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EVALUATION OF DIAGNOSTIC ACCURACY OF CORE NEEDLE BIOPSIES IN BONE AND SOFT-TISSUE LESIONS: AN INSTITUTIONAL EXPERIENCE

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HOW TO CITE THIS ARTICLE:

E. Jaya Shankar, Shailaja Prabhala, B. Kishore Reddy, Sreenadh Boppana, N. Eshwar Chandra, T. Ramamurti. "Evaluation of Diagnostic Accuracy of Core Needle Biopsies in Bone and Soft-Tissue Lesions: An Institutional Experience". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 51, October 09; Page: 11874-11880, DOI: 10.14260/jemds/2014/3565

ABSTRACT: INTRODUCTION: Tissue diagnosis is essential for effective management of bone and soft tissue lesions. In this regard pathologist plays a crucial role in patient management by giving appropriate diagnosis. **AIMS AND OBJECTIVES:** The aim of the present study was to evaluate the diagnostic accuracy of core needle biopsies (CNB) by comparing with excised specimens, and to calculate the specificity (sp), sensitivity (sn), positive predictive value (ppv) and negative predictive value (npv) of CNB, and to study the complications. **MATERIALS AND METHODS:** We retrospectively reviewed all the bone and soft tissue tumor cases (60 cases, 50 bone and 10 soft tissue cases). Core needle biopsies (CNB) were performed in all cases at our institute, using a Jamshidi needle for bone lesions and tru-cut needle for soft tissue lesions between March 2010 and February 2014. Biopsy accuracy and errors were determined on the basis of histopathological examination of the excised specimens. **RESULTS:** Of the sixty CNBs done at our institute, we had 32 benign (30 bone & 2 soft tissue) and 28 malignant (20 bone & 8 soft tissue) cases. On correlating with excised specimens CNB reports were diagnostic and accurate in 58 cases (96%). Two false negative cases (major errors, 8% and 0% minor errors) reported. The sp, sn, ppv, and npv were calculated for benign and malignant lesions. No complications were seen with CNB. **CONCLUSION:** The present study indicates that core needle biopsy is safe and reliable for diagnosing the bone and soft tissue lesions.

KEYWORDS: Bone and soft tissue lesions, needle biopsy, diagnosis.

INTRODUCTION: In this era limb-salvage procedures are increasingly common in the treatment of malignant lesions of bone and soft tissues. Open biopsy has been the conventional procedure for obtaining adequate and representative sample for tissue diagnosis. Disadvantages of this procedure include spillage of tumor cells and wound complications.^[1] Core needle biopsy (CNB), has been used as a powerful tool to diagnose and there by a treatment plan can be decided by the team approach involving surgeons, radiologists, oncologists, radiotherapists and pathologists in the management of bone and soft tissue lesions.^[2]

The CNB has been shown to be safe and effective with studies reporting diagnostic accuracies of 69 % to 99%, and lower complication rate of 0% to 6%.^[3,4,10] It has high sensitivity and specificity in primary, locally recurrent, or metastatic lesions in various anatomic locations.^[5-7] A retrospective study was undertaken to evaluate the diagnostic accuracy of core needle biopsy of bone and soft-tissue lesions.

MATERIALS AND METHODS: With the approval of hospital ethical committee, a retrospective analysis of diagnostic accuracy of core needle biopsies (CNB) of bone and soft tissue lesions was

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carried out. The study period was from March 2010 to February 2014. During this period, out of sixty cases, fifty bone and ten soft tissue cases underwent CNB at our institute. The needle biopsy was performed as daycare procedure under local anesthesia or with sedation by the surgeon who was a well-trained ortho-oncosurgeon.

The biopsy site was prepared aseptically, and the biopsy was obtained using Jamshidi needle or tru-cut needle. The core biopsy specimens were immediately fixed in formalin and sent for histopathological examination. After receiving the specimen, the bone biopsy was initially put in 10% nitric acid for decalcification, later taken into routine processing. Soft tissues were directly taken into tissue processing. After paraffin block preparation, sections were stained with routine hematoxylin and eosin stain. Major errors, were defined as benign diagnosis in a malignant tumor and minor errors were defined as errors in histopathological grade.^[8,9]

Based on CNB report, decision on wide local excision was made in a tumor board with a team approach. The members in the team include ortho-oncosurgeon, pathologists, radiologists, and medical oncologists. The excised specimen includes the CNB biopsy site and appropriate number of sections were studied from the given specimen. Immunohistochemistry using appropriate antibodies was performed, on paraffin embedded tumor sections mainly in cases of metastatic lesions and soft tissue lesions. By comparing the reports of excised specimen, with the CNB report, the diagnostic accuracy; and the sp, sn, ppv, and npv were calculated to evaluate the diagnostic efficacy of CNB.

