Short communication

Bone marrow examination: An audit from tertiary care oncology centre

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, as well ease to perform these procedures on outpatient basis under local anaesthesia makes them a very important diagnostic tool in medical oncology. These procedures can yield accurate diagnosis in relatively short amount of time and in skilled hands its 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 mean of 49.67, Median of 53years. Out of 111 bone marrow examinations, 71 procedures were performed for the diagnostic purpose. Whereas 40 procedures are for follow up after initial diagnosis, majority 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. The ability of these methods to avoid more invasive procedures, as well ease to perform these procedures on outpatient basis under local anaesthesia makes them a very important diagnostic tool in medical oncology [1,2]. These procedures can yield accurate diagnosis in relatively short amount of time and in skilled hands its relatively uncomplicated to perform.

Bone marrow examination is not only an integral tool to establish diagnosis of haematological disorders but also a very important tool to assess response assessment, effect of chemotherapy & unexplained cytopenias. Bone marrow procedures are performed both in outpatient and inpatient basis [3]. Most common site used is posterior superior iliac

spine, though other sites can be used such as sternum or anterior superior iliac spine in relevant scenarios.

Indications for definitive diagnosis of leukaemia's, plasma cell dyscrasias, chronic myeloproliferative or lymphoproliferative neoplasms & MDS. It is also a very important tool in response assessment in leukaemia's and 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 procedure 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 internal iliac or superior gluteal artery, when the site is 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 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.	Age	Diagnostic	%	Follow-	%	Grand	%

No.	Group			up		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:

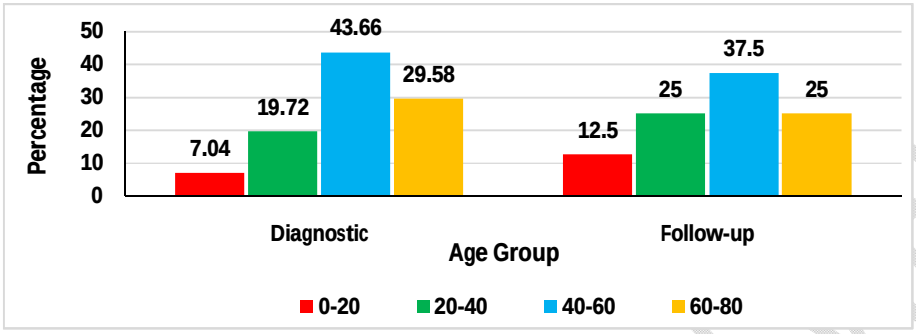
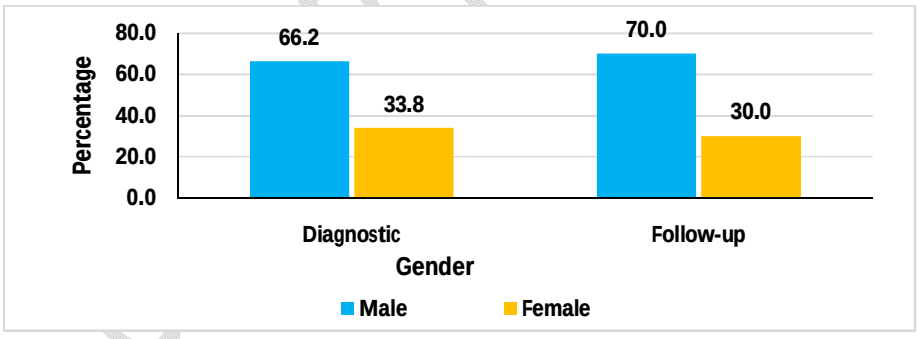


Table 2: Gender distribution

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:



