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Prospective Study of Core Needle Biopsy on Bone Lesion

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Original Research Article

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Abstract: Bone is the host to many diseases. Diagnostic biopsies of bone lesions are generally done in two forms i.e. Percutaneous core needle biopsy or open surgical biopsy. Core needle biopsy is initial method of tissue diagnosis in bone tumours. To study the adequacy and accuracy of core needle biopsy in diagnosing bone lesions. To establish definitive diagnosis of bone pathology. The study was conducted in department of pathology, MNJ Cancer Institute and TB & Chest hospital, Osmania Medical College, Hyderabad. A total of 53 cases were analyzed prospectively for a period of two years from October 2015 to September 2017. Female to Male ratio was 1.1:1, Average age 3 to 70 years. Out of 53, 26 cases were primary malignant bone tumors, 12 were metastatic deposits, 10 were benign tumours (9 -Giant cell tumors,1-osteo chondroma) 2 were chronic osteomyelitis,3 were not adequate. In 26 cases of primary malignant tumours 10 - osteosarcoma, 6 - ewings sarcoma, 4 - chondrosarcoma, 2 - plasma cell neoplasm, 1 case was high grade NHL, 1 - chordoma, 1 synovial sarcoma,1 germ cell tumour. Adequacy rate (94.6%) in our study is in concordance with the similar study of Amit Joshi *et al*., (2013) where adequacy rate was 92%.present study is also in concordance with study of Logon et al with adequacy rate of 97.8%. It has demonstrated that the Core needle biopsy is a safe, easy, and effective technique for the evaluation bone tumours, with a high rate of diagnostic yield and accuracy.

Keywords: Core needle biopsy, Bone lesions, Adequacy rate, Osteosarcoma, Ewings sarcoma.

INTRODUCTION

Bone is host to many diseases which range from infectious/inflammatory, metabolic bone disorders, benign and malignant neoplasm's. Bone tumors are one of the commonest complaints encountered in surgical oncology OPD's which makes it important to differentiate between benign and malignant conditions before treating it. The successful diagnosis and treatment plan can be decided by the team approach involving pathologists, radiologists, surgeons, oncologists and radiotherapists in the management of bone tumours [1-4].

Surgical management of patient can be divided into 3 phases pre, intra and post operative. Vitally important is preoperative decision making and planning. The foundation of this success is through preoperative histopathological diagnosis which is most definite of methods of preoperative diagnosis [4-6].

Diagnostic biopsies of bone lesions are generally done in two forms i.e. Percutaneous core needle biopsy or open surgical biopsy [7-9]. Core needle biopsy also known as Tru-cut biopsy is initial method of tissue diagnosis in bone tumors [2]. It avoids unnecessary excision biopsy. Hence most widely used compared to open biopsy [1, 2, 5].

This study is aimed to find out the adequacy and to establish definitive preoperative diagnosis of bone pathology by means of core needle bone biopsy histopathological examination (HPE)

Core biopsy has evolved as an alternative to fine-needle aspiration. This technique improves diagnosis of histological subtype and grade compared with fine-needle aspiration [10]. The sensitivity ranges from 81.8% to 100%, specificity from 91% to 100%, and diagnostic accuracy from 72.7% to 100%. In addition, the complication rate is only a 0.1% to 1.1% [1].

In core needle biopsies the false negative rate is lower. The architecture of tissue is preserved; thus, it is usually possible not only the histological diagnosis and the grade of tumor, but also allows an immuno

histochemical or molecular analysis [11-12]. The advantages are low risk of contamination and minimally invasive procedure for the patient [5, 13].

In case of deep lesions, the aid of CT guidance has further increased the accuracy, reduced complications, and therefore has now become the procedure of choice [2, 14].

Indications of core biopsy of bone lesions

Suspected bone metastasis, primary bone tumours, Skeletal infection Other malignant and indeterminate lesions whose nature cannot be confirmed by clinical biologic and imaging features [7-8].

Contraindications of core biopsy of bone lesions:

- No Absolute Contraindications
- When there is suspicion of highly vascular lesion Eg. Metastasis from kidney and thyroid carcinoma [7-8].

