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Epidemiological Study of Bone Tumors in West Bengal with Special Reference to Correlation between Fine Needle Aspiration Cytology (FNAC) and Histopathology of Bone Tumors

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Abstract: *Introduction- There are still now no standardized bone tumour data available for West Bengal which has a wide geographical variation. Detailed study of correlation between cytology and histopathological findings of bone tumor are very few in literature for this part of India. Aims and objective-So the present study helps us to know the distribution of bone tumors in West Bengal as well as to delineate correlation between cytology and histopathological findings of bone tumor studied in this part of India. Materials and methods-Patients within age range of 5-65 years have been selected for this survey as most of the primary bone tumours are restricted within this age group. Retrospective and Prospective datas were collected during the time period of 2005-2010 as available data for pathology departments bone tumor cytology and histopathology registry khata and population survey in tumor clinic of out patient department from 2011-16. All recorded datas have been analyzed using standard statistical method (Kappa Statistics) .*

Results-A total of 130 patients were found to have had bone tumours from Pathology dept.registry data of our medical college from suspected 167 cases in this present sample survey studied for the period of 2005 to 2010 .We collected datas further from2011 to 2016 from the collective data of bone tumor clinic of dept. of Orthopedics were found to have had 287 malignant and 67 benign bone tumors among 354 cases selected for this study.

Key words*: Bone tumor,FNAC of bone tumor , histopathology of bone tumor,bone tumor epidemiology,west Bengal.*

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I. Introduction

Bone tumor primarily may be classified according to the tissue of origin - I. Bone-forming tumors; II. Cartilage-forming tumors; III. Giant-cell tumors; IV. Mesenchymal tumors; and V. Vascular tumors. The four most common types of bone sarcomas are osteosarcoma, chondrosarcoma,,malignant fibrous histiocytoma(MFH) of bone, and Ewing's sarcoma(ES). A team at a specialized center, including an orthopedic surgeon with experience in bone tumors, a radiologist, an experienced pathologist and a medical oncologist is essential for the appropriate management of these tumors[1,3].

Bone tumours are relatively uncommon and it is estimated that new cases of primary bone sarcoma is much lower in number in contrast with new cases of lung and breast cancer[2]. Most of the studies on incidence

and relative frequency of bone tumours have been carried out in Europe, USA and other developed countries[1,2]. Relatively little information is available from Asian and African countries[4,5]. There are still now no standardized bone tumour data available for West Bengal which has a wide geographical variation.Furthermore literature review shows that correlation of cytology and histopathological findings of bone tumor in our setup is also very less. So the present study was formulated to know the distribution of bone tumors in West Bengal as well as to know the correlation of cytology and histopathological findings of bone tumor in our setup. The same study can be applied to control the health problem and evaluation of treatment modalities as a whole for bone tumor.

The Aims and Objectives

1. Evaluation FNAC of of benign and malignant bone tumours obtained in catering area of our medical college of West Bengal.
2. To prepare a standardized baseline data bank in relation to FNAC findings of benign and malignant bone tumors in West Bengal.
3. To correlate cytological findings of bone tumor with histopathological features of the bone tumor cases.

II. Materials and method:

Study area: The study was carrird out in the out pateent tumor clinic of dept. of orthopaedics in a govt. medical college of Kolkata.The study also contains the data of bone tumors of dept. of pathology,cytology and histopathology registry khata.

Study population: Patient within age range of 5-65 years have been selected for this survey as most of the primary bone tumours are restricted within this age group.

Study period: Retrospective and Prospective datas were collected during the time period of 2005-2010 as available data for pathology dept. tumor histopathology registry khata and population survey in tumor clinic of out patient department from 2011-16.

Selection of patients and parameters studied: After properly selecting the patients following parameters like age, sex, race, geographical variation, site, history of trauma, FNAC report and histopathlogy reports have been studied .

Study tools:

a. Questionnaire
b. Health record survey
c. Biochemical and hematological report survey
d. Radiological reports evaluation
e. FNAC slides and report
f. Histopathology slides and report evaluation

Plan for analysis of result: All recorded data have been analyzed using standard statistical method (Kappa Statistics)

IV. Result And Analysis

A total of 130 patients were found to have had bone tumours from Pathology dept.registry data of our medical college in Kolkata from suspected 167 cases in this present sample survey studied for the period of 2005 to 2010 among which 103 (81%) malignant and 27 (19%) benign bone tumors were found. We collected datas further of 2011 to 2016 from the collective data of bone tumor clinic of dept. of Orthopedics , as representative data of catchment area of our medical college of West Bengal, were found to have had 287 malignant and 67 benign bone tumors among 354 cases selected for this study from 407 suspected sample of bone tumors during the same time period.

