies. In the current era most these techniques are needed for exact diagnosis, prognosis and deciding the targetedtreatment options. It also helps in assessment of early relapse detections. In our audit amongst the diagnostic procedures most commonly performed investigation is flowcytometry followed by IHC. In follow up samples, again the most common investigation done is flowcytometry followed by IHC. The detailed account of various ancillary test performed, is represented in the following table and bar diagrams.

Table 7:

Sr. No.	BMB	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	63	88.73	24	60.00	87	78.38
2	**No**	8	11.27	16	40.00	24	21.62
	Grand Total	71	100.00	40	100.00	111	100.00

Graph 7:



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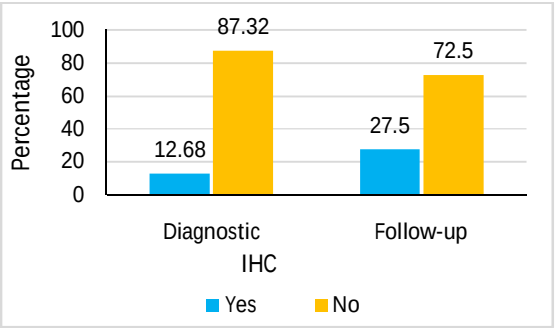


Table 8:

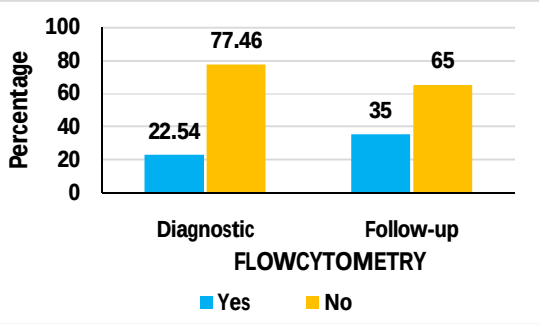
Sr. No.	IHC	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	9	12.68	11	27.50	20	18.02
2	**No**	62	87.32	29	72.50	91	81.98

	Grand Total	71	100.00	40	100.00	111	100.00

Table 9:

Sr. No.	FLOWCYTOMETRY	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	16	22.54	14	35.00	30	27.03
2	**No**	55	77.46	26	65.00	81	72.97
	Grand Total	71	100.00	40	100.00	111	100.00

Graph 9:



Graph 10:

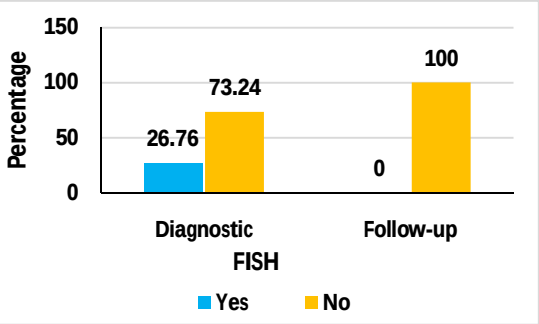


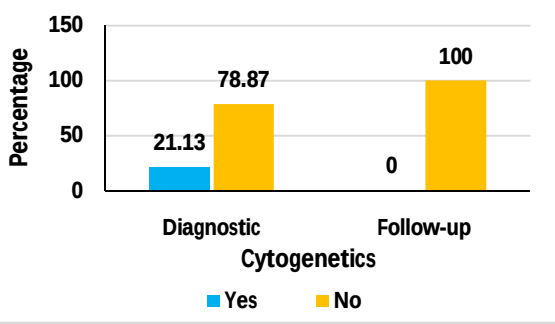
Table 10:

Sr. No.	FISH	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	19	26.76		0.00	19	17.12
2	**No**	52	73.24	40	100.00	92	82.88
	Grand Total	71	100.00	40	100.00	111	100.00

Table 11:

Sr. No.	Cytogenetics	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	15	21.13		0.00	15	13.51
2	**No**	56	78.87	40	100.00	96	86.49
	Grand Total	71	100.00	40	100.00	111	100.00

Graph 11:



Graph 12:

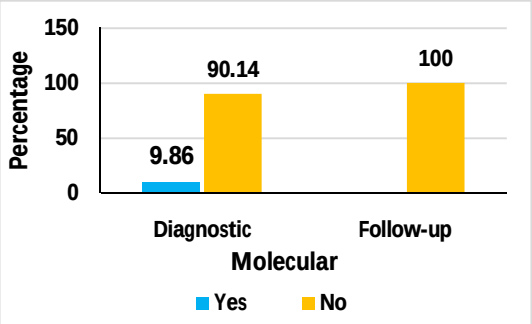


Table 12:

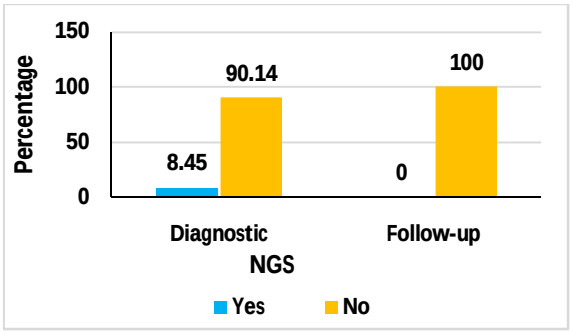
Sr. No.	Molecular	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	7	9.86	-	0.00	7	6.31

2	**No**	64	90.14	40	100.00	104	93.69
	Grand Total	71	100.00	40	100.00	111	100.00

Table 13:

Sr. No.	NGS	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	6	8.45		0.00	6	5.41
2	**No**	64	90.14	40	100.00	104	93.69
	Grand Total	71	100.00	40	100.00	111	100.00

Graph 13:



Graph 14:

Our experience:

Bone marrow aspirate and biopsy are the common procedures in hematopathology. As a consultant in haematology, I usually explain the procedure, take the written consents, perform the procedure and also hear the feedback of their experience.

Pain is the most common complication of bone marrow procedure. In our experience,46 psychological anxiety depends on the priming of the patient about procedure, & how you converse with the patient during procedures. In our setting, pain was “mostly well tolerated”. We didn’t encounter any other procedure related side effect like, bleeding or local site infection.

We used all steel salah’s needle for bone marrow aspiration procedure and Jamshedi needle for bone marrow biopsies. We used local anaesthesia, Lignocaine 2%, for both the procedures. All the procedures performed, yielded adequate samples including bone marrow aspirates, biopsies and imprint smears on case-to-case basis.

Conclusion: Bone marrow examination play a significant role in diagnosis and response assessment of haematological neoplasms. A through pre procedural assessment, clinical corelation and adequacy of bone marrow sample further improves the importance of bone marrow procedure in a tertiary care oncology centre.

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