Equipment and Technical aspects

- Radiological guidance(CT, MRI, USG, Fluoroscopic):
- Biopsy needles: Core needle bone biopsy can be performed with different types of needles, depending on biopsy site and type of lesion [8].
  - Trephine biopsy needles
  - Co-axial biopsy needles
  - Cutting needles

Trephine biopsy needle: They include following needles Ackerman needle, Craig needle, Turkel needle, ostycut needle, T-Jamshidi needle Figure-1.

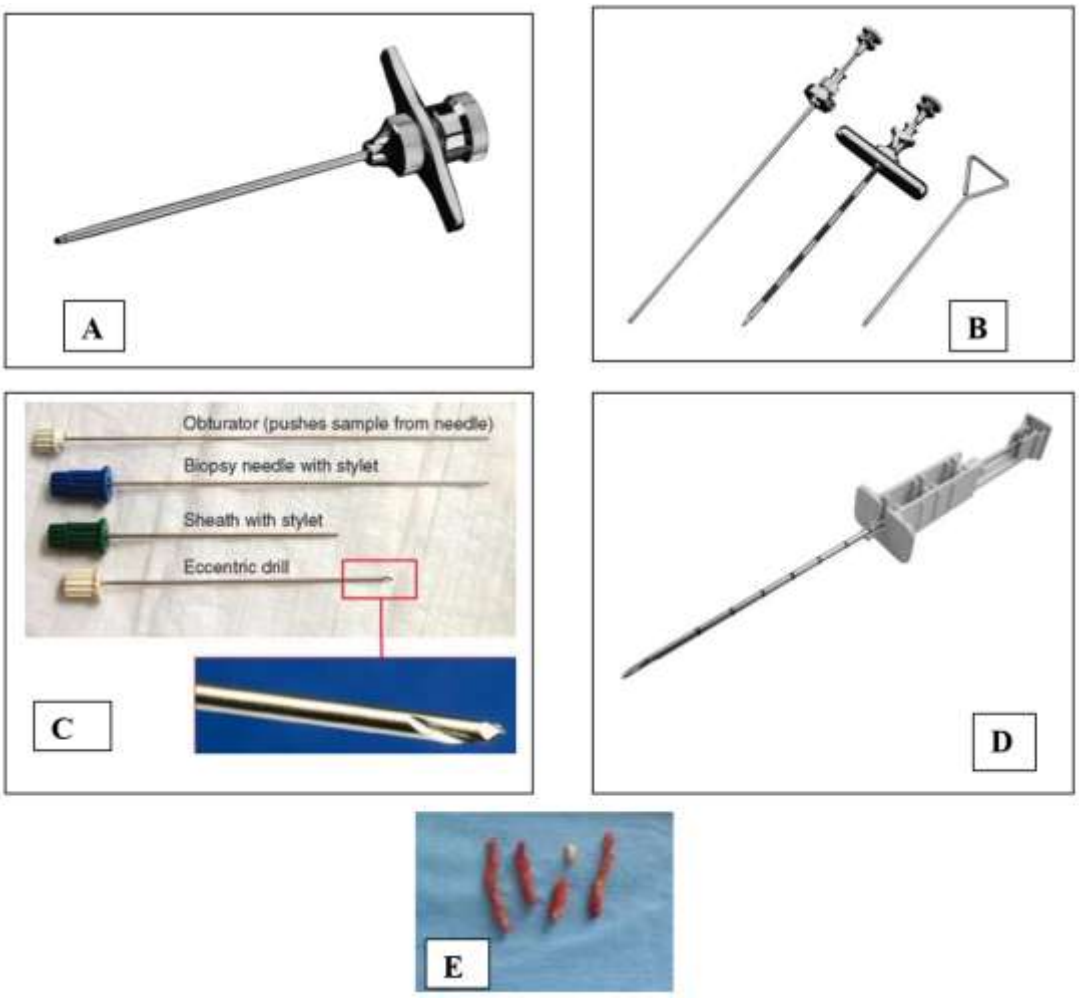

Fig-1: A - Jamshidi needle, B - Ackerman needle, C- Bonopty needle, D- Tru-cut biopsy needle, E - Core needle biopsy specimen

Coaxial biopsy needle: is more frequently used for sclerotic lesions. Eg: Bonopty needle.

