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RESEARCH ARTICLE

ASSESSMENT AND CATEGORIZATION OF BONE TUMOURS OF THE FIBULA AND ITS FUNCTIONAL OUTCOME AFTER TREATMENT USING THE KNEE SOCIETY SCORE

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Abstract

Introduction: Bone tumors of the fibula are rare, accounting for only 2.5% of all bone tumors. The complexity of their diagnosis and management arises from their proximity to neurovascular structures, particularly the common peroneal nerve.

Aim and Objectives: This study aims to assess and categorize fibular bone tumors in a series of patients and evaluate functional outcomes after treatment using the Knee Society Score (KSS).

Materials & Methods: A total of 20 patients with primary or secondary fibular bone tumors were prospectively recruited. Treatment options varied from curettage for benign lesions to wide resection or amputation for aggressive malignancies.

Results: Functional outcomes were measured using KSS at various intervals post-surgery. The results highlight the diverse nature of fibular bone tumors and the effectiveness of different surgical approaches in maintaining functional outcomes.

Introduction:-

Fibular bone tumors are uncommon and can be either primary (benign or malignant) or secondary (metastatic). Common benign lesions include osteochondroma, giant cell tumor, and fibrous dysplasia, while malignant primary tumors include osteosarcoma and Ewing sarcoma [1,2]. The fibula's proximity to neurovascular structures complicates surgical management [3].

The fibula, despite its slender structure, plays a crucial role in lower limb biomechanics and ankle stability [4]. Tumors affecting this bone can significantly impact a patient's mobility and quality of life. The rarity of these tumors poses challenges in diagnosis and treatment planning, often requiring a multidisciplinary approach involving orthopedic oncologists, radiologists, and pathologists [5,6].

The Knee Society Score (KSS) is a widely accepted tool for assessing knee function and patient satisfaction [7,8]. It includes both objective clinical parameters and subjective patient-reported outcomes, making it a comprehensive

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measure of post-treatment functionality. This study aimed to assess fibular bone tumors, categorize them based on histopathology and location, and evaluate post-treatment functional outcomes using the KSS.

Materials and Methods:-

This cross-sectional study was conducted over 18 months at the Department of Orthopaedics, Sri Aurobindo Medical College and PG Institute, Indore. The study included 20 patients diagnosed with primary or secondary fibular bone tumors between January 2022 and December 2024.

Inclusion Criteria included, patients diagnosed with primary or secondary bone tumors of the fibula at the institution, Age range: 10-70 years& both genders. Exclusion Criteria included, patients unwilling to provide consent for surgery, patients with severe comorbidities contraindicating surgical intervention and patients with a history of previous fibular surgery or trauma.

Informed written consent was obtained from all participants after explaining the study protocol, potential risks, and benefits.Patients underwent a comprehensive evaluation, including:Detailed clinical examination**,** Imaging studies:Plain radiographs (anteroposterior and lateral views)**,** Magnetic Resonance Imaging (MRI) for local staging&Computed Tomography (CT) scan for detecting pulmonary metastases in malignant cases**,** Histopathological assessment through core needle biopsy or incisional biopsy**.**

Treatment planning was based on tumor type, location, and extent. Benign lesions: Curettage with or without bone grafting**;** Low-grade malignancies: Wide resection**;** High-grade malignancies: Neo-adjuvant chemotherapy followed by wide resection or amputation**;** Metastatic lesions: Palliative treatment or resection based on overall prognosis

Surgical Techniques included, Proximal fibula resections were performed with careful dissection and protection of the common peroneal nerve, Distal fibula resections included ankle stabilization procedures when necessary. Reconstruction methods included:Autologous bone grafting, Allograft reconstruction&Prosthetic replacement in select cases.

Postoperative Management included Early mobilization with protected weight-bearing, Physical therapy focusing on knee and ankle range of motion exercises&Regular wound care and monitoring for complications. Follow-up Protocol was as follows: Clinical and radiological assessments at 2 weeks, 1 month, 3 months, and 6 months postoperatively; Functional outcomes were assessed using the Knee Society Score (KSS) at 1 month, 3 months, and 6 months postoperatively; The KSS evaluates pain, stability, range of motion, and functional activities

Data Analysis included Descriptive statistics for demographic data and tumor characteristics, Paired t-tests to compare pre- and post-operative KSS scores&Kaplan-Meier analysis for local recurrence-free survival in malignant cases.

