

Short communication

Bone marrow examination: An audit from tertiary care oncology center

Abstract:

Introduction: Bone marrow aspiration and biopsies are the main pillars in the diagnosis of haematological disorders. The ability of these methods to avoid more invasive procedures and be easy to perform on an outpatient basis under local anesthesia makes them a very important diagnostic tool in medical oncology. These procedures can yield an accurate diagnosis in a relatively short amount of time and in skilled hands it is relatively uncomplicated to perform.

Objective: To evaluate the utility, indications, and outcomes of bone marrow aspiration & biopsy procedures from 1.1.2022 till 12.9.2022.

Methods: A simple Observational & analytical study design using the data from 1st January 2022 to 12th September 2022. The data was maintained by the department of laboratory medicine, in haematology section.

Results: A total of 111 bone marrow examinations were performed during the current year till 12.09.2022. The male-to-female ratio is 2.08:1. Age range is from 17 to 79 years with a mean of 49.67, Median of 53 years. Out of 111 bone marrow examinations, 71 procedures were performed for the diagnostic purpose. Whereas 40 procedures are for follow-up after initial diagnosis, 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.

Keywords: Bone marrow, diagnosis, haematological disorders, chemotherapy

Introduction

Bone marrow aspiration and biopsies are the main pillars in the diagnosis of haematological disorders. These methods are a very important diagnostic tool in medical oncology to avoid more invasive procedures, which are easy to perform under local anaesthesia as well as can yield an accurate diagnosis in a relatively short amount of time in skilled hands it is relatively uncomplicated to perform [1,2].

Bone marrow examination is not only an integral tool to establish the diagnosis of haematological disorders but also a very important tool to assess response assessment, the effect of chemotherapy & unexplained cytopenia. Bone marrow procedures are performed both on an outpatient and inpatient basis [3]. The most common site used is the posterior superior iliac spine, though other sites can be used such as the sternum or anterior superior iliac spine in relevant scenarios.

Indications for definitive diagnosis of leukemia, plasma cell dyscrasias, chronic myeloproliferative or lymphoproliferative neoplasms & MDS. It is also a very important tool in response assessment in leukemias and plasma cell dyscrasias. In a tertiary care oncology hospital, it can also help to solve the riddles of unexplained cytopenia 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 the internal 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 tamponade, 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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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:

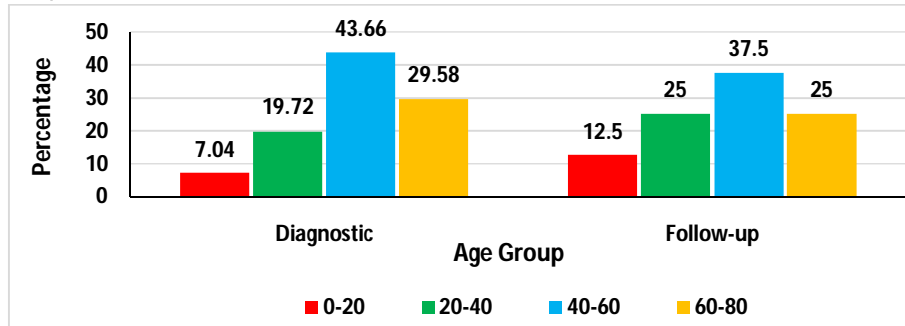
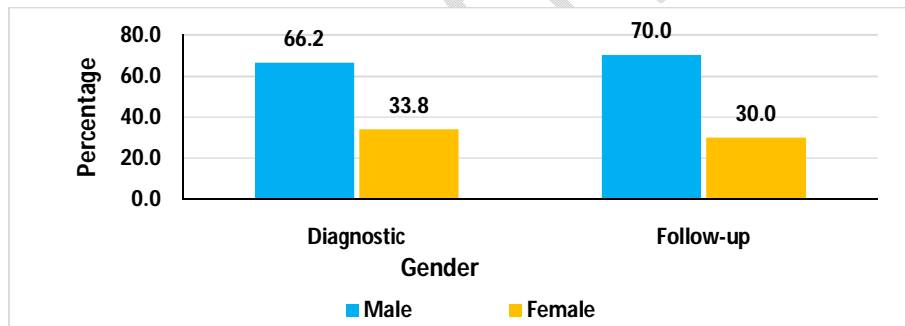


Table 2: Gender distribution

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:



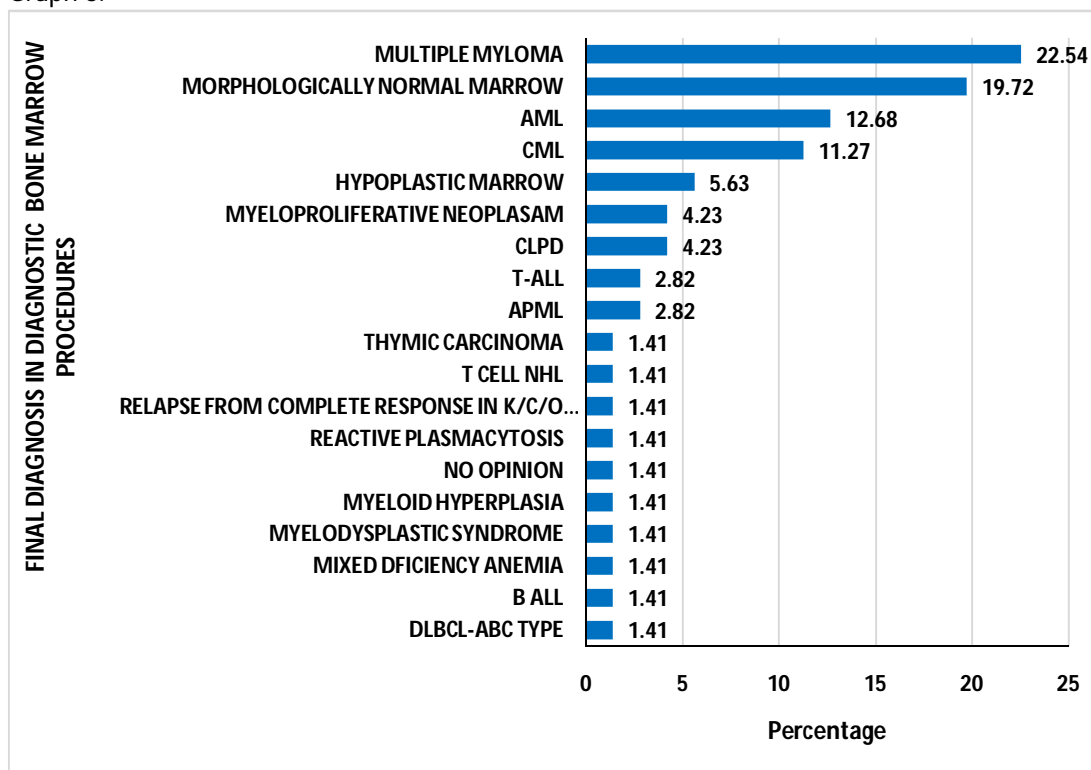
Diagnostic procedures: A total of 71 procedures were done, and of those 49 cases were diagnosed with malignant conditions. Whereas 22 cases were of non-malignant pathology. Majority of these cases in which some types of malignant pathological conditions were suspected, 14 were labeled as morphologically 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 a known case of carcinoma breast. Now, from the diagnosed malignant (49) – pathological cases, the 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 MYELOMA	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	MYELOYDYSPLASTIC 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

Graph 3:



Follow-up procedures: A total of 40 procedures **were done**, 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 do **follow-up marrow examinations** in CML but these cases presented with pancytopenia, while on treatment with tyrosine kinase inhibitors. Two of them **were diagnosed** with 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. **In one case** of low-grade lymphoproliferative disorder, **the patient** received 4 cycles of **rituximab** and **presented** with unexplained **cytopenia**. This patient was diagnosed **with** Aplastic anaemia on **a bone** marrow biopsy.