RESULTS: Of the 60 core needle biopsies (CNB) done at our institute, we had 32 benign (30 bone & 2 soft tissue) and 28 malignant (20 bone & 8 soft tissue) cases. After correlating the histopathological diagnosis of excised specimen with the reports of CNB, the total diagnostic accuracy of our study was 96.66%. Two false negative cases (major errors, 7.14%) were reported with malignant bone lesions. The diagnostic pitfalls (major errors) occurred in a case of osteosarcoma, where the initial needle biopsy was reported as osteoblastoma, the diagnosis of sarcoma was made on frozen section, and the treatment plan was changed.

In another case of chondrosarcoma, the needle biopsy was reported as osteochondroma, but the excised specimen showed evidence of giant osteochondroma having foci of chondrosarcomatous changes. Minor errors were none. The anatomical distribution of the site of the lesions was shown in table 1. The results of total benign and malignant cases and their comparison with CNB reports were shown in table 2. The specificity (sp), sensitivity (sn), positive predictive value (ppv), and negative predictive value (npv) were 95.23%, 100%, 96.66% and 100% for benign, and 100%, 95.23%, 100% and 96.66% for malignant lesions respectively.

The diagnostic accuracy of CNB in correlation with final histopathological examination of excised specimens was 96.66%. Needle tract spread was seen in two out of 28 malignant. Comparison of our results with other similar studies was shown in tables 3 & 4. Immunohistochemistry was done in all soft tissue sarcomas for further categorizations using antibodies like vimentin, smooth muscle antigen, S100, desmin etc. On follow-up, all the patients with malignant bone and soft tissue lesions received appropriate chemotherapy and radiation. Totally six cases died out of 28 malignant cases to extensive metastases and treatment related complications.

DISCUSSION: The present study, in comparison with other published data, conclusively demonstrates that a single core needle biopsy can provide adequate tissue to make a correct

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diagnosis in most patients suspected of having bone and soft tissue malignancies.^[1-3] Multiple needle biopsies or open biopsy were not performed. Percutaneous needle biopsy is very effective and safe for the diagnosis of musculoskeletal masses.^[1-4] Core needle biopsy enables examination of the tumor architecture and interrelation of its cells.

The specimen is also amendable to special stains or tests, which can aid making an accurate diagnosis.^[4] In the current study, the accuracy of malignant diagnosis was 99.66%, similar to the results that were (69-99%) reported in the literature,^[2-6] the accuracy of correct histological diagnosis was (98%), higher than the percentage (69-77%) reported in literature.^[2-6] The sensitivity, specificity, positive predictive value and negative predictive values were comparable to that reported in the literature [Table 3 & 4].

Though the specificity and positive predictive value of core needle biopsy found be nearer to 100%, the sensitivity and negative predictive value ranges have been reported was 82% to 95%; and 76% to 91% in the literature ^[2-7, 10] this indicates the susceptibility of this CNB to produce false negative results. The reasons for these inaccuracies include surgeon's experience, pathologist's experience, lesion location, and lesion type. In our study, the specificity and positive predictive value were excellent (both 100%) similar to previous reports, but the sensitivity and negative predictive values were 92.85%, and 94% respectively.

The false negative cases (major error) in the present study ^[8, 9] were due to deeper location of the lesion. CNB facilitates the planning of the definitive surgery and neo adjuvant chemotherapy. In addition, non-diagnostic CNB can be easily repeated or followed by an open biopsy without inflicting major morbidity to the patient. But in our study open biopsy was not done in any case. CNB is a safe procedure if performed by skilled persons; complication rates can be as low as < 1%.^[3,10] In the present study the complication rate was nil compared to reported literature. Immunohistochemistry was useful in differentiating primary versus metastasis, and definite categorization of soft-tissue lesions.

CONCLUSION: Core needle biopsy is safe and reliable for diagnosing the bone and soft tissue lesions, and it can be recommended as initial diagnostic modality because of its high specificity and positive predictive value.