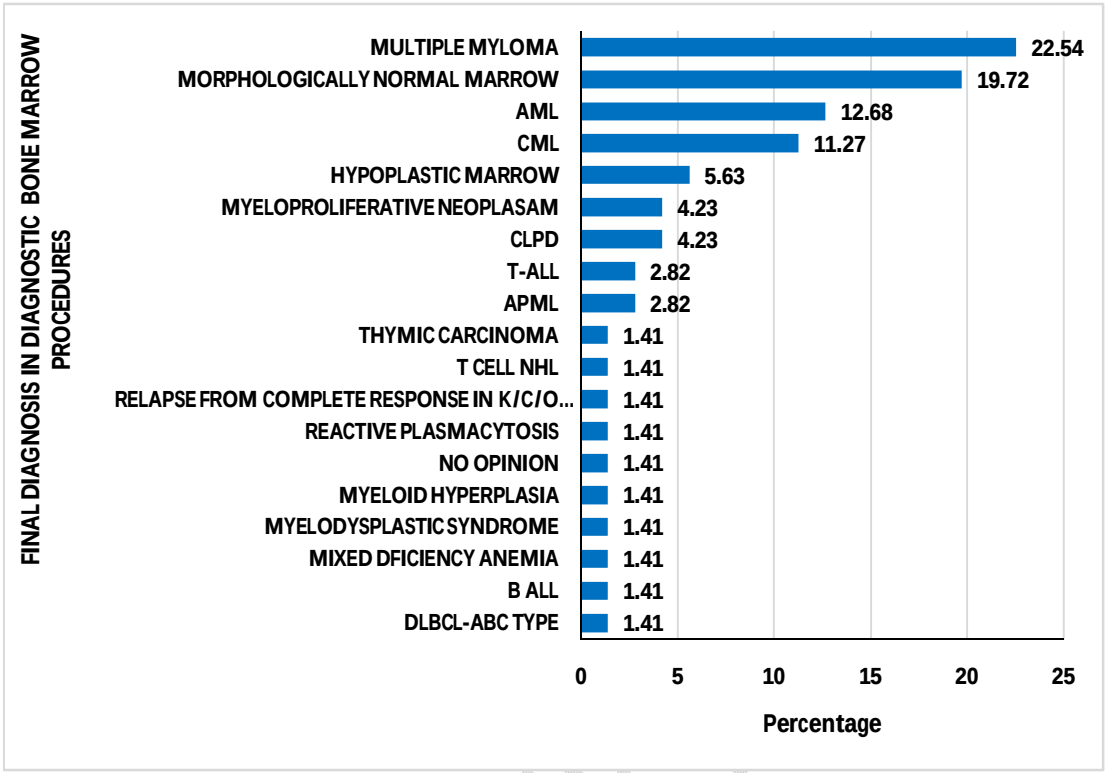
Diagnostic procedures: A total of 71 procedures done, of those 49 cases diagnosed with malignant conditions. Whereas 22 cases were of non-malignant pathology. Majority of these cases in which some types of malignant pathological conditions were suspected, 14 were labelled as morphologically normal marrow. 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 known case 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

Graph 3:



Follow up procedures: A total of 40 procedures 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 examination's in CML but these cases presented with pancytopenia, while on treatment with tyrosine kinase inhibitors. Two of them 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. One case of low-grade lymphoproliferative disorder, patient received 4 cycles of rituximab, presented with unexplained cytopenia's. This patient was diagnosed as Aplastic anaemia on bone marrow biopsy.

Table 4:

Sr. No.	RESPONSE ASSESMENT 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	HYPOPLASTICC MARROW	4	10.00
4	PARTIAL RESPONSE (MM)	3	7.50
5	RELAPSE	2	5.00
6	BONE MARROW LYPMHOCYTOSIS	1	2.50
7	BONE MARROW NECROSIS	1	2.50
8	COMPLETE REPSONE(MM)	1	2.50
9	COMPLETE RESPONSE WITH INCOMPLETE COUT RECOVERY (AL)	1	2.50
10	PROGRSSION TO MYELOFIBROSIS	1	2.50
	Grand Total	40	100.00

Graph 4: **RESPONSE ASSESMENT IN FOLLOW-UP MARROW EXAMINATION**

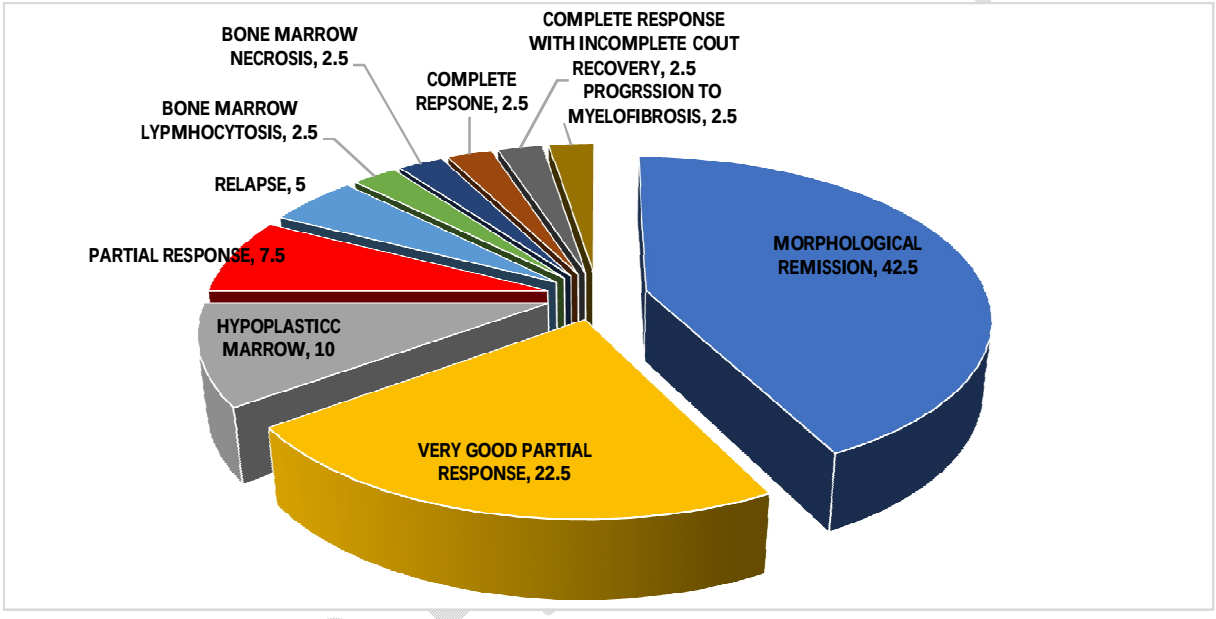


Table 5:

Sr. No.	RESPONSE IN MULTIPLE MYLOMA	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 MYLOMA (in percentage)

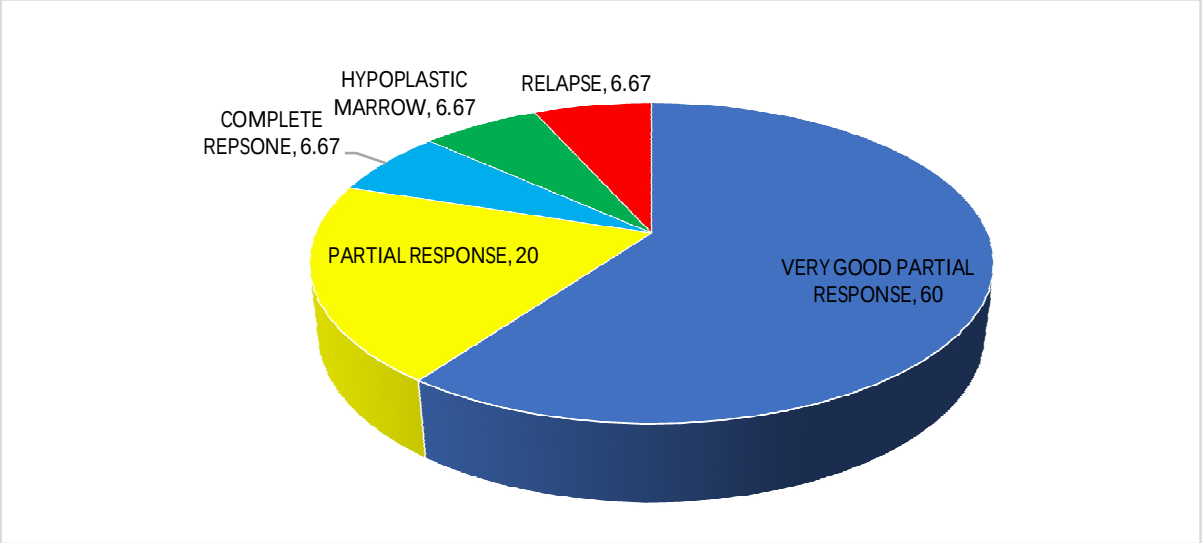
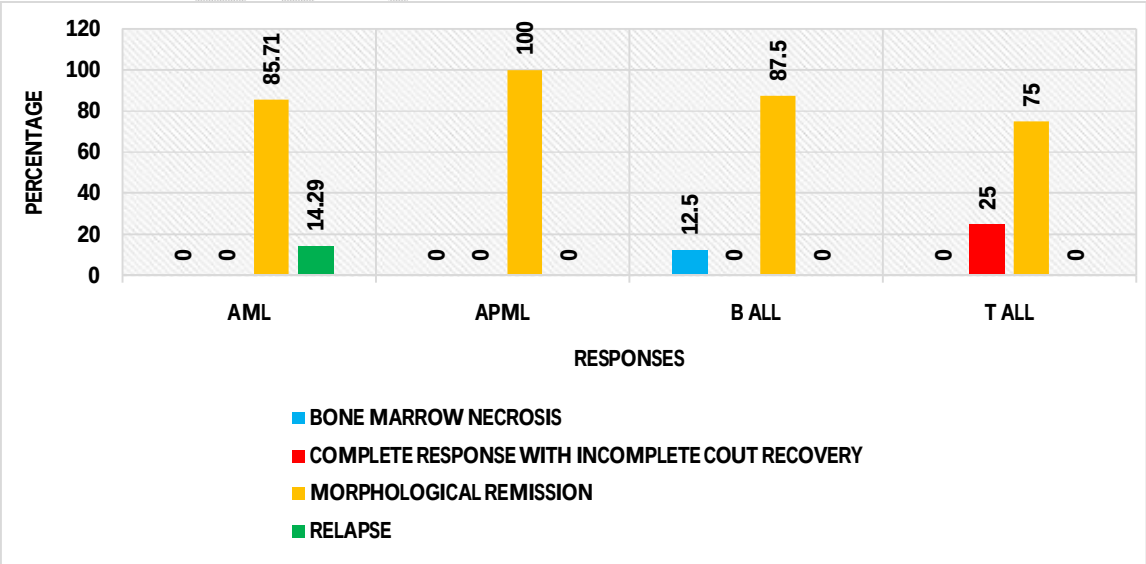