Table 4:

Sr. No.	RESPONSE ASSESSMENT IN FOLLOW-UP MARROW EXAMINATION	NO. OF CASES	%
1	MORPHOLOGICAL REMISSION (AL)	17	42.50
2	VERY GOOD PARTIAL RESPONSE (MM)	9	22.50
3	HYPOPLASTIC 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

Graph 4: RESPONSE ASSESMENT IN FOLLOW-UP MARROW EXAMINATION

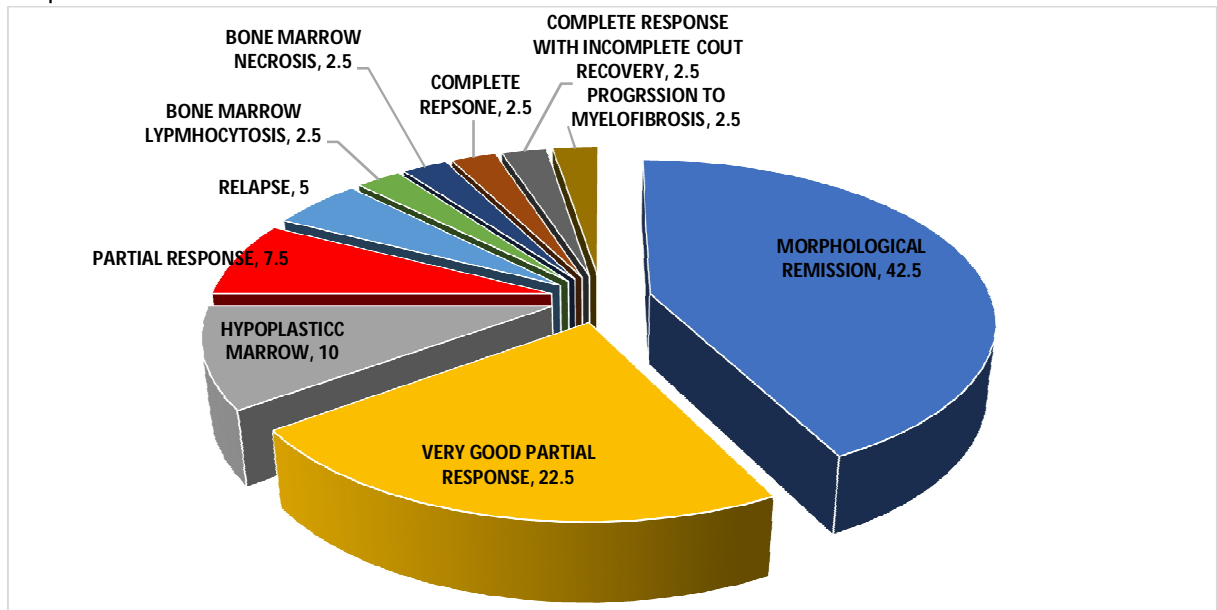


Table 5:

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

Graph 5: RESPONSE IN MULTIPLE MYELOMA (in percentage)