Cutting needles: are used in Osteolytic lesions with destroyed cortex that are usually used for soft tissue biopsies. Eg: Tru-cut needle and sure cut needle.

AIMS & OBJECTIVES

To study the adequacy and accuracy of core needle biopsy in diagnosing bone Lesions. To establish definitive diagnosis of bone pathology by core needle bone biopsy

MATERIALS AND METHODS

The study was conducted in department of pathology, MNJ Cancer Institute and TB & Chest hospital, Osmania Medical College, Hyderabad. Patient with clinical and/or radiological suspicion of bone lesions were referred to department of pathology.

A total of 53 cases were analyzed prospectively for a period of two years from October 2015 to September 2017.

Fifty-three patients (53) were referred for core needle biopsy, of whom 13 were selected for CT guided biopsy,4 were selected for USG guided biopsy and in 36 cases biopsy was done by palpation method without any image guidance.

Biopsies were performed as daycare procedure under local anesthesia in supervision of using Jamshidi needle in 44 cases, Tru-cut biopsy needle was used in 9 cases of bone tumours with soft tissue extension.

Core biopsy specimens were immediately fixed in formalin. After fixation decalcification was done by using 10%nitri acid and then routine processing was done.

After paraffin block preparation, in all cases, 4-µm-thick sections of formalin-fixed, paraffin-embedded material were stained with hematoxylin and eosin. Histochemical techniques and immunohistochemical marker studies were performed in selected cases to increase diagnostic information.

Diagnostic accuracy, sensitivity, specificity, and positive and negative predictive values were determined on the basis of correct differentiation between malignant tumors and benign conditions. The results were compared with literature

OBSERVATIONS AND RESULTS

Out of 53, 28 were female and 25 were male patients. Female to Male ratio was 1.1:1 Average age ranges from 3 to 70 years.

Out of 53, 26 cases were primary malignant bone tumors, 12 were metastatic deposits,10 were benign tumours(9 -Giant cell tumors,1-osteo chondroma) 2 were chronic osteomyelitis,3 were not adequate Chart 1 & 2.

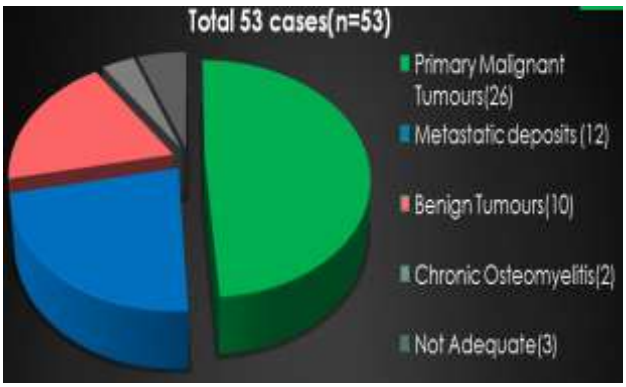

Chart-1: Diagnostic results of core needle biopsy

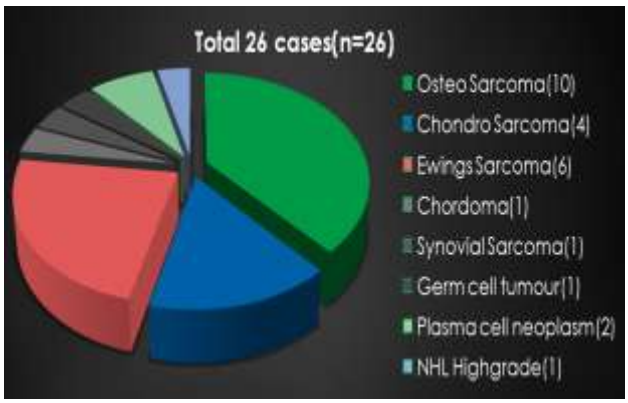

Chart-2: Diagnostic results of primary malignant bone tumours

In 26 cases of primary malignant tumours 10 cases were osteosarcoma, 6 were ewings sarcoma, 4 were chondrosarcoma, 2 were plasma cell neoplasm, 1 case was high grade NHL, 1 was chordoma, 1 synovial sarcoma,1 germ cell tumour Figure 2 & 3.