Results of our study are tabulated as follows:

V. Tables and figures

Table – 1 Sex distribution of cases in different malignant bone tumors

Sex	OS (126)	ES (76)	CS (36)	Plsm (4)	MM (13)	HGGCT (20)	MFH (8)	FS (4)
Male	84(66.5%)	27(36%)	24(66%)	3(75%)	7(53.84%)	10(50%)	5(66%)	0
Female	42(33.5%)	49(64%)	12(34%)	1(25%)	6(46.16%)	10(50%)	3(33%)	4(100%)
Total	126	76	36	4	13	20	8	4

OS-osteosarcoma.ES-Ewings sarcoma.CS-chondrosarcoma.Plsm-Plasmacytoma
MM-multiple myeloma.HGGCT-high grade giant cell tumor.MFH-malignant fibrous histiocytoma. FS-fibrosarcoma.

Table 2 - Age distribution of cases in different bone malignancies.

Age/Yr	OS (126)		ES (76)		CS (36)		Plsm (4)		MM (13)		HGGCT (20)		MFH (8)		FS (4)		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
6 -15	37	18	14	25	3	1	X	X	X	X	X	X	X	X	X	X	54	44
%	44%		50%		11%												31.34 %	
16-25	42	21	13	24	X	X	X	X	X	X	10	10	X	X	X	X	15	11
%	50%		50%								100%						38.80 %	
26 -35	5	3	X	X	8	4	X	X	X	X	X	X	3	2	X	X	2	5
%	6%				33%								66%				10.44 %	
36-45	X	X	X	X	6	2	X	X	X	X	X	X	X	X	X	4	1	2
%					22%										100%		4.47%	
46-55	X	X	X	X	7	5	1	1	3	3	X	X	2	1	X	X	5	3
%					33%		50%		50%				33%				11.94 %	
56-65	X	X	X	X	X	X	2	X	4	3	X	X	X	X	X	X	3	X
%							50%		50%								4.47%	
Total	84	42	27	49	24	12	3	1	7	6	10	10	5	3	X	4	39	28

Table 3-Correlation of FNAC and Histopathology findings

Tumors	OS(126)	ES(76)	CS(36)	PL(4)	HGGT(20)	MFH(8)	MM(13)	FS(4)
Consistent with H/P diagnosis	60(50%)	54(71.4%)	24(66.6%)	3(75%)	20(100%)	x	4	X
Not Consistent with H/P diagnosis	17(13.3%)	X	x	1(25%)	x	1	x	1
Non diagnostic	36(28.3%)	11(14.28%)	8(22.2%)	x	x	2	x	X
Could not be done	17(13.3%)	11(14.28%)	4(11.1%)	x	x	x	x	X

Table 4- Correlation between cytology and histopathology of primary malignant bone tumors.

Histopathology→

	OS	ES	CS	PL	GCT	MM	MFH	FS
OS	61							
ES		63						

CS	6		24					
PL				4				
GCT					20			
MM				1		12		
MFH								1
FS								
Others	10	8	5				2	1

Cytology

OS- Osteosarcoma, ES- Ewing's Sarcoma, CS- Chondrosarcoma, PL- Plasmacytoma, MM- Multiple Myeloma, GCT- High Grade Giant Cell Tumor, MFH- Malignant Fibrous Histiocytoma, FS- Fibrosarcoma.

Among 287 cases of primary malignant bone tumors 217 cases were correlated cyto and histologically by Kappa statistics
Kappa coefficient from this table calculated by the formula
Observed agreement – Chance agreement
1- Chance agreement

Kappa coefficient for this table of combined cytology and histopathology is 0.59.
The proposed standards for strength of agreement for the kappa coefficient:
≤0=poor, .01-.20=slight, .21-.40=fair, .41-.60=moderate, .61-.80=substantial, and .81-1=almost perfect.
So for the cytology and histopathology of primary malignant bone tumors it is of Moderate agreement.