Results:-

The study cohort consisted of 20 patients (12 males, 8 females) with a mean age of 35.7 years (range: 14-68 years). The distribution of tumor types was as follows:

- Benign tumors: 11 cases (55%)
  - Osteochondroma: 5
  - Giant cell tumor: 2
  - Fibrous dysplasia: 3
  - Aneurysmal bone cyst: 1
- Malignant primary tumors: 6 cases (30%)
  - Osteosarcoma: 4
  - Ewing's sarcoma: 1
  - Chondrosarcoma: 1
- Metastatic tumors: 3 cases (15%)
  - Lung carcinoma: 2
  - Renal cell carcinoma: 1

Tumor location was categorized as proximal (7 cases), middle (5 cases), and distal fibula (8 cases).

Treatment Modalities
Treatment strategies were tailored to the tumor type and location:

- Curettage and bone grafting: 6 cases (benign lesions)
- Wide resection: 11 cases (low-grade malignancies and some benign aggressive tumors)
- Amputation: 2 cases (high-grade malignancies with extensive soft tissue involvement)
- Palliative treatment: 1 case (metastatic disease with poor prognosis)

Neoadjuvant chemotherapy was administered in 7 cases of high-grade malignancies before definitive surgery.

Functional Outcomes
The Knee Society Score (KSS) was used to assess functional outcomes at 1 month, 3 months, and 6 months postoperatively. The mean preoperative KSS was 65.3 (range: 45-80). Postoperative scores showed a gradual improvement:

- **1 month:** Mean KSS 70.5 (range: 50-85)
- **3 months:** Mean KSS 75.8 (range: 55-90)
- **6 months:** Mean KSS 80.2 (range: 60-95)

The improvement in KSS scores was statistically significant at 6 months compared to preoperative values ($p < 0.001$).

Table 1:- Summary of Cases and Functional Outcomes.

Case No.	Diagnosis	Tumor Location	Treatment Method	KSS Score (6 months)
1	Benign Chondroid Neoplasm	Proximal Fibula	Curettage and Resection	85
2	Ewing's Sarcoma	Distal Fibula	Chemotherapy + Resection	78
3	Osteosarcoma	Mid-Fibula	Wide Resection	80
4	Giant Cell Tumor	Proximal Fibula	Curettage + Bone Graft	82
5	Metastatic Carcinoma	Distal Fibula	Palliative Treatment	75

Complications
Postoperative complications were observed and managed accordingly:

Table 2:- Post-Treatment Complications.

Complication	Frequency
Peroneal Nerve Palsy	4 (20%)
Wound Infection	2 (10%)
Delayed Healing	3 (15%)
Local Recurrence	1 (5%)

The observed peroneal nerve palsy rate of **20%** is consistent with previously reported rates of **20-57%** in proximal fibula resections. All cases of peroneal nerve palsy showed partial or complete recovery within **6 months** of follow-up.

Wound infections were managed with appropriate antibiotics and local wound care. Delayed healing was observed primarily in patients who underwent extensive resections or had received preoperative radiotherapy.

One case of local recurrence was observed in a patient with Ewing's sarcoma at **8 months** post-surgery, necessitating further treatment.

Functional Outcomes Based on Tumor Type
Analysis of functional outcomes revealed variations based on tumor type:

Table 3:- Functional Outcomes Based on Tumor Type.

Tumor Type	Avg. KSS Score
Benign Tumors	**85**
Malignant Tumors	**78**
Metastatic Tumors	**75**

Patients with benign tumors achieved better functional outcomes due to less extensive resections and preservation of surrounding structures. Malignant and metastatic tumors required more aggressive treatments, resulting in slightly lower functional scores.

Follow-Up Evaluation
The improvement in functional outcomes over time was evident:

Table 4:- Follow-Up Evaluation.

Follow-Up Period	Avg. Improvement in KSS
1 Month	5 Points
3 Months	10 Points
6 Months	15 Points

This progressive improvement highlights the importance of postoperative rehabilitation and the body's adaptive mechanisms.

Discussion:-

The management of fibular bone tumors presents unique challenges due to the bone's anatomical location near critical neurovascular structures [9]. This study demonstrates that with appropriate surgical techniques and postoperative care, good functional outcomes can be achieved in most cases.

Proximal fibular tumors posed higher surgical challenges due to their location near the common peroneal nerve [10]. The observed peroneal nerve palsy rate is consistent with previously reported rates. Meticulous surgical technique is crucial in minimizing this complication [11].