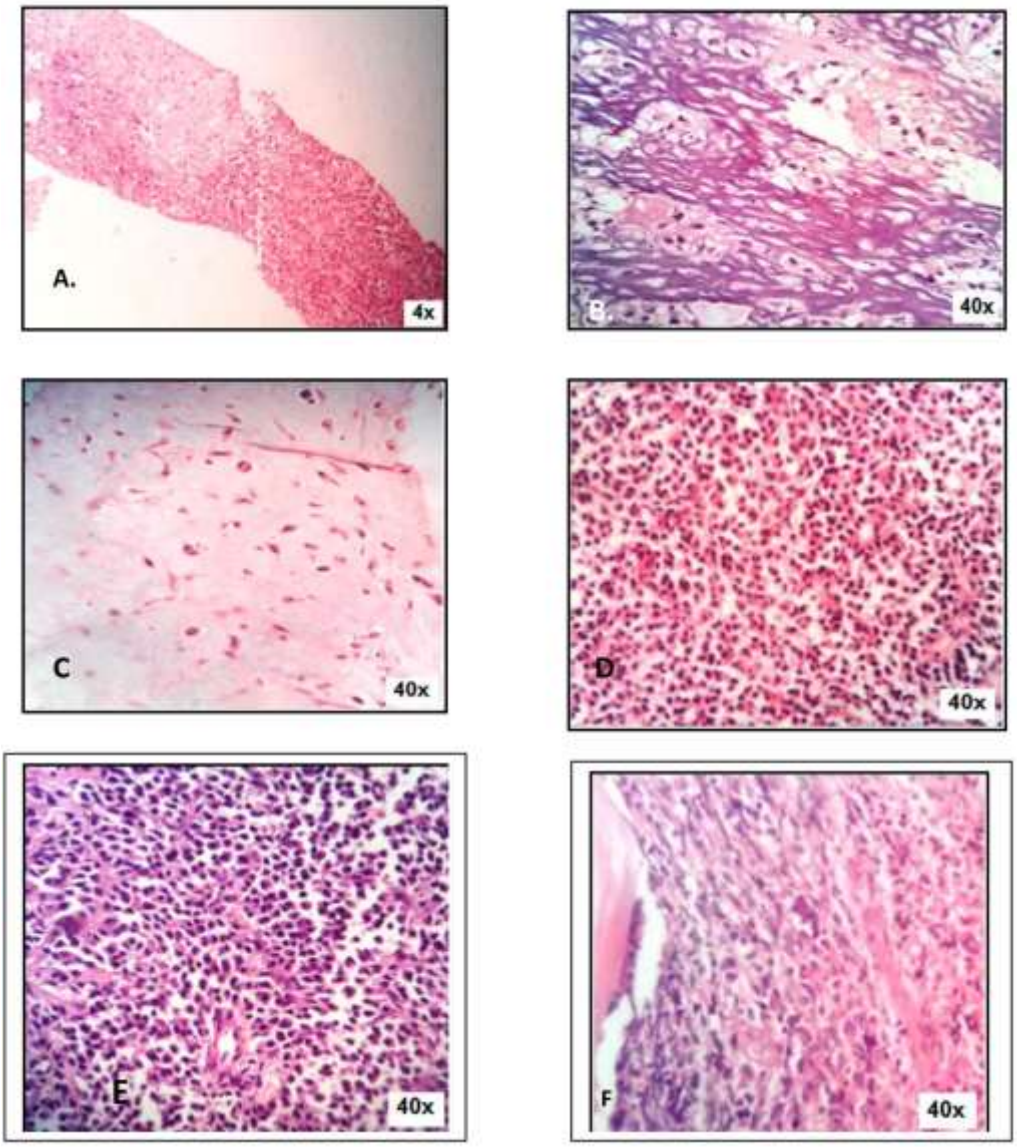

Fig-2: A – Low power view of Osteosarcoma, B - Osteosarcoma showing characteristic basophilic thin trabeculae of neoplastic bone with an appearance of reminiscent of fungal hyphae, C- chondrosarcoma with predominance of myxochondroid areas, D- ewings sarcoma showing uniform cells, E- plasma cells with abundant cytoplasm and eccentrically located nuclei, F - NHL showing centroblast like cells with indented nuclei and scattered small lymphocytes

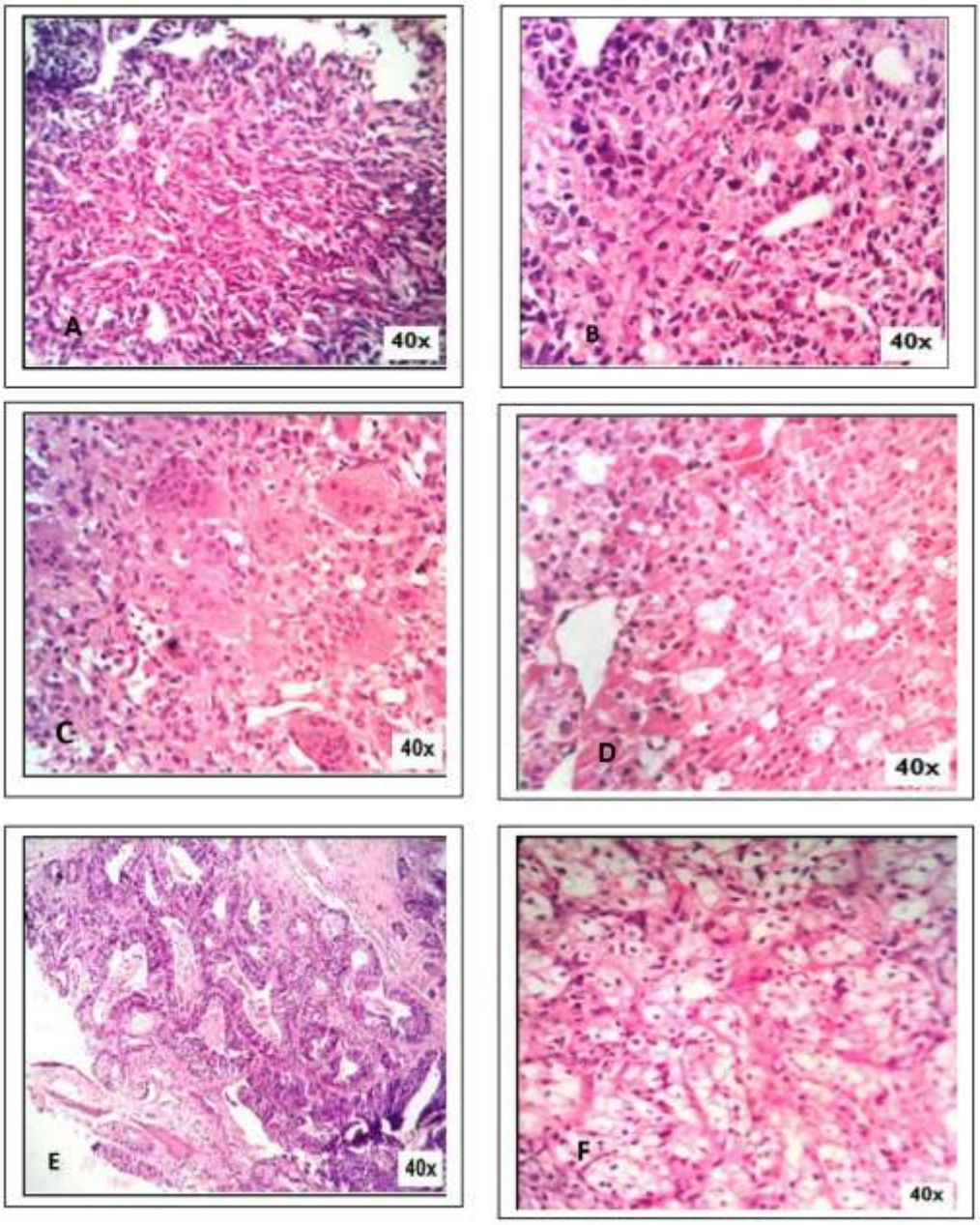

Fig-3: A- synovial sarcoma showing spindle cell sarcomatous component and hemangiopericytoma like areas, B - Germ Cell tumor, C - GCT showing uniform cells and spatial distribution of osteoclast giant cells. D- H&E Microphotograph of FTC mets, E- Microphotograph of adenocarcinoma mets, F- Microphotograph of RCC mets