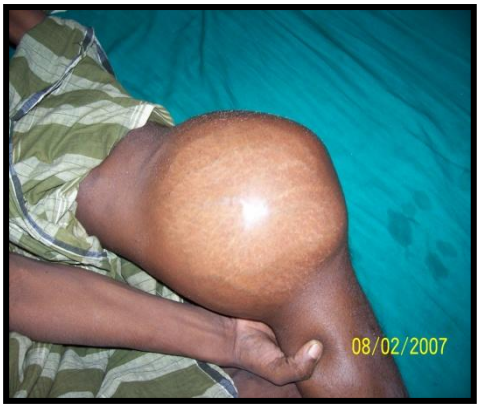

Figure 1- Clinical photograph of osteosarcoma. A huge globular swelling in lower end of left femur.

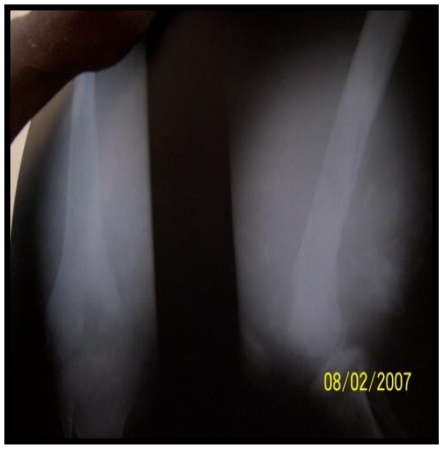

Figure 2- X ray film of the same patient showing the tumor in the lower metaphyseal area of left femur.

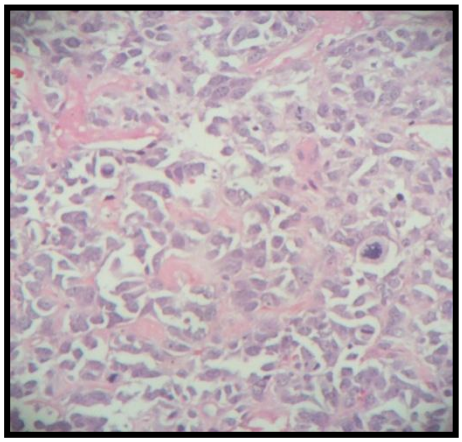

Figure 3- Photomicrograph of histopathological section of the tumor showing pink osteoid and malignant osteoblasts H & E 100X.

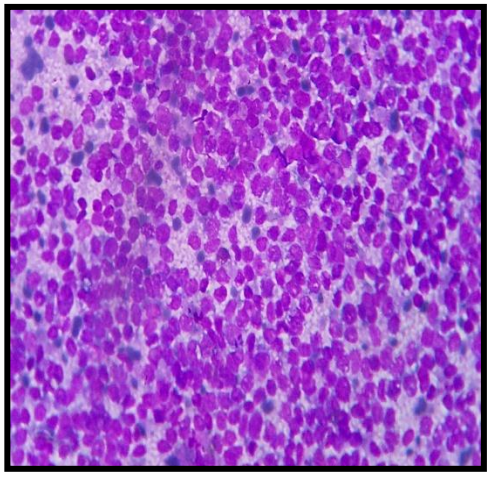

Figure 4: FNAC Ewing's sarcoma. Small blue uniform round cells. LG 400 X.

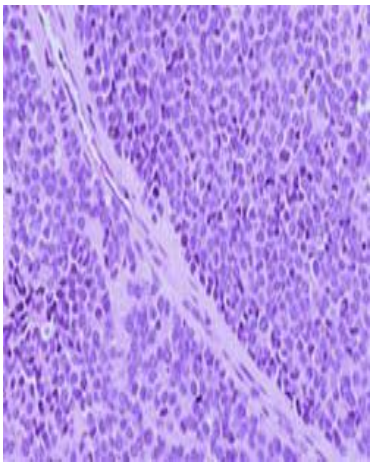

Figure 5: Ewing's sarcoma:Biopsy material showed a highly cellular, infiltrative neoplasm consisting of sheets of tightly packed, round cells with very scant cytoplasm

VI. Discussion

A total of 130 patients were found to have had bone tumours from Pathology dept.histopathology registry data of our medical college, Kolkata from suspected 167 cases in this present sample survey studied for the period of 2005 to 2010 among which 103 (81%) malignant and 27 (19%) benign bone tumors were found. We collected datas further from2011 to 2016 from the collective data of bone tumor clinic of dept. of

Orthopedic as representative data of catchment area of our medical college of West Bengal were found to have had 287 malignant and 67 benign bone tumors among 354 cases selected for this study from 407 suspected sample of bone tumors during the same time period. Benign bone tumors are 21% and primary malignant bone tumors are 37% and secondaries are 24% as registered in bone tumor registry case records(Table1,2).

Cause of lower percentage of benign tumors may be due to their prolonged symptom free period and thereby non-attendance to hospital and cause of lower percentage of secondary bone tumors in comparison to primary malignant bone tumors may be due to the referral of those cases to other discipline of primary site concerned .

The histopathological reports were corroborated with clinic-radiological findings and other investigation reports. Among 354 cases of bone tumors 289 (81.22%) were correctly matched with cytological and histopathological diagnosis(Table3,4).

In the present epidemiological evaluation of distribution of bone tumors on the tripod of time (age), place (site) and person (sex) we had 126 cases of osteosarcoma (44.77%), 76 Ewings sarcoma cases (20.89%), 36 chondorsarcoma cases (13.43%), high grade GCT 20 cases (5.97%), plasmacytoma 4 cases, 8 cases of MFH, 13 multiple myoloma and 4 fibrosarcoma cases out of 287 cases of primary malignant bone tumors. Among the cases of benign bone tumors a higher percentage of low grade GCT had been noted which if taken together with high grade GCT give rise to higher percentage of giant cell tumor in population survey(Table2,3).

Kumar R.V. et al[6] reported that Osteosarcoma (37.7%) and Ewing's sarcoma (15.6%) were the most common primary lesions. The age of the patients ranged from 6 – 65 years with maximum number of patients in the 16-25 year age group (38.80%) followed by 6-15 years age group (31.34%). Rao et al[7] performed a study on 523 cases of primary bone cancers in Dakshin Kannada district of Karnataka, India, over a period of 36 years and they reported peak incidence of this tumor was in 2nd and 3rd decade of life with a male preponderance. But in the study of Hicks et.al [8] the mean age of this tumor is 10 year. In our study also among 67 cases 39 (58.20%) were male and 28 cases (41.80) were female. A male preponderance also observed by some other authors like Snyder and Coley[9] Ottolenghi et.al[10,12,13] and Moore et.al[11,12,13]

In our study among the 126 osteosarcoma cases 84 (66.50%) were male and 42 cases (33.50%) were female and this male preponderance of osteosarcoma is also supported by the work of Murphey et.al[14] where male was 68% and female was 32% among the 40 patients of osteosarcoma. We had 50% of osteosarcoma cases at age group 16-25 years followed by 44% in 6-15 years. But in the rest 6% cases of higher age group (26-35 years) there is female preponderance.

Among the 126 cases of osteosarcoma histologically 113 (90%) cases were diagnosed as conventional variety which is also supported by the study of Hicks et.al[8]. 6.66% cases of osteosarcoma were telangiactetic variety in histopathology and few were parosteal variety in our observation. Conventional variety is the commonest osteosarcoma diagnosed(Fig1,2,3).

The incidence of Ewing's sarcoma in our study is 20.89% which is obviously to some extent lower in contrast to literature findings. In our observation of Ewing's sarcomas, all occurred in age groups 6-15 year and 16 – 25 year in equal percentage (50%). Out of 76 Ewing's sarcomas 49 were female (64%), 27 (36%) were male which is in contrast to the said study by Ijaj Ahmad et al [15,16] who also reported about male preponderance of Ewing's sarcoma in Pakistan[17]. FNAC was consistent with Ewing's tumor in 70% (63) cases which yielded cellular smears and the cells were uniform looking, round and small with scanty cytoplasm and round nuclei, arranged in small clusters, sheets and singly. Similar observation was made by Akhter M. et.al[17] Meis T.M. et.al [18] and Silverman JF et. al.[19] The absence of tumor giant cells and osteoid in the 20 cases of this study was also found by Hajdu and Melame[20] and Ackerman et.al[21] in their studies(fig4,5).