Table 6:

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 COUT 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:

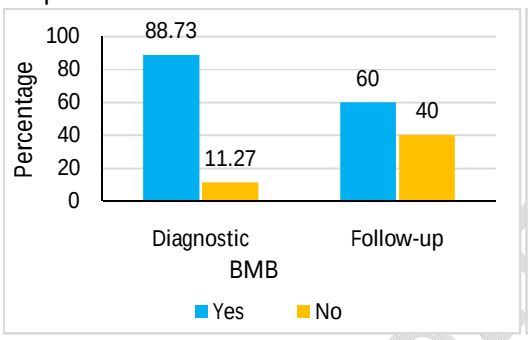


Ancillary testing: Bone marrow procedure serve as a primary tool for providing biological samples for ancillary testing including flowcytometry, cytogenetic and molecular studies. In the current era most these techniques are needed for exact diagnosis, prognosis and deciding the targeted treatment options.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

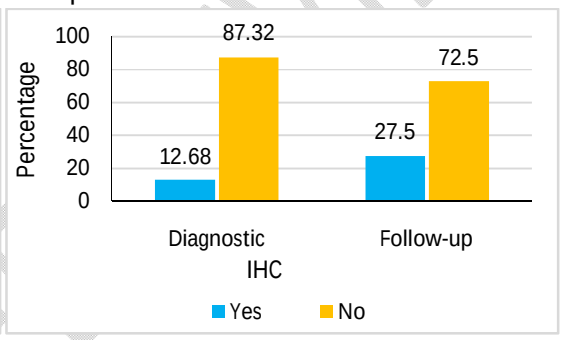


Table 8:

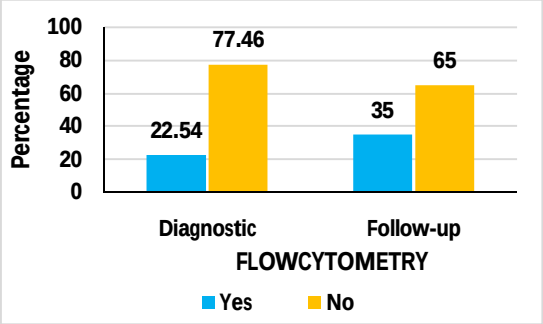
Sr. No.	IHC	Diagnostic	%	Follow-up	%	Grand Total	%
1	**Yes**	9	12.68	11	27.50	20	18.02
2	**No**	62	87.32	29	72.50	91	81.98
	Grand Total	71	100.00	40	100.00	111	100.00