In our study12 patients, 10 with a prior diagnosis of carcinoma (2cases of intestinal adenocarcinoma, 2 cases of lung adenocarcinoma, 1case of follicular hurthle cell carcinoma of thyroid, 2 cases of renal cell carcinoma, 2 cases of infiltrating ductal carcinoma, 1 case of squamous cell carcinoma lung) and 2 cases of bone tumours with unknown primary carcinoma/sarcoma, had a biopsy to confirm or rule out metastasis.

In our study in total of 53 cases, in 50 cases biopsy sample is adequate to diagnose only 3 were not adequate. Adequacy rate is 94.6%.

Adequacy (diagnostic field) : sample which can be interpreted and have pathological tissue on basis of which a diagnosis can be achieved.

In our study out of 53, in 36 cases which can be palpated easily in those cases Tru-cut biopsy was done without image guidance. Palpation method is also as effective as image guided biopsy.

Lesions in the spine, paraspinal area and pelvis are difficult to target, in those cases biopsy was done by using ct guidance and 12 out of 13 were adequate (92.3%). USG guided biopsies were done in 4 cases, with adequacy rate of100%.

Out of 50 cases which were diagnosed by core needle biopsy, 2 cases of osteosarcoma and 2 cases of ewings sarcoma were on neoadjuvant chemotherapy, 1 case of plasmacytoma was on chemo and radiotherapy, 11 cases of metastatic deposits were on palliative chemotherapy and 2 cases of chronic osteomyelitis were followed up with medical treatment. Total 18 cases out of 50 were on medical treatment and follow up.

3 cases (1 metastatic deposit from breast ductal carcinoma, 1 osteosarcoma, 1 germ cell tumour) were lost to follow up. Total 29 cases were undergone appropriate surgery based up on core needle biopsy diagnosis.

DISCUSSION

Successful pre-operative diagnosis of pathologic bone lesions is of great importance when considering the treatment and prognosis of the disease. Vitally important is histological diagnosis before starting definitive management of bone tumours [1, 3].

Before 1982 optimum method of biopsy was subject to debate. Open biopsy is considered the gold standard, most of the malignant tumors of the extremities were treated with amputations in the past.

Tru-cut biopsy is considered as initial method of tissue diagnosis in bone tumours. Schneitzer and Deely and Kattapuzam *et al*., suggested the use of the Tru-cut biopsy method in bone lesions [10] Ultrasound, CT scan, fluoroscopy, and even MRI can be used to guide the needle to the correct location and to improve the accuracy of Tru-cut biopsy .

Adequacy rate (94.6%) in our study is in concordance with the similar study of Amit Joshi *et al*., where adequacy rate was 92% [1]. Present study is also in concordance with study of Logon et al with adequacy rate of 97.8% Table-1 [7]**.**

Table-1: Showing Adequacy rate in different similar studies

Study by	Adequacy rate
Torraini Martin *et al*., [15]	96.9%
Amit Joshi *et al*., [1]	92%
Logon *et al*., [7]	97.8%
Present study	94.6%

Tru-cut biopsy of suspected primary bone neoplasm is a well-established procedure, with a reported accuracy in diagnosis ranging from 69% to 99% and low complication rate of 0% to 6% [17].

Adequacy rate of palpation method in our study was 94.4%. Similar study by Amith joshi *et al.*, reported that the palpation technique seems to be equally effective as image guided biopsies , and is more feasible as it can be performed without the need of any equipments and it is cost effective as well [1].

Adequacy rate of CT guided biopsy method was 92.3%, this is in concordance with the study by N. A. Jambhekar *et al*., in 2006 where adequacy rate of CT guided core needle bone biopsy was 96% [2]. CT-guided core needle biopsy facilitates definitive therapy without the patient having to undergo a major surgical procedure for diagnosis [2, 3, 5 6, 11, 12].

In one case biopsy was done to exclude residual or recurrent disease of synovial sarcoma at the primary site that is medial condyle of tibia after treatment with chemotherapy and radiotherapy. Recurrence of synovial sarcoma was confirmed. In similar study by Jambhekar et al in 2005, in two patients, biopsy was performed to exclude residual or recurrent disease at the primary site after treatment with chemotherapy and/or radiotherapy. Recurrence was confirmed in one and excluded in the other [2].

In our experience there were few limitations in case of cystic lesions and myxoid tumours, special caution is necessary, which may yield biopsies with indeterminate diagnosis . In present study this problem was emerged in 2 cases, in one myxoid chondrosarcoma confirmed at definitive surgery, another patient with a juxtracortical cystic lesion. Several authors recommended special caution in myxoid tumors, which may yield biopsies with indeterminate diagnoses [18].

N. A. Jambhekar *et al*., reported biopsies of cartilaginous tumors are of little value unless malignant cells are identified; In these specific situations, careful analysis of clinical and imaging data is crucial and may warrant direct referral for open biopsy or even definitive surgical treatment (such as in low-grade chondrosarcomas) [2].

In 9 giant cell tumours which were diagnosed by core needle biopsy treated with curettage and bone grafting. In similar study by jambhekar *et al*., in 2005, where accuracy rate was 95.7%, biopsy from lesion at T3 in a young patient reported as a giant cell tumour that was treated with curettage but the final diagnosis that emerged was a giant cell-rich osteosarcoma. In this case Tru-cut biopsy was considered as inaccurate [2].

In total 29 cases who underwent surgical treatment, our core needle biopsy diagnosis was matching with definitive diagnosis after surgery.

Accuracy rate in our study was 100%. It is in concordance with other similar studies. eg:the study of F. Pohlig *et al*., where accuracy rate was 100% [16], study of Amit Joshi *et al*., where accuracy rate was 94.5% [1], the study of Logon et al with accuracy rate of 96% [7].

The diagnostic accuracy, sensitivity, specificity, and positive and negative predictive values are presented in Table 2 & 3.

Table-2: Showing diagnostic accuracy, sensitivity, specificity, and positive and negative predictive values

Parameter	N	Percentage (%)
Accuracy	47/47	100%
Sensitivity	20/20	100
Specificity	9/9	100
Positive predictive value	19/19	100
Negative predictive value	10/10	100

Table-3: Showing comparison with previous similar studies

Study by	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Amit joshi *et al*., [1]	92.85%	100%	100%	57.14%
Torraini Martin *et al*., [15]	96%	100%	100%	95%
F.Pohlig *et al*., [16]	100%	100%	100%	100%
Present study	100%	100%	100%	100%

In present study we used Jamshidi needle in all 53 cases. The most common complications are pain, hematoma and infection, although there are isolated reports of severe neurologic damage, hemorrhage, pneumothorax,and tuberculous sinus tracts [17]. Being a simple and complication-free method makes the Core needle biopsy technique preferable [1, 7].

Stoker DJ *et al*., started the therapy in 84% of their cases following core needle biopsy without the need-for any excision biopsy [19].

In the present study of core needle biopsy of bone lesions in 53 cases, adequacy rate was 94.6% and accuracy rate was 100% with 100% sensitivity and specificity and no complications associated with procedure. Akira Kawai, Kohji Taguchi, Shinsuke Sugihara, Toshiyuki Kunisada and Hajime Inoue *et al*., [20] Fifty-eight specimens (87.9%) were judged to be adequate and able to differentiate malignant tumors from benign lesions in 98.3% of the cases and arrive at a specific diagnosis in 91.4%.

SUMMARY AND CONCLUSION

As a result of advances in chemotherapy and surgical techniques in case of bone tumours, amputations was largely been replaced by limb salvage surgeries. Histological diagnosis before starting definitive management of bone tumours is vitally important.

Our prospective study of 53 consecutive core needle biopsies on bone lesions shows adequacy rate of 94.6% and accuracy rate of 100% with 100% sensitivity and specificity and no complications associated with procedure. It has demonstrated that the Core needle biopsy is a safe, easy, and effective technique for the evaluation bone tumours, with a high rate of diagnostic yield and accuracy. It facilitates definitive therapy without the patient having to undergo a major surgical procedure for diagnosis.

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