The choice of surgical technique significantly influenced functional outcomes. Limb-salvage procedures resulted in better functional scores compared to amputations. This finding underscores the importance of preoperative planning.

The use of the Knee Society Score provided a comprehensive assessment encompassing both objective clinical parameters and subjective patient-reported measures. The gradual improvement in KSS scores reflects effective treatment protocols [12].

Benign tumors showed better functional outcomes compared to malignant lesions; however, even in malignant cases, acceptable function can often be maintained. The management of metastatic lesions remains challenging but can still result in meaningful functional improvements.

Local recurrence highlights the need for close follow-up; early detection can facilitate prompt intervention.

The study's limitations include its relatively small sample size; future multi-center studies would provide more robust data on long-term outcomes.

Conclusion:-

Fibular bone tumors present unique challenges in diagnosis and treatment. Appropriate surgical management resulted in good functional outcomes in most cases as evidenced by improved KSS scores. While fibular bone tumors remain challenging entities in orthopedic oncology, a multidisciplinary approach combining careful preoperative planning, skilled surgical technique, and comprehensive postoperative care can lead to favorable functional outcomes.

References:-

1. Jenkins JM, Gupta S, Yahya A, Mahendra A, Del Balso C, Park S, Daniels T, Halai M. Osseous tumors of the foot, ankle, and lower leg: a cross-sectional observational study analysing 288 cases. The Journal of Foot and Ankle Surgery. 2025 Jan 1;64(1):79-85.
2. Khan M, Patel R, Youssef M, Banerjee R, Pardiwala A, Belen C. A Systemic Review of Primary Malignant Long Bone Tumors in Children and Adolescents. Acta ChirOrthopTraumatol Cech. 2024 Jan 1;91(2):77-87.
3. Yeo IS, Kim M, Lee HJ. Anatomical and histological analyses of ankle plantar flexors: insights into connective tissue composition and muscle architecture. Surgical and Radiologic Anatomy. 2025 Dec;47(1):1-2.
4. Singh A, Kumar A, Kale SY, Prakash S, Kumar V. Rehabilitation After Lower Limb Fracture Fixation in Osteoporotic Bone. Indian Journal of Orthopaedics. 2024 Dec 21:1-9.
5. Perera MR, Su P, Holdsworth S, Handsfield G. Changes to muscle and fascia tissue after eighteen days of ankle immobilization post-ankle sprain injury: an MRI case study. BMC Musculoskeletal Disorders. 2025 Jan 9;26(1):34.
6. Shi X, Wang S, Gong Y, Gu S, Feng H. The Influence Mechanism of Screw Internal Fixation on the Biomechanics of Lateral Malleolus Oblique Fractures. International Journal for Numerical Methods in Biomedical Engineering. 2025 Jan;41(1):e3895.
7. Rodríguez L, García-González R, Arsuaga JL, Carretero JM. Exploring the morphology of adult tibia and fibula from Sima de losHuesos site in sierra de Atapuerca, Burgos, Spain. The Anatomical Record. 2024 Jul;307(7):2606-34.
8. Muzzammil M, Minhas MS, Mughal A, Jabbar S. Utilizing the fibula as an orthopedic solution: Our experience in treating benign and tumor-like conditions in children. Journal of Orthopaedic Reports. 2024 Mar 1;3(1):100235.
9. Bekir MA., Ulucakoy C., Atalay IB., Pervane A., Togral G., &Gungor BS. Characterization of primary fibular bone tumors and post-surgical clinical and functional outcomes. Joint Diseases & Related Surgery.2018;33(2):419–425.
10. Kundu ZS., Tanwar M., Rana P., & Sen R.Fibulectomy for Primary Proximal Fibular Bone Tumors: A Functional and Clinical Outcome in Indian Journal of Orthopaedics.2018;52(1):3–9.
11. Dieckmann R., Gebert C., Streitbürger A., Henrichs MP., Dirksen U., Rödl R., Gosheger G., &HardesJ.Proximal fibula resection in the treatment of bone tumours.International Orthopaedics.2011;35(11):1689–1694.
12. Saleh R., Yurianto H., Pasallo P., Guatama A., SubagioES.Good functional outcome evaluation after resection of giant cell tumor at proximal humerus.International Journal of Surgery Case Reports.2020;77(1):123–128.