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:



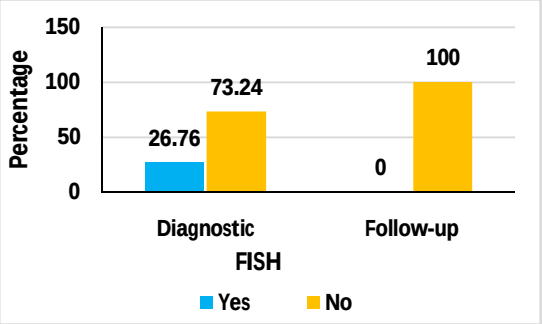


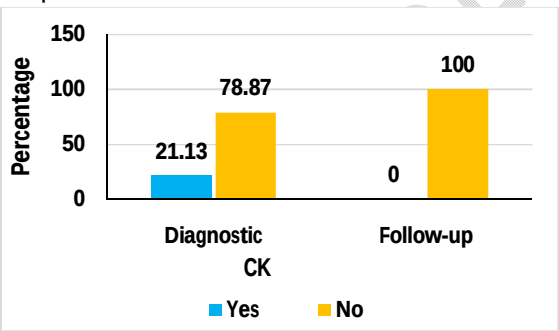
Table 10:

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:

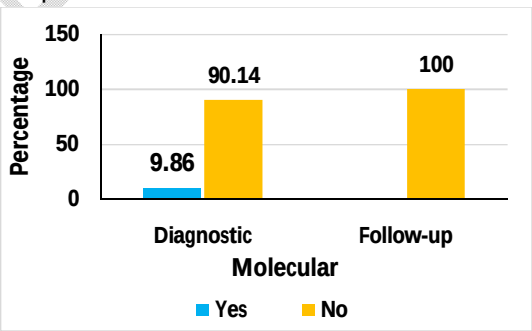


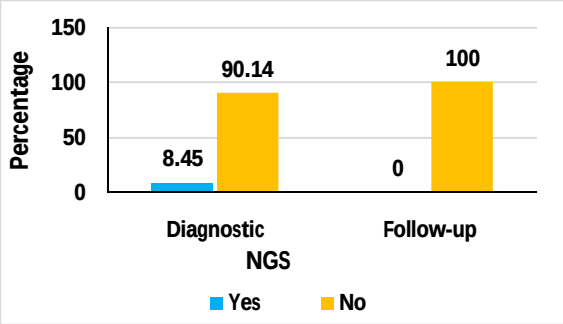
Table 12:

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

1. Riley RS, Hogan TF, Pavot DR, Forysthe R, Massey D, Smith E, Wright Jr L, Ben-Ezra JM. A pathologist's perspective on bone marrow aspiration and biopsy: I. Performing a bone marrow examination. Journal of clinical laboratory analysis. 2004;18(2):70-90.

2. Hyun BH, Gulati GL, Ashton JK. Bone marrow examination: techniques and interpretation. Hematology/oncology clinics of North America. 1988 Dec 1;2(4):513-23.

3. Bashawri LA. Bone marrow examination. Indications and diagnostic value. Saudi medical journal. 2002 Feb 1;23(2):191-6.

4. Jha A, Sayami G, Adhikari RC, Panta AD, Jha R. Bone marrow examination in cases of pancytopenia. J Nepal Med Assoc. 2008 Jan 1;47(169):12-7.

5. Memon S, Shaikh S, Nizamani MA. Etiological spectrum of pancytopenia based on bone marrow examination in children. J Coll Physicians Surg Pak. 2008 Mar 1;18(3):163-7.

6. Sajjad M, Kouser S, Khan T, Al Abideen Z, Qadir H, Mehmood M. Pattern of malignant hematological disorders using bone marrow aspirate and biopsy at tertiary care hospital, Karachi. Journal of Muhammad Medical College. 2022 Jun 21;12(2):145-8.

7. Kakiuchi T, Eguchi K, Koga D, Eguchi H, Nishi M, Sonoda M, Ishimura M, Matsuo M. Changes in bone marrow and peripheral blood lymphocyte subset findings with onset of hepatitis-associated aplastic anemia. Medicine. 2022 Feb 2;101(8).