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Site	Number of cases (n=60)
Arm (humerus)	04 (Right-2, Left-2)
Fore arm (radius)	03
Fingers	03
Chestwall	02
Spine	04
Hip	02
Gluteal region	02
Thigh	06
Femur	18 (Right -12, Left-6)
Tibia	16 (Right-10, Left-6)

Table 1: Anatomic distribution of lesions biopsied

Sl. No	Report on CNB with number of cases	Final HPE	Correlated (yes/no)
Bone cases (Excised)			
1.	Granulomatous inflammation ⁽⁰²⁾	Granulomatous inflammation ⁽²⁾	Yes.
2.	Acute non-specific arthritis ⁽⁰⁶⁾	Not available	-
3.	Giant cell tumor ⁽¹⁰⁾	Giant cell tumor ⁽¹⁰⁾	yes
4.	Aneurysmal bone cyst ⁽⁰⁴⁾	Aneurysmal bone cyst ⁽⁰⁴⁾	yes
5.	GCT of tendon sheath ⁽⁰²⁾	GCT of tendon sheath ⁽⁰²⁾	yes
6.	Osteochondroma ⁽⁰⁴⁾	Osteochondroma ⁽⁰³⁾ Chondrosarcoma ⁽⁰¹⁾	Yes (3) Major error (1)
7.	Enchondroma ⁽⁰²⁾	Enchondroma ⁽⁰²⁾	yes
8.	Osteoblastoma ⁽⁰¹⁾	Osteosarcoma ⁽⁰¹⁾	No; major error

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9.	Osteosarcoma ⁽⁰⁹⁾	Osteosarcoma ⁽⁰⁹⁾	yes
10.	Chondrosarcoma ⁽⁰⁸⁾	Chondrosarcoma ⁽⁰⁸⁾	yes
12.	Metastasis ⁽⁰²⁾ (Thyroid-1, Breast-1)	Not available	-----
Soft tissues (Excised)			
13.	Neurofibroma ⁽⁰²⁾	Neurofibroma ⁽⁰²⁾	yes
14.	Malignant spindle cell lesion ⁽⁰⁶⁾ (IHC done for categorization)	MFH -1, Leiomyosarcoma -2, Liposarcoma-1, MPNST-1, Fibromyxoid sarcoma-1	yes
15.	Metastasis ⁽⁰²⁾ NHL-1, Sq C Ca-1	Not available	-----

Table 2: List of Non-malignant and Malignant cases and Comparison of Core Needle Biopsy report with Final Histopathological Diagnosis of Excised Specimen

CNB-core needle biopsy; HPE-Histopathological examination; GCT of tendonsheath-Giant cell tumor of tendon sheath; MFH-Malignant fibrous histiocyoma, IHC-Immunohistochemistry, MPNST-Malignant peripheral nerve sheath tumor, NHL-Non-Hodgkins lymphoma, Sq C Ca- Squamous cell carcinoma

Study	year	Number of biopsies	Tissue adequacy	Complications
WCI ³	1992-97	185	100%	1.1%
Prior data ³	1979-97	19-472	83-100%	0-1%
Present study	2010-14	60 (B/M)	100%	0%

Table 3: Comparison of our study with other similar studies

WCI- Washington Cancer Institute

Study	Diagnostic accuracy	Specificity (sp) %	Sensitivity (sn) %	Positive Predictive Value (ppv) %	Negative Predictive value (npv) %
WCI ³	72.7 - 92	100	82	100	82
Prior data ³	64-100	91-100	93-100	100	79-100
Our study	96.66	100	92.85	100	94

Table 4: Comparison of our study with similar studies

WCI-Washington Cancer Institute

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Figure-1 a, b: 40y, male, right humerus-Giant cell tumor, Hematoxylin and Eosin 100x and 400x.
c, d: 32y,female, proximal end of right tibia-Enchondroma; Hematoxylin and Eosin 100x and 400x.

Figure 1

Figure-2 a,b: 16y, female, Lt Iliac mass, Mesenchymal chondrosarcoma, Hematoxylin and Eosin 100x and 400x.
c,d: 14y, female, Upper end of Lt tibia, Osteosarcoma, Hematoxylin and Eosin 100x and 400x.

Figure 2

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Date of Submission: 18/09/2014.
 Date of Peer Review: 19/09/2014.
 Date of Acceptance: 30/09/2014.
 Date of Publishing: 07/10/2014.