Unplanned Surgical Incisions in Bone and Soft Tissue Tumor Biopsy: Are we up to the mark?

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ABSTRACT

Objective: To determine the frequency of inappropriately placed biopsy incision in patients with bone and soft tissue tumors.

Methods: This retrospective cross sectional study was conducted in Orthopaedic and Oncology unit Rehman Medical Institute**.** The records of all the patients with bone and soft tissue tumors presented during time period extending from 23rd May 2017 to 23rd June 2022 were reviewed. Appropriateness of the surgical margins and surgical scars were assessed after complete staging studies. During subsequent surgery, if required, the need for complex reconstructive procedures in the form of local or free flaps or skin grafting was assessed along with ablative surgery due to the wrongly placed surgical incisions.

Results: The records of 451 patients were studied out of which 184(40.79%) patients had biopsies performed in the author's institution. Of the remaining patients 77(28.83%) had wrong or inappropriately based surgical incisions with most of those were in soft tissue tumor cases (75.32%). Few (10.38%, n=8) of the inappropriately based incision cases had to undergo amputation while the rest had their limb salvaged.

Conclusion: The frequency of inappropriately placed biopsy incision in patients with bone and soft tissue tumors was high. We are not up to the mark. We recommend further training for musculoskeletal (MSK) oncology cases performed only in referral units to optimize outcome.

Keywords: Biopsy, Incision, Limb Salvage, Musculoskeletal, Sarcoma, Tumor.

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INTRODUCTION

Sarcomas are a rare and diverse group of malignant tumors derived from the embryonal mesodermal germ layer, with an incidence of approximately 2 to 4 people per 100,000 population per year[1]. They have more than 50 subtypes and are divided into two broad categories: soft tissue sarcoma (STS) and bone sarcomas.[2] The STS is more common than bone sarcomas with ratio 4:1 and there is a male preponderance with a ratio of approximately 1.4:1.3 Anatomically extremities are the most common sites for STS, the lower limb being more commonly involved than the upper limb, with a 28% to 12% distribution of all STS, respectively. The thigh is the most common site in the body for STS, with 44% of all extremities having STS.[3] Diagnostic workup for all sarcomas after clinical examination and local and systemic staging includes a biopsy for histological diagnosis and to confirm the type and grade of the tumor. [4] Planning and execution of biopsy is a crucial step in the diagnosis and treatment of sarcomas with insufficient or incorrect biopsies leading to poor outcomes potentially leading to failure of limb salvage surgery or necessitating more complex reconstructive procedures. Various techniques for biopsies have been described with needle biopsy being the preferred technique at the author's institution due to lower morbidity, and logistical and financial benefits.[5] CT or ultrasound-guided biopsies are recommended for deep-seated tumors.[6] However, in centers with lack of expertise or logistics open biopsies adhering to the principles of biopsy are acceptable and, in some texts, still considered the gold standard. The principles of biopsy must be adhered to in all cases.[7,8] Planning the surgical

approach for biopsy is crucial as the biopsy tract should be considered contaminated with tumor cells when planning and executing definitive surgery. With poorly planned and placed biopsies the chances of amputation due to contamination of non-involved tissue increase and have been shown to result in more adverse outcomes.[9] Given the associated risks it is recommended that centers that cannot adequately investigate the patient should refer them to sarcoma specialist centers before performing a biopsy to optimize their outcomes. [10,11] The surgeon doing the biopsy should be familiar with incisions for limb salvage surgery and standard and nonstandard amputation flaps. Hence an unplanned sarcoma excision or whoops surgery refers to removing a mass without knowing its malignant nature and without applying the principles of sarcoma surgery. [12] Moreover subsequent surgical procedures may become more complex requiring the involvement of plastic and microvascular surgery. Before any planned surgical intervention evaluation should include local and systemic staging. [14] Numerous studies have demonstrated that as a downstream effect of inappropriate excision 7.4%–18.5% of cases require amputation to achieve subsequent local control of the disease.[13,14]

We conducted this study to evaluate the frequency of unplanned and wrongly placed biopsy/excisional biopsy or whoops procedure incisions in sarcoma patients presenting to our service and its effect on patients needing complex reconstructions or amputations.