0ut of 36 chondrosarcoma cases which is 13.43% of our series, and which is very close to 15% incidence of chondrosarcoma studied by Schazowicz et.al[22] and 11% by Dahlin and Unni [22]. 24 (66%) cases were occurred in male and 12 in female (34%) which is tallied with 2:1 (M:F) sex ratio in literatures of classic conventional chondrosarcoma by Schazowicz et.al [22] who showed male 65% and Dahlin and Unni [23] 60%. Chondrosarcomas are seen to be occurred in higher age groups. In our study, among 36 cases 32 (88%) were occurred in 26 – 55 year in contrast to age range of 20 to 60 years as found by the study of Gitelis et.al 1981[23,24]

The number of high grade giant cell tumor was 20 which is 5.97% in our study of primary malignant bone tumors, and they have equal incidence in male and female. All the 20 cases of high grade GCT were seen in 16 – 25 year age group in contrast to the study of Yoshinao et. al[25,26,33] who reviewed eight (8) cases of primary malignant giant cell tumor of bone and found that there was a wide range in age from 17 to 76 years, with the sixth decade of life being the most common and the tumor was more frequent among females (male to female ratio--3:5).

Solitary Plasmacytoma of bone were 4 cases (5.97%) in our study and 75% of plasmacytoma occurred in male but in 13 cases of multiple myeloma there is equal incidence in male and female. Plasmacytoma and Multiple myeloma occurred in a higher age group 50 – 65 years but Patients presenting with Solitary

Plasmacytoma of bone were younger, as compared to the patients with multiple myeloma and these features are tallied with other studies as found n literature.[27,34,35,36]

Cause of lower percentage of benign tumors may be due to their prolonged symptom free period and thereby non-attendance to hospital and cause of lower percentage of secondary bone tumors in comparison to primary malignant bone tumors may be due to the referral of those cases to other discipline of primary site concerned or to the dept. of Radiotherapy for treatment.

The histopathological reports were corroborated with clinic-radiological findings and other investigation reports. Among 354 cases of bone tumors 289 (81.22%) were correctly matched with cytological and histopathological diagnosis.

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FNAC was consistent with Ewing's tumor in 70% (63) cases which yielded cellular smears and the cells were uniform looking, round and small with scanty cytoplasm and round nuclei, arranged in small clusters, sheets and singly. Similar observation was made by Akhter M. et.al[28] Meis T.M. et.al [29] and Silverman JF et. al.[30] The absence of tumor giant cells and osteoid in the 20 cases of this study was also found by Hajdu and Melamed [31] and Ackerman et.al[32] in their studies.

The Overall sensitivity of FNAC of primary malignant bone tumors showed in our study to have 56.71%. Sensitivity of FNAC was highest in Malignant GCT 100% then in chondrosarcoma 75%, Ewing's sarcoma 70%, and osteosarcoma 50%.

Although our study was based on biopsy proven cases and was spread over a time period of 10 years because of lack of proper data recording system, the results obtained can't be claimed as the representative of the whole population.We have to take into account the following reasons:

1. We don't have properly organized hospital based and population based tumor registry.
2. Only a small portion of our population is motivated and this leads to poor follow up of cases and to understand the value of diagnosis.
3. Vast majority of the people are poor and living in rural areas with bad communication, thus has little chance to attend medical colleges which are located in big cities only.
4. A large number of people living even in the cities, go out side west Bengal just after hearing the diagnosis of cancer as no so called one roofed state of art bone tumor institute is available here.

Inspite of all these pitfalls a beginning has been made to conduct the epidemiological study of bone tumor and the correlation of cytological and histopathological features of bone tumors on the scientific basis and this search will goes on.

VII. Summary And Conclusion:

There is still now no standardized bone tumour registry available for West Bengal which has a wide geographical variation as far as both orthopaedic and pathology departments are concerned. So the present study helps us to know the age and sex wise distribution of bone tumors in West Bengal.Furthermore a statistical correlation data is now formulated in context of west Bengal regarding the cytological and histopathological features of bone tumors. .The same study can be also be applied to control the health problem and evaluation of treatment modalities as a whole. In our study there are some limiting factor like difference of opinion on FNAC and biopsy slide review reports, lack of initiative from different dept. to register their cases in bone tumour clinic and absence of any specialized bone tumours center within govt. hospital.

So, to conclude we can say that a continuous work is required in this field to prepare a proper and statistically significant bone tumor register in this region of West Bengal and the search will goes on.

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