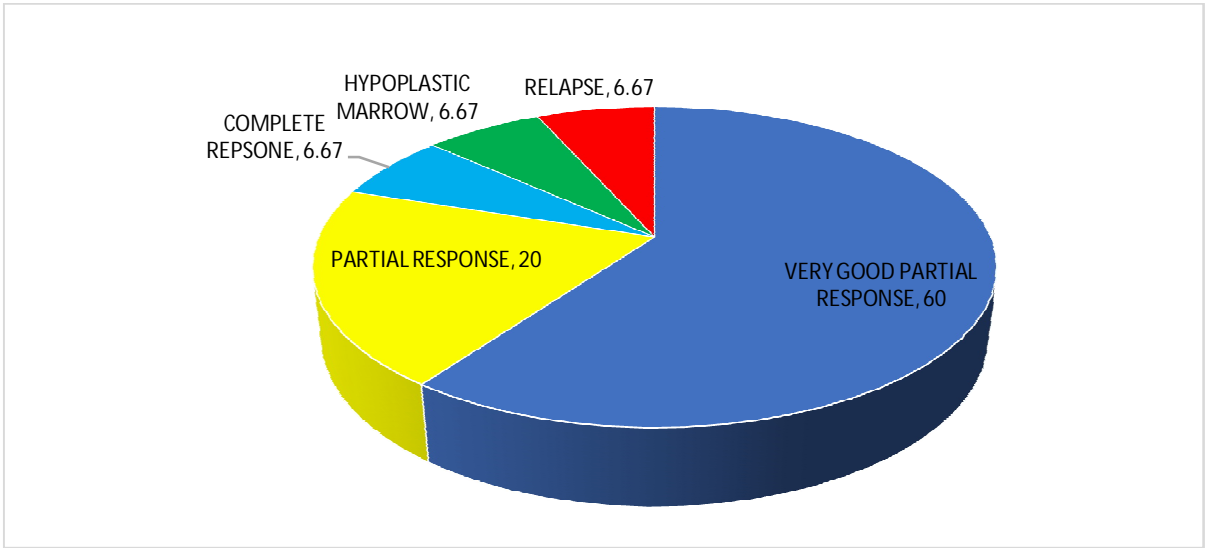
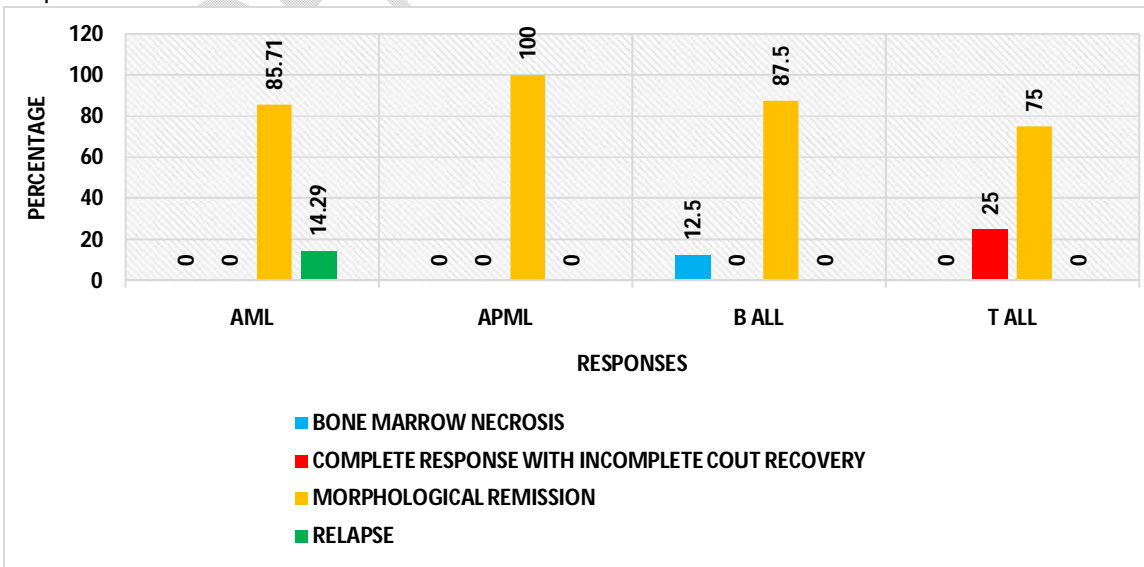


Table 6:

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:

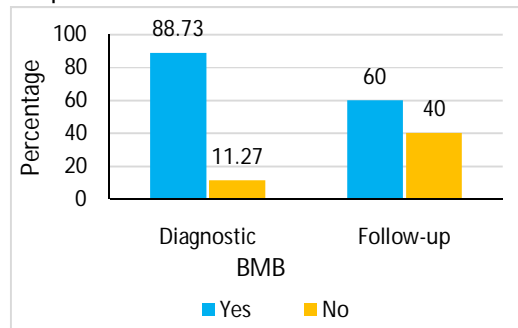


Ancillary testing: Bone marrow procedure serve as a primary tool for providing biological samples for ancillary testing including flowcytometry, cytogenetic and molecular studies. In the current era most these techniques are needed for exact diagnosis, prognosis and deciding the targeted treatment options. 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:



Graph 8:

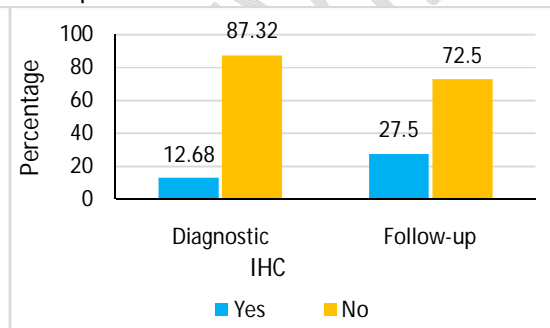


Table 8:

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:

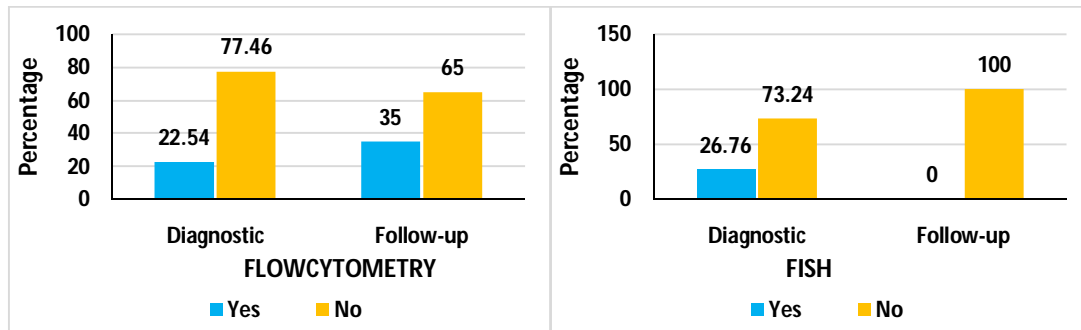


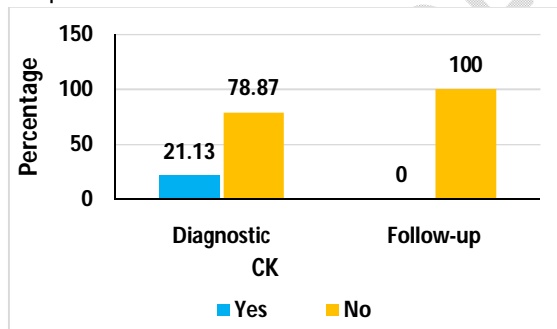
Table 10:

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.	CK	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:

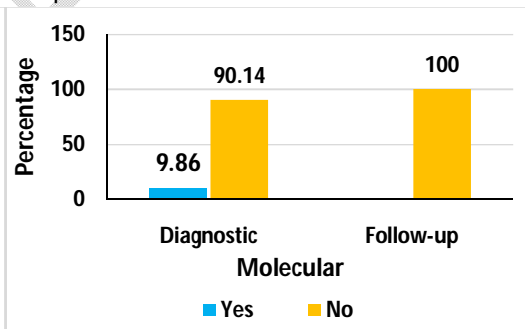


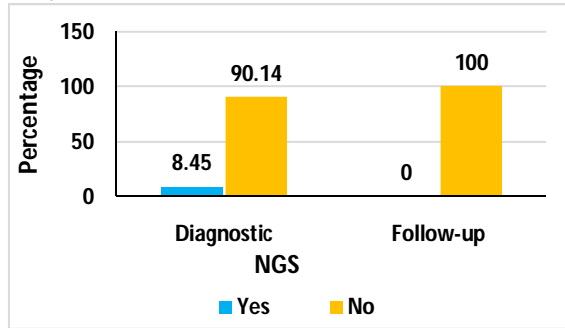
Table 12:

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:

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.

References

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UNDER PEER REVIEW