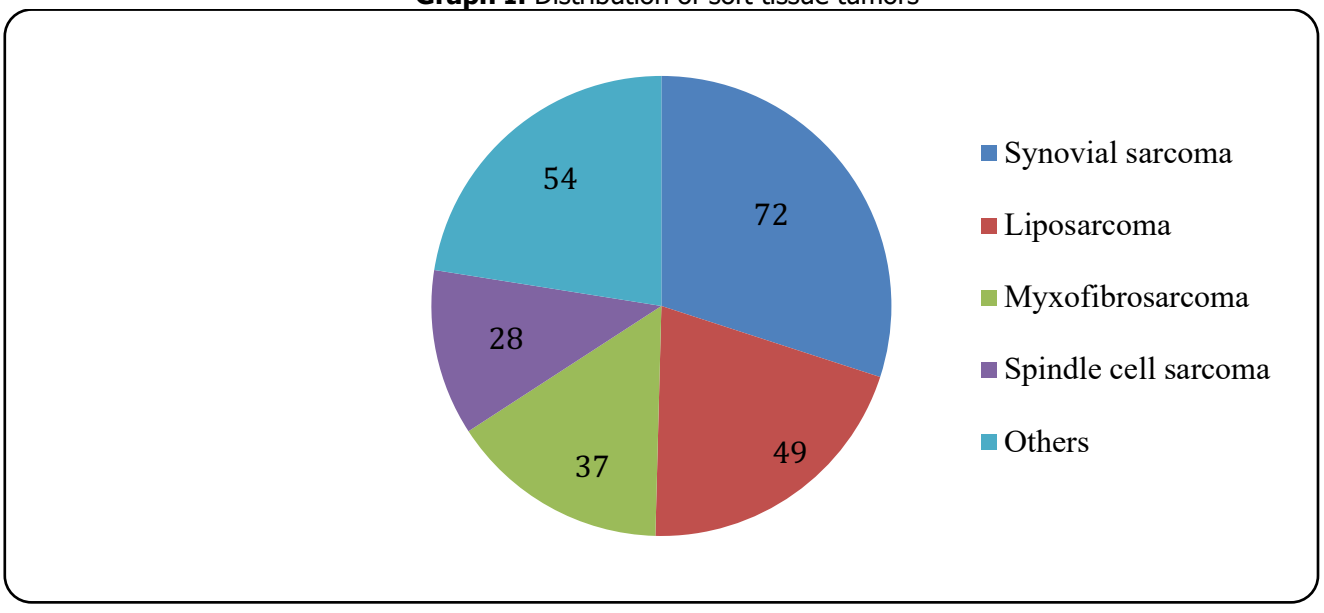
METHODS

We conducted this retrospective cross sectional study in Orthopaedic and Oncology unit Rehman Medical Institute**.** The records of all the patients with bone and soft tissue tumors presented during time period extending from 23rd May 2017 to 23rd June 2022 were reviewed. Appropriateness of the surgical margins and surgical scars were assessed after complete staging studies. During subsequent surgery, if required, the need for complex reconstructive procedures in the form of local or free flaps or skin grafting was assessed along with ablative surgery due to the wrongly placed surgical incisions. Any patients who had missing data were excluded from the study. Data was analyzed using SPSS 2version 24. Frequency and percentages were calculated for qualitative data while quantitative data was presented as mean and standard deviation. Data was presented in graphs where necessary.

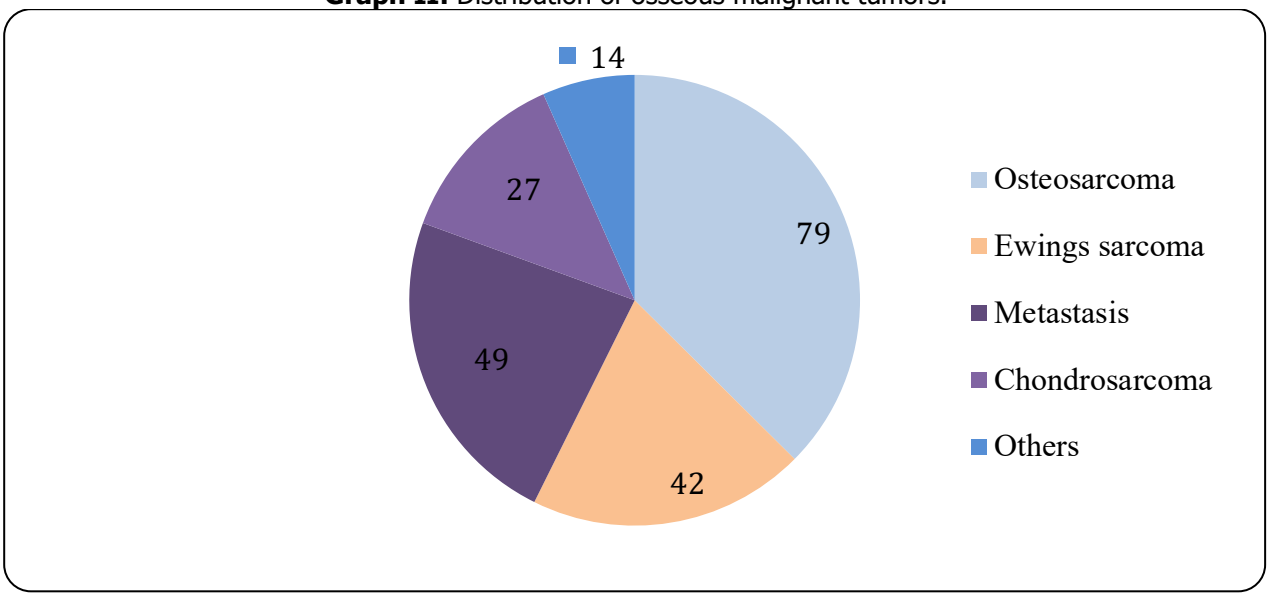
RESULTS

A total of 451 patients were found eligible for inclusion in the study during the defined period out of which 267(59.20%) patients were referred from other units or had biopsies/surgeries performed at other units. Of these cases 240 (53.21 %) patients had soft tissue tumors and the remaining (211,46.78%) had osseous tumors. The most common soft tissue sarcoma was synovial sarcoma documented in 72(30%) patients as shown in graph I.

Graph I: Distribution of soft tissue tumors



Graph II: Distribution of osseous malignant tumors.



The most common primary bone tumor was Osteosarcoma noted in 79(37.44%)(as shown in graph II. After careful review and application of sarcoma surgery principles, 77(28.83%) patients were found to have inappropriately based surgical or biopsy scars, mostly in soft tissue tumor cases (n= 58, 75.32). In a comparative analysis, none of the patients(184) operated on in our sarcoma unit had wrongly placed biopsy/surgical scars.

After staging studies and discussion in multidisciplinary surgical meetings 8(10.38 %) were found unsuitable for limb salvage surgery and underwent amputation. The main reason was the involvement of joints due to previous surgical incisions or multiple surgical incisions not amenable to any reconstructive surgery. The remaining 69(89.62%) patients underwent limb salvage surgery with 12(17.39%) patients requiring plastic and microsurgical intervention.

