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A PROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF HOFFA FRACTURE TREATED WITH CANNULATED CANCELLOUS SCREWS, HERBERT SCREWS AND BUTTRESS PLATES – A PROSPECTIVE OBSERVATIONAL COHORT STUDY.

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Abstract

Background

The three categories of partial articular fractures that make up distal femur AO type 33 B fractures are coronal split fracture, medial condyle fracture, and sagittal lateral condyle fracture. The rate of damage or the degree of osteoporosis influences the likelihood of a distal femur fracture.

Objectives

Examining the functional results of Hoffa fractures—coronal plane fractures of the femoral condyle—treated with buttress plates, cannulated cancellous screws, and Herbert screws is the goal of this study.

Materials and Methods

The orthopedic department of Srirama Chandra Bhanja (SCB) Medical College in Cuttack, Odisha, India, carried out this prospective study to examine the functional results of Hoffa fractures treated with buttress plates, cannulated cancellous screws, and Herbert screws. The research was conducted from June 2022 to May 2024.

Results

The study included 20 patients with an average age of 30.25 ± 7.01 years, predominantly male and manual laborers. Right-sided Hoffa fractures were more common, with Type I fractures and lateral condylar involvement being the most frequent. Male competitors made up 14 (70%), while female participants made up 06 (30%). 4.15±1.66 days passed between the injury and operation. The mean radiological union time was 2.3 ± 1.49 months, and the mean functional Knee Society Score was 80.45 ± 15.01. Complications were minimal, with infection in 10% and delayed union in 5% of cases.

Conclusion

Hoffa fractures are most frequently observed in male young adults and are mostly caused by automobile accidents. According to the results, anatomical factors also suggest that the lateral condyle sustains injuries more frequently than the medial condyle. Interestingly, every instance in this study was identified by X-ray and verified by CT scans, indicating that careful monitoring of X-rays by themselves can successfully detect Hoffa fractures.

Recommendation

Early intervention and tailored surgical approaches may improve Hoffa fracture outcomes.

Keywords: *Neers score, articular anatomy, lag screw, cannulated cancellous screw, Hoffa's fracture*
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Introduction

Distal femur AO type 33 B fractures consist of three types: coronal split fractures, medial condyle fractures, and sagittal fractures of the lateral condyle. Hoffa (1904) first described coronal plane fractures (classified as AO type B3), which are rarer compared to the more common sagittal plane fractures of the distal femur. A very uncommon injury, Hoffa's fracture is a tangential, unicondylar fracture of the distal femoral condyle. These are uncommon, isolated femoral condyle fractures [1]. Compared to medial condyle fractures, lateral condyle Hoffa fractures occur three times as frequently [2].

Because of physiological valgus and the direction of force, which is typically direct trauma to a flexed knee with a minor abduction component, Hoffa's fracture and type 33 B fractures are more likely to harm the lateral condyle than

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either of the other condyles. About 30% of the time, Hoffa's fractures go undetected on a normal radiograph, and 38% of type 33 B fractures have these fractures [1].

The rate of damage or the degree of osteoporosis influences the likelihood of a distal femur fracture. A fracture occurs in a particular pattern as a result of a zone of weakness in the distal femur's anatomic location. These include the intercondylar notch, where the patella serves as a wedge, the space between the medial or lateral condyle and the trochlear groove, and the transition from the diaphysis to the metaphysis. The front and rear surfaces of the distal femur are not parallel, giving it a trapezoidal shape in cross-section. The medial side is angled at 10 degrees, while the lateral side is angled at 25 degrees [1].

According to some reports, the mechanism of injury is direct contact on the medial side of the knee in flexion for a medial condylar fracture and a direct anteroposterior force to the flexed and abducted knee for lateral condylar fractures. This knee intra-articular fracture may result from a combination of stresses, such as twisting and vertical push. Due to muscle tension and the vulnerability of the bones, this fracture is naturally unstable [3].

Superior functional effects using internal fixation have been documented in a number of published papers [4, 5, 6]. Additionally, faster weight-bearing and knee motion made possible by rigid fixation assist avoid some of the major issues linked to extended bed rest and traction [7, 8].

Because displaced fractures necessitate the use of lag screws following manual reduction and full exposure of the fracture site, managing them is particularly challenging. Osteonecrosis of the condylar fragment may arise from this procedure's disruption of the vascular architecture, especially during medial condyle fixation [9]. Increased building, transportation, and industrial activity are all associated with an increase in Hoffa fractures. The objective of this study was to evaluate the functional results of coronal plane distal femur condyle fractures treated with buttressing condylar plates, cannulated cancellous screws, and Herbert screws.

Examining the functional results of Hoffa fractures—coronal plane fractures of the femoral condyle—treated with buttress plates, cannulated cancellous screws, and Herbert screws is the goal of this study.

Methodology

Study Design

This was a prospective observational cohort study conducted to evaluate the functional outcomes of Hoffa fractures treated with buttress plates, cannulated cancellous screws, and Herbert screws. The study was carried out over 24 months from June 2022 to May 2024 in the Department of Orthopedics at Srirama Chandra Bhanja (SCB) Medical College, Cuttack, Odisha, India.

Study Setting

SCB Medical College and Hospital is a tertiary care teaching hospital located in Cuttack, Odisha. It serves as a referral center for complex trauma cases across eastern India. The orthopedic department is equipped with specialized trauma and surgical units, advanced imaging facilities, and a multidisciplinary team for comprehensive patient care and rehabilitation.

Study Population

The study population consisted of patients with Hoffa fractures of the femur who were admitted to the Orthopedic Indoor Department of SCB Medical College in Cuttack, Odisha, India. This study included 20 patients with a total sample size of femur Hoffa fractures. Patients over the age of eighteen who have either an open or closed femoral condyle coronal plane fracture, meet the Letenneur classification-based displacement criteria, have radiologically diagnosed fractures based on Letenneur classification, and are willing to provide informed consent are all eligible to be included. Patients under the age of eighteen, those medically ineligible for surgery, those with pathological fractures other than osteoporosis, those with concomitant head injuries, and those with concomitant neurovascular injuries were also excluded.

Bias

To minimize selection bias, all eligible patients meeting the inclusion criteria during the study period were consecutively enrolled. Information bias was reduced through standardized data collection procedures and the use of consistent radiological criteria for classification. Observer bias was minimized by having at least two orthopedic surgeons independently assess radiographs and classify the fractures.

Data Collection

Initial stabilization and evaluation of the patient's respiration, circulation, and airway were performed when they were admitted to the emergency room. The study comprised patients with a coronal plane fracture of the femoral condyle (Hoffa fracture) identified by computed tomography (CT) and X-ray of the knee joint exhibiting symptoms. The following information was recorded: age, sex, occupation, side of injury, mechanism of injury, time between injury and ED visit, co-morbidities, and fracture classification.

Ethical Considerations

The study was conducted according to the Declaration of Helsinki. Ethical clearance was obtained from the Institutional Ethics Committee of SCB Medical College, Cuttack, Odisha (Approval No).

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Statistical Analysis

Excel was used to enter the data. The data were displayed as either n (%) or mean±standard deviation.

Results

The participant demographics are shown in Table 1. The patients were 30.25±7.01 years old on average. Male competitors made up 14 (70%), while female participants made up 06 (30%). 4.15±1.66 days passed between the injury and operation. The majority were manual laborers (n=12, 60%), followed by students (n=5, 25%) and office workers (n=3, 15%).

Table 1. Demographics of Participants

Parameters	Value (n=20)
Age (in years)	30.25±7.01
Male Participants	14 (70%)
Female Participants	06 (30%)
Manual labors	12 (60%)
Students	5 (25%)
Office workers	3 (15%)

Table 2 presents the clinical characteristics of the patient cohort. The right femoral condyle was more commonly affected (60%) compared to the left (40%). The mean duration between injury and surgery was 4.15 ± 1.66 days. According to the Letenneur classification, Type I fractures were the most prevalent (65%), followed by Type II (25%) and Type III (10%). Lateral condylar involvement was observed in the majority of cases (85%), while only 15% involved the medial condyle. Regarding the surgical approach, 50% of patients were treated with cannulated cancellous screws, 30% with Herbert screws, and 20% with buttressing condylar plates.

Table 2: Clinical data of the patient cohort:

Variable	No. of patients (%)
Left side of Injury	08 (40%)
Right side of Injury	12 (60%)
Duration between Injury and Surgery (in days)	4.15±1.66
Letenneur Classification	
Type I	13 (65%)
Type II	05 (25%)
Type III	02 (10%)
Lateral condyles involved	17 (85%)
Medial condyles involved	03 (15%)
Method of Treatment	
Cannulated cancellous Screws	10 (50%)
Herbert Screws	06 (30%)
Buttressing Condylar Plates	04 (20%)

Data were presented either as mean±SD or n (%)

The surgical results are shown in Table 3. The radiologically recorded length of union was found to be 2.3±1.49. The study population had a functional knee society score of 80.45±15.01. Complications among participants included delayed union in one patient (5%) and infection in two patients (10%).

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Table 3. Outcomes of the surgery

Outcomes	Value
Duration of union noted radiologically (in months)	2.3±1.49
Functional knee society score in the study population	80.45±15.01
Complications in the study Population	
Infection	02 (10%)
Delayed Union	01 (5%)
Nil	17 (85%)

Data were presented either as mean±SD or n (%)

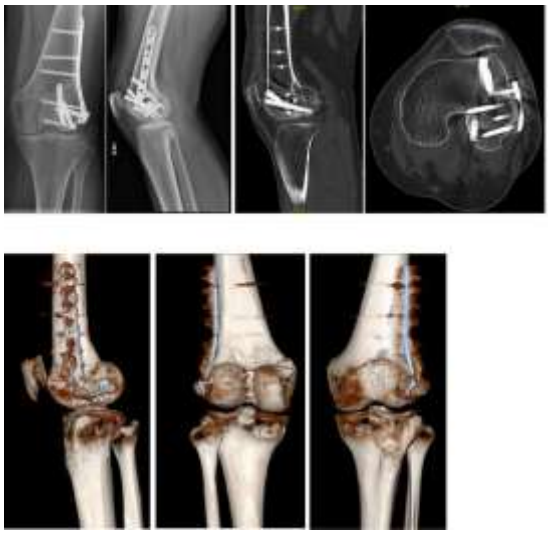

Figure 1: Post-operative X-ray and CT scan of Hoffa fracture in patient 1.

Discussion

All 20 of the Hoffa fracture instances in this investigation were first identified by X-ray imaging and then verified by CT scans. This method emphasizes how crucial it is to use cutting-edge imaging methods to precisely determine the size and kind of these fractures, guaranteeing proper management and treatment planning. The results demonstrate how difficult it is to diagnose Hoffa fractures and how important imaging modalities are for thorough assessment and efficient clinical decision-making.

Hoffa fractures are distributed across age categories, and 11 instances, or a large majority, occur in patients between the ages of 20 and 30. Seven people are impacted, and 35% of instances include patients between the ages of 31 and 40. Ten percent of cases involve patients between the ages of 41 and 50, which includes two patients. Hoffa fractures primarily strike younger persons, especially those in their twenties, as this research highlights. According to a study by Trikha V et al., the age range of 22 to 40 years is the most frequently impacted by Hoffa fractures. This observation is consistent with their findings [10].

Thirty percent of the 20 patients with Hoffa fractures are female, and seventy percent are male. This implies that males are more likely than females to suffer from Hoffa fractures. These results emphasize the age and gender differences in the incidence of Hoffa fractures and highlight demographic trends in these fractures. According to Kurahatti et al., 17 patients with Hoffa's fracture—12 men and 5 females—with an average age of 31.1 years were treated with cannulated cancellous screws with a lag effect. This is consistent with the present study, which found that male patients were more [11].

Furthermore, the distribution of condyles involved in Hoffa fractures highlighted a significant preference for the lateral condyle, which was affected in 85% of cases compared to the medial condyle's involvement in 15% of cases. In both studies, including the one by Manfredini et al., the lateral condyle was involved in 13 cases and the medial condyle in 6 cases. The study by Nedunkilli et al. found that 14 patients had type I fractures, 3 had type II fractures, and 1 had a type III fracture based on the Letenneur classification [12].

A notable preference for the lateral condyle, which was impacted in 85% of instances, was also revealed by the distribution of condyles involved in Hoffa fractures, as

opposed to the 15% involvement of the medial condyle. The lateral condyle was implicated in 13 cases and the medial condyle in 6 cases in both investigations, including the one conducted by Mandredini M et al [13].

Within 0–3 months after treatment, the majority of Hoffa fractures (85%, or 17 patients) showed evidence of union, according to radiological evaluation of healing duration. The majority of Hoffa fractures demonstrated satisfactory early healing, with 85% achieving radiological union within the first three months. This suggests effective fracture stabilization and timely postoperative recovery in most cases. Of these patients, 8 were treated with cannulated cancellous screws, 4 with buttress condylar plates, and 6 with Herbert screws.

An average Knee Society Score of 87.5 with a standard deviation of 10.4 was reported by Singh et al. On the other hand, the current investigation discovered a higher standard deviation of 15.01 and a lower mean score of 80.45. According to this discrepancy, the Knee Society Scores in the current investigation were more variable and, on average, slightly lower than those in Singh et al.'s study, which showed typically higher knee function outcomes [14]. According to this discrepancy, the Knee Society Scores in the current investigation were more variable and, on average, indicated a slightly lower functional outcome compared to studies with higher mean scores and lower variability.

Generalizability

The findings of this study are based on a limited sample size of 20 patients from a single tertiary care center in Odisha, which may restrict the generalizability to broader populations. However, the study provides useful clinical insights applicable to similar resource-limited orthopedic settings.

Limitations

The study's limited sample size is one of its drawbacks. It is hard to say for sure if this surgical approach is a better course of treatment because there was no comparable group. The treatment of Hoffa's fractures requires a great deal of skill because minimally invasive surgery is feasible but presents technical difficulties for patients with related distal femur fractures.

Conclusion

According to this study, Hoffa fractures are most frequently observed in male young adults and are mostly caused by automobile accidents. According to the results, anatomical factors also suggest that the lateral condyle sustains injuries more frequently than the medial condyle. Interestingly, every instance in this study was identified by X-ray and verified by CT scans, indicating that careful monitoring of X-rays by themselves can successfully detect Hoffa fractures.

Excellent functional results for Hoffa fractures treated with different fixation techniques, such as buttressing condylar plates, Herbert screws, and cancellous screws, are highlighted in the study. These techniques worked well for treating the fractