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DIAGNOSTIC EFFICACY OF OPEN VS PERCUTANEOUS CORE NEEDLE BIOPSY FOR MUSCULOSKELETAL MALIGNANCIES

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Abstract

Background: A simple yet vital procedure in determining the cause of musculoskeletal lesions is the biopsy. Closed needle biopsy (CNB) is a widely used alternative to open incisional biopsy, which has historically been considered the gold-standard procedure due to its high diagnostic accuracy. CNB can be performed under local anaesthesia at an outpatient clinic or in conjunction with image guidance. The current research compares CNB to open incisional biopsy for the goal of examining the diagnosis reliability for muscles and joints sarcoma patients in an outpatient clinic without the application of real-time image guidance.

Material and Method: This study was conducted from January 2021 to December 2021 at the Department of Orthopedics, Hayatabad Medical Complex, Peshawar. A total of 200 individuals with musculoskeletal sarcoma (soft tissue sarcoma or bone sarcoma were included. Circumstances of CNB with unexplained excision, returning sarcoma, and image-guided procedures (fluoroscopy, ultrasound imaging, CT) were not included

Results: The open incisional biopsy demonstrated 97.14% of the diagnostic accuracy for nature, 89.52% for a particular diagnosis, 89.52% for histological type, and 88.57% for histological stage. In contrast, the CNB demonstrated 96.84%, 89.47%, 88.42%, and 86.32% diagnostic accuracy, respectively. In every histological feature, there was no statistically significant distinction among the two approaches (p-value>0.05). For open incisional a biopsy, the diagnostic scores were 98.13% and 97.94% for CNB, accordingly, and there was no significant difference (p-value >0.05). Six instances (3%) had serious mistakes overall; three cases (2.86%) involved open incisional biopsies; and 3 cases (3.16%) involved CNB. Nine (8.57%) via open incisional biopsy, nine (9.47%) from CNB, and eighteen cases (nine per cent) to minor mistakes were reported. Neither technique has any complications linked to biopsies.

Conclusion: when compared to open incisional biopsies, CNB assessment of musculoskeletal sarcoma may obtain a respectably high diagnostic accuracy rate.

Keywords: Accurate diagnosis, Musculoskeletal sarcoma, Close needle biopsy

Introduction

The biopsy is an easy working that is vital for the accurate identification of reactive, inflamed, pathogenic, and cancerous lesions of the bones and the muscles. While the open incisional approach has historically been accepted as the most effective, it needs local or local anesthesia, an incision, working room services, and high expenses. Open biopsy has an overall diagnosis accuracy of 91 to 96 percent (1-4). Open incisional biopsy reporting can have complications like blood clot, seroma, infection, wound dehiscence with tumor fungation, fracture, and local recurrence (2–5). Open incisional biopsy reporting can have complications such as seroma, hematoma, and contamination, dehiscence of the wound with tumor fungation, fracture, and localized recurrence (2–5). In individuals with sarcoma, a mistake resulting from improper incision site may change therapy choices and have unfavorable effects. Percutaneous methods, such as closed needle biopsy (CNB), have been developed as a substitute to open biopsy. If the relevant features of the tumors were palpable, these procedures might be carried out as a single procedure under minor anesthesia in an outpatient setting or at the radiology suites utilizing guided imaging, such as fluoroscopy, computerized tomography (CT), MRI (magnetic resonance imaging), or ultrasonography (6–17). Less invasive, smaller incisions, time savings, no need for hospitalization, reduced costs, avoiding of general or regional anesthesia, and a lower rate of complications related to the wound are some of the benefits of CNB over open to incisional biopsy. Other benefits include fewer barriers from biopsy wounds to definitive surgery, an earlier start to chemotherapy or electromagnetic radiation, the capacity to perform in challenging but readily available areas (things like as the pelvis or spine), and the ease with which multiple site biopsy can be completed simultaneously. Errors in tumor sampling and a reduction in diagnostic precision are possible drawbacks. The goal of the current study was to evaluate the diagnostic efficacy of open vs percutaneous core needle biopsy for musculoskeletal malignancies

Material and Method

This study was conducted from January 2021 to December 2021 at the Department of Orthopedics, Hayatabad Medical Complex, Peshawar. A total of 200 individuals with musculoskeletal sarcoma (soft tissue sarcoma or bone sarcoma were included. Circumstances of CNB with unexplained excision, returning sarcoma, and image-guided procedures (fluoroscopy, ultrasound imaging, CT) were not included. The Department of Orthopedics, the Histopathological Reports from the Department of Pathology, and the Tumor Registry of the Musculoskeletal Oncology Unit's computerized database were the sources from which the data was obtained. The collected data were patent age and gender, tumor site, Soft tissue sarcoma or bone sarcoma preliminary diagnosis determined by CNB and an open incisional biopsy, each of which was assessed independently for four factors: nature (benign & cancerous), particular Pathological type, Histological grade, and prognosis (name of tumor) and quantity of biopsies in every technique. Final pathological evaluation of the removed material, acquired by final surgical procedure when combined with a surgical, radiography, or lab course at the sense of follow-up. Both major and slight errors and complications from biopsies.

Five orthopedic oncologists with fellowship training in orthopedic oncology at the same facility carried out all CNB and open incisional biopsy operations. Following the completion of all examinations (the lab, CT, magnetic resonance imaging, and bones scanning), every individual had the biopsy. The biopsy premise was tight in all instances, and the quality of the surgical procedures was identical.

Depending on the patient's particular requirements, general, regional, or local anesthetic was used throughout the procedure known as open incisional biopsy in the operating room. Participants were frequently aware of the acute difficulties and spent a night in the hospital after surgery. Using reference to CNB, all instances were administered using Tru-Cut® needles (14GX15cm, Allegiance, the state of Illinois, USA). Following a clinical assessment, laboratory assessment of and review of radiographic imaging, patients were informed of the risks, advantages, and alternatives associated with biopsies. Prior to any operation, their written agreement was obtained.

The CNB was carried out by the authors in a clinic's outpatient procedure room, and the patients were released the same day. In order to execute the CNB, we first cleaned and dressed the area sterilely. Next, we injected 1% lidocaine to provide a local anesthetic, and last we inserted a needle into the mass. MRI of the lesion served as a meticulous guidance for the insertion point, depth, and direction of the needle, following the same guidelines as an open incisional biopsy. The authors made an effort to get several biopsy core (at least four pieces) by coaxial entry with a single entry (15). Every time, the quantity and quality of biopsy cores were examined. In order to prevent crushing artifacts during histopathological analysis, the center specimens were handled with extreme care. If an infection was believed to be present, the specimens were submitted for the cultivation of bacteria or staining. In order to stop the bleeding, the patients' wounds were sealed using a compressive bandage, and they were monitored over at least thirty minutes in order to make sure there were no potential problems right away, such hemorrhage or neurovascular damage. The doctor's recommendation for pain treatment was given to each patient. The biopsy core specimens underwent regular processing such as hematoxylin and eosin dyeing for persistent sections of histopathology, after being preserved in formalin. To validate the diagnosis, specific stains and immunohistochemistry to analyses were carried out in a subset of patients.

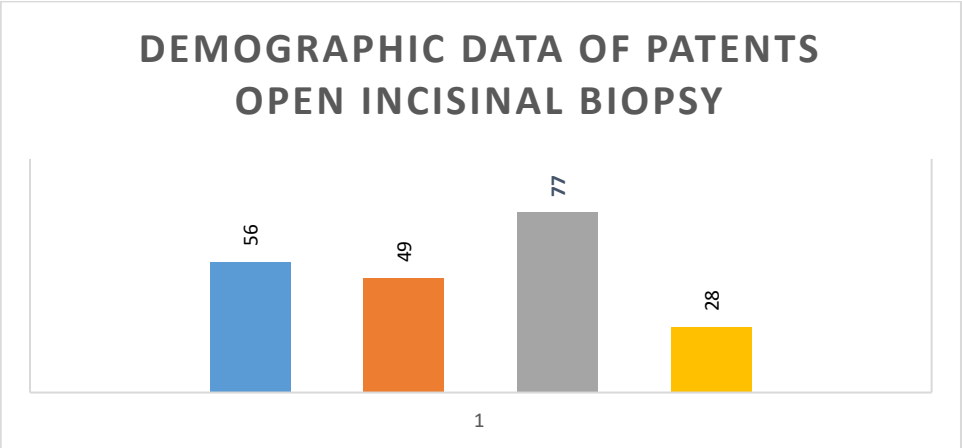
All cases were evaluated and documented by skilled pathologists specialized in bone and soft tissue, according to the 2002 WHO categorization system for bone and soft tissue cancers (18). Orthopedists and examiners have been reviewing pathological slides every week to discuss cases and validate diagnoses. A multidisciplinary group of orthopedics, oncologists, pathologists, and technologists that specializes in musculoskeletal tumors held a monthly interdepartmental carcinoma meeting to examine and discuss the final diagnosis and treatment method for each particular patient.

By comparing both, the authors assessed the main result, diagnostic accuracy, and the secondary outcome, diagnosing yield, error, and complication. Biopsy techniques. In order to assess diagnostic accuracy, we looked at four different characteristics of the histopathology: nature (malignant vs benign), specific diagnosis (tumor name), histological type, and histological grade. Each sample has been evaluated and interpreted in accordance with the guidelines given. The histopathology report consistent with the final diagnosis, which was achieved by obtaining reports of the resected material during definitive surgery and connected with the clinicoradiographic/laboratory or clinical course, is the accurate result. The histology result obtained from a biopsy that is inconsistent with the final diagnosis made by the histology reports of the resected material after definitive surgery, unclear, or necessitating a repeat biopsy is the wrong result. Furthermore, the result definition was used to compute the diagnostic yield and accuracy as follows: The total number of biopsies conducted divided by the sum of true both positive and true negative outcomes is the definition of diagnostic accuracy. The number of successful biopsies (diagnostic result) divided by the total number of biopsies is the diagnostic yield. There were two categories for the mistakes (false positive and false negative): large and small. The major error means misdiagnosis in nature of the tumor, such as misdiagnosing a benign tumor for a malignant one. A small mistake is defined as a misinterpretation of sarcoma in terms of histological grade, histological type, or particular nomenclature. Within two weeks following the procedure, problems connected to the biopsy, including seroma, hemorrhage infection, and wound dehiscence with tumor fungation, were to be identified. In terms of statistical analysis, demographic data, diagnostic yield, and diagnostic accuracy were all measured using statistical methods that were descriptive. Using STATA/MP12, the chi-square or Fisher's exact test was utilized to assess the proportions and establish a correlation between the two biopsy techniques. Each p-value has two tails. A p-value of less than 0.05 was deemed statistically significant.

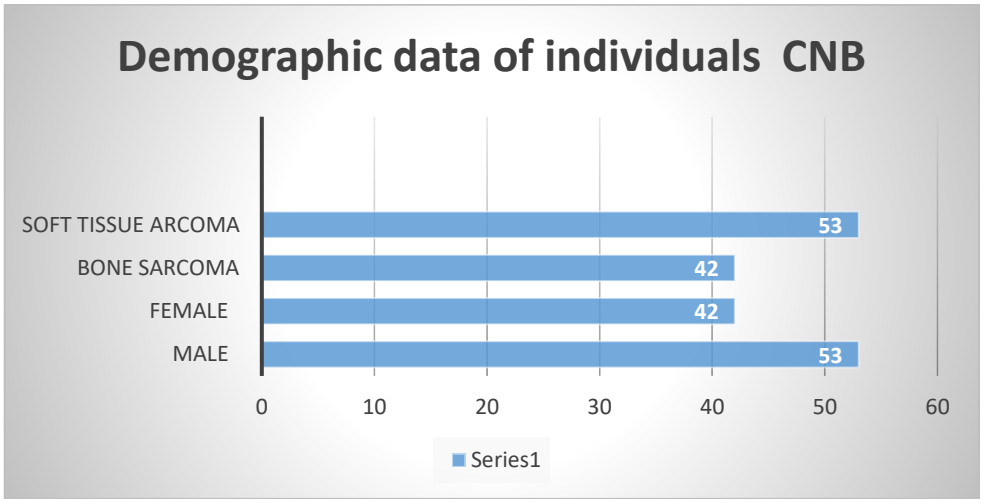
Results

200 participants in total—105 from open incisional biopsy and 95 from CNB—were enrolled in the research; 109 of the cases (55%) were male and 91 of the cases (45%) were female. After an open incisional biopsy, the patients' mean age were 34.8+20 years, but after a CNB, it was 39.4+20.3

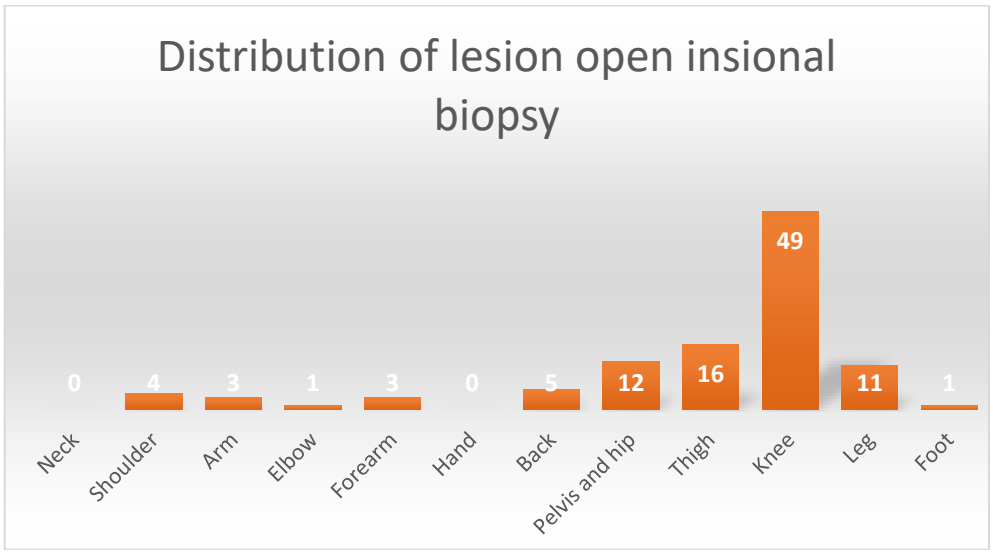
years. Bone sarcoma was found in 120 circumstances whereas soft-tissue sarcoma was present in 80 cases. **Graph 1 and 2** displays the distribution of lesions and patient demographic information.
Graphs 3 and 4 show the final histopathological diagnosis of lesions from both biopsy techniques, which were soft-tissue and common bone sarcomas in the extremities with no variation in distribution. Table 1 displayed the diagnosis accuracy in each area when comparing the two approaches.
In contrast, the diagnostic accuracy of CNB was 96.84% over nature, 89.47% for specific diagnosis, 88.42% for histological type, and 86.32% for histological grade. The open incisional biopsy had diagnostic accuracy of 97.14% for nature, 89.52% for specific assessment, 89.52% for histological type, and 88.57% for histological grade. In every histological feature (nature; the p-value = 0.901 95% CI = -0.432 to 0.380), there was no statistically significant distinction between the two approaches. Diagnosis; 0.991 95% p-value a p value Means 0.803 95% confidence interval (CI) = -0.250 to 0.193 for histological type, p-value Equal 0.63 95% CI = -0.261 to 0.158 for histological grade. Across open incisional biopsy, which stands for the diagnostic yields were 98.13% and 97.94% for CNB, respectively, for both approaches.
Table 2 demonstrates that there was no statistically significant difference between CNB and open incisional biopsy (p-value = 0.919 and 95% confidence interval = -0.469 - 0.520). Six instances (3%) had severe errors overall, three cases (2.86%) involved open incisional biopsy, and three cases (3.16%) used CNB.
Nine circumstances (8.57%) had open incisional biopsy, nine of them (9.47%) used CNB, and eighteen cases (9%) involved small errors. Misdiagnosis of benign conditions as malignant, such as epithelioid sarcoma for fibromatosis, giant cell tumor for osteosarcoma, and chondroma for osteosarcoma, were significant errors in CNB. All patients were appropriately handled despite the error that was made. One patient had another open incisional biopsy, while the other two received broad local excision, either with or without chemotherapy, as treatment for sarcoma. Since the authors use a multidisciplinary strategy, clinic-radio-pathological diagnostic concept, and histological data in addition to other techniques, they diagnose musculoskeletal tumors. For this reason, pathology and clinical and radiographic data must be consistent. Misdiagnosis of a tumor called as fibromatosis, epithelioid cancer as fibrmatosis, and cancer as giant cell tumor were the three main inaccuracies made in the open incisional biopsy procedure. One case's histological grade, one case's histological grade and histological type, and seven cases' histopathological grade with histological type and particular diagnosis all had little error in their CNB interpretations. Minor errors a single example of misdiagnosis in histological grade, one case of histological grade that was incorrect with histological type, and seven cases of histological grade with histology type with a particular indication were found by open incisional biopsy. With regards to the two biopsy techniques, there were no issues.



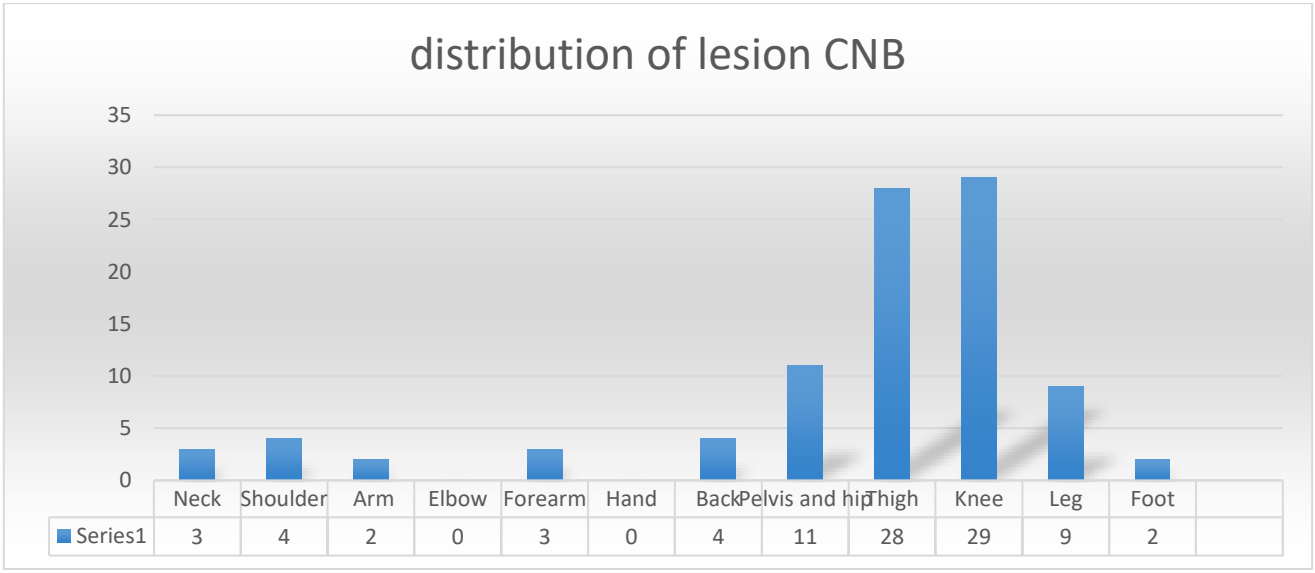
Graph 1



Graph 2



Graph 3



Graph 4

TABLE 1 Final pathological diagnosis for open incisional and close needle biopsy

Final pathological identification for open incisional and close needle biopsy		
	Open incisional biopsy	Close needle biopsy
Sarcoma of soft tissue		
Malignant histiocytoma	7	14
Synovial tumor	8	10
Myxoid melanoma	4	9
Leiomyoma malignance	2	6
Epithelioid malignant cells	2	6
Fibro tumor	2	3
Lipoid malignancy	1	3
Malignant peripheral nerve sheath cancer	2	1
Bone malignancy		
Osteosarcoma	55	1
Ewing- sarcoma	11	30
Chondro-tumur	8	9
Chordae	2	3
Adamantinoma	1	0
Total	105	95

Table 2.Comparison of diagnostic accuracy of open incisional biopsy & close needle biopsy

Procedure of biopsy	Accuracy rate %			
	Nature	Proper investigation	Histological type	Grade of tissue
Open incisional biopsy	97.12%	89.50%	90.51%	87.56%
Close needle biopsy	96.83%	89.45%	87.41%	85.30%
The value of p	0.901	0.992	0.801	0.631
95 persent CI	-0.431 to 0.381	-0.226 to 0.223	-0.251 to 0.191	-0.262 to 0.157

Table 3 Comparison of diagnostic yield of open incisional biopsy & close needle biopsy

Comparison of diagnostic yield of open incisional biopsy & close needle biopsy					
Procedure of biopsy	Cases	Sum of all biopsies	Yield in %	P value	95%Cl
Open incisional biopsy	105	107	98.23	0.018	- 0.469 to 0.520
Close needle biopsy	95	97	97.49		

Discussion

The best biopsy method for musculoskeletal malignancy is still up for debate and is often determined by the choices of the operating surgeons. Even though CNB has been used more often these days, several studies have demonstrated its ability to diagnose for musculoskeletal tumors using a variety of methods. These include standard CNB without image guidance, photo guided (such as the procedure, ultrasound scans CT, or an MRI assistance), or any number of devices that have different core sizes. The range of CNB's overall diagnostic accuracy is 68 percent to entirely (6-17, 19-22). The majority of the research in this discipline uses imageguided CNB and consists of retrospective studies without a statistical comparison between the two approaches. Certain research

exclude insufficient or non-diagnostic biopsies from their quantitative evaluation, perhaps leading to an erroneous elevation of rate of accuracy (23–25). Because of direct, precise targeting, picture-guided CNB produces greater diagnostic precision than the CNB with real-time image guidance. Nevertheless, the image-guided biopsies lengthens the procedure's duration, raises its cost, and increases irradiation risk exposure and demand of radiological facilities.

Few studies have been conducted on CNB in an office-based or outpatient clinic environment without the use of image-guided papers that contrast the diagnostic precision of two distinct biopsy techniques. When evaluating routine core needle biopsy to open biopsy for musculoskeletal tumors, Skrzynski MC (2) observed diagnostic accuracy.

The research used an ambidirectional design, comparing a prospective study including 62 individuals who had CNB to a retrospective analysis involving 50 patients that had open incisional biopsy at the same facility. CNB had an 84% diagnostic accuracy rate, whereas open incisional biopsy had a 96% diagnostic accuracy rate. All musculoskeletal lesions, benign and malignant, were present in the individuals.

There was no statistical analytic comparative or subgroup examination of the histological features. Adams SC (6) reported a descriptive study with a high diagnostic accuracy rate using CNB in an outpatient clinic setting without image guidance. However, all malignancies, both primary and secondary, were included in the subjects, and there was no statistical analysis to compare the rate of diagnosis with open incisional biopsy. 52 patients took part in a prospective comparison research comparing CNB with open incisional biopsy, which was described by Thipachart (26). CNB had a diagnosis accuracy of 90.38%, whereas open incisional biopsy had a 98.37% accuracy rate. However, the patient subjects were limited to soft tissue tumors, such as both benign as well as malignant lesions, which were compared among two techniques in the same patient concurrently and under operating theater circumstances.

When compared to earlier research, the authors' findings on the diagnostic accuracy of CNB are also excellent. In four histological subgroups' subgroup analysis

Regarding nature, particular diagnosis, histological type, and histological grade, the precision of diagnosis was comparatively lower in the subgroups. The success rates for open incisional biopsy contrasted well with this outcome. Because we only included individuals with malignancy and excluded patients with other musculoskeletal diseases, there seems to be a good diagnostic accuracy for CNB. Based on clinical and radiological data, the authors carefully conducted biopsy procedures on these individuals. A few restrictions apply to our investigation. Since the research was retrospective in nature, patients were chosen at random and may use any technique. A prospective, randomised, controlled trial where the only variable is the kind of biopsy conducted is the best method for studying comparisons of outcomes.

However, as the same standards were used for both patient groups' inclusion in this research, they could be compared. Each patient had a sarcoma that presented clinically similarly. The same team of skilled orthopaedic oncologists conducted the biopsy using both methods in a modern setting at the same hospital, and the same team of skilled bone and soft tissue pathologists examined the findings. Furthermore, our subject matter only covered primary malignancies of the bone and soft tissues (sarcomas); benign lesions resembling tumours, infections, and metastases were excluded. Therefore, our study's diagnostic accuracy did not accurately reflect the accuracy of musculoskeletal lesions as a whole. Additionally, we were unable to conduct the same number of specimens in every instance and could only do the CNB on one kind of instrument—the TruCut® needle—for all patients. It looks to have greater fluctuation in the quantity of biopsy core samples.

Nonetheless, in order to maximise diagnostic output (15), we made an effort to collect at least 4 core specimens for every biopsy, and all biopsy specimens were handled by the same team of orthopaedic cancer specialists at the same hospital. As a consequence, the findings regarding various needle kinds could not be represented in our research. Finally, because the authors conducted their research at a sarcoma therapy centre using a multidisciplinary team approach and had several experienced experts engaged from the start of the treatment procedure, including the biopsy, our

findings may not apply to other settings. Notwithstanding these drawbacks, the research offers essential and relevant clinical data.

Correct diagnosis is essential to starting treatment for musculoskeletal tumours. To achieve this, sufficient sample amounts, the right portion of the lesion, and precise histopathological interpretation by a qualified pathologist are required for a final diagnosis. Biopsy mistakes may sometimes arise based on these considerations. Even with an open biopsy, the histological malignancy of some lesions could not be distinguished, such as well-differentiated it from innocuous lipoma or myxomatous tumour.

The majority of representative regions may be ignored since the CNB has a limited quantity of sample material and sarcoma sometimes exhibits histological variability. In some cases, a biopsy may provide a different preliminary diagnosis than a conclusive diagnosis based on the resected material. It suggests that in order to arrive at a definitive diagnosis, a thorough study of the whole material be required. In these situations, getting many samples from different levels from the lesion under imaging data may reduce the possibility of a false positive. In addition to histological results, our clinical and radiographic methodology is our guiding premise for diagnosing musculoskeletal tumours. The kind of tumours may be inferred from image results from radiographic methods (computed tomography, magnetic resonance imaging, plain radiography, etc.). The diverse professionals on this team include radiologists, pathologists, orthopaedic oncologists, and nurses. Before looking at the tissue, the pathologist has to be aware of these information in order to make a differential diagnosis.

To ensure that the musculoskeletal lesions are correctly diagnosed, the team must maintain closed communication. In order to secure the experts' participation, the authors advise doing the close needle biopsy at hospitals with a history of treating

Skeletal muscle injuries. Although a cost analysis of CNB was not particularly conducted by the authors in the current research, there have been reports of savings when using CNB instead of open incisional biopsy (2, 26), which is what we hypothesize in the current study for the same scenario.

Conclusion

In conclusion, compared to an open incisional a biopsy, the CNB can diagnose musculoskeletal sarcomas with an adequate high level of diagnostic accuracy in an outpatient clinic without immediate imaging guidance. It is a dependable technique for musculoskeletal sarcoma diagnosis. To diagnose musculoskeletal sarcoma with caution, however, a multidisciplinary team approach based on the clinic-radio- pathology diagnostic concept should be carried out. This approach has been used in our institution's medical procedures.

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