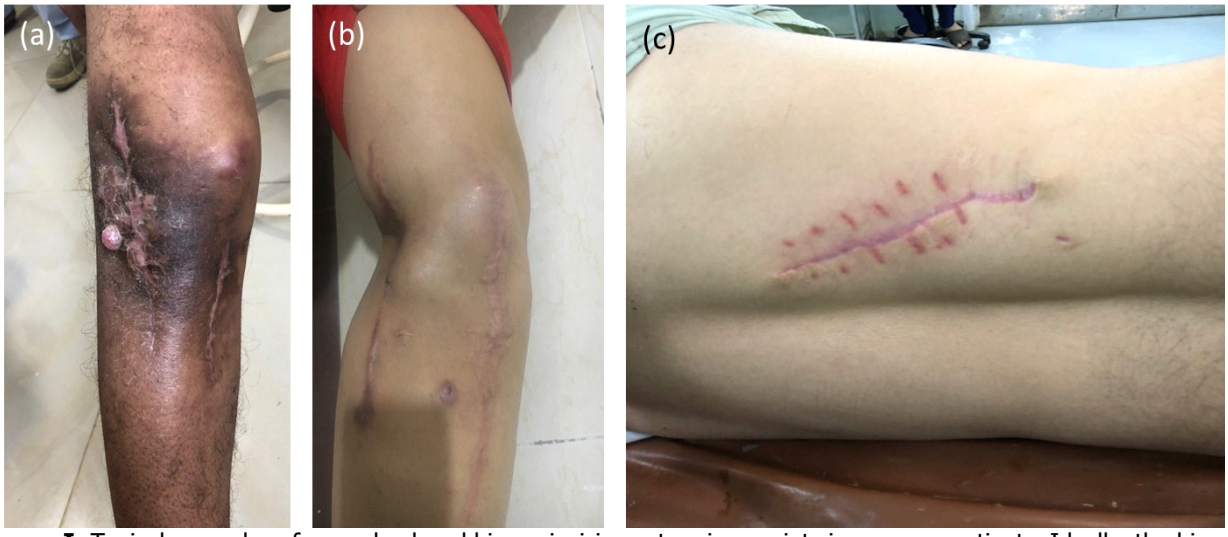


Figure I: Typical examples of wrongly placed biopsy incisions at various points in sarcoma patients. Ideally, the biopsy incision/track should be the final incision line. **(a)** Patient with recurrent synovial sarcoma at the knee, with both medial and lateral incisions for previous surgery not amenable to any reconstruction leading to amputation a consequence. **(b)** Elbow scar due to anterior and posterior-lateral incision for biopsy. The limb salvage surgery, in this case, is complicated because of the inability to excise all the involved tissue. **(c)** wrongly placed an excisional biopsy scar over the back of the patient.

Figure II: Recovery of wrongly placed excisional biopsy limbs after heavy tissue loss. Herein, **(a)** is the lower limb wrongly placed excisional biopsy track crossing the hip joint anteriorly very close to the neurovascular structure. **(b)** is depicting extreme difficulty to excise the scar and achieve negative margins. **(c)** shows successfully achieved clear margins subject to extensive dissections. Likewise, **(d-f)** are the upper limb excisional biopsy track recovery after extensive tissue excision. **(d)** The transverse incisions violate regular surgical planes, making it difficult to achieve clear margins without extensive dissection and soft tissue loss. **(e)** achieved clear

Figure III: Wrongly placed biopsy incision for soft tissue tumor resulting in difficult to achieve clear margin during the definitive procedure.

DISCUSSION

The biopsy is a key step in establishing a diagnosis for the treatment of musculoskeletal tumors. Taking a biopsy is a simple step but should be planned properly to obtain accurate and adequate tissue samples and to avoid complications which can hamper further treatment. Biopsy should preferably be performed by the same surgeon who will perform definitive surgery on the same patient.[15]

The term unplanned excision was first described by Giuliano and Eilber for the excision of benign tumors. [16] Lack of awareness of the principles of tumor management results in inappropriate procedures performed on patients.[17]

Chandrasekar reported 14.7% to 53% of new patients being referred to the sarcoma unit after unplanned surgery.[18] In our study we came across

59.20% of the patients who were sent from other units after the unplanned biopsy was performed. When performed in a specialized center by a trained musculoskeletal clinician, the rate of errors and complications related to biopsy can be significantly reduced. [19] Chen found that when the biopsy was performed in a referring institute, the rate of complications, inaccuracy, and negative impact on further management was two to 12 times higher, in contrast to those performed in a sarcoma unit.[20] In our study none of the patients operated in our unit had any wrongly placed biopsy incisions or scars or any complications.

The error rate is higher in those cases performed in referral institutions in comparison with those performed in a sarcoma unit. Around 50% of cases with major errors in those referred from other institutions, were reported by Mankin in 1996.[21] This rate was 28.83% in our study in which out of a total of 267 referrals, 77 patients were found to have wrongly placed or complicated biopsy incision scars.(fig I,II,III) When performing a biopsy one should keep in mind the possibilities of definitive surgery and should plan the incision in such a way that it will not affect further management. Hoshi et al reported that amputation was performed in 2 patients out of 38 patients who underwent unplanned resection of sarcoma.[22] We came across 8 patients out of 77 in whom limb salvation was not possible, and we had to perform an amputation.

Our study had few limitations. The design of our study was retrospective and our sample size was small. We had not done survival analysis of our patients. Further studies are therefore recommended to address these limitations.

CONCLUSION

The frequency of inappropriately placed biopsy incision in patients with bone and soft tissue tumors was high. We are not up to the mark. We recommend further training for musculoskeletal (MSK) oncology cases performed only in referral units to optimize outcome.

Conflict of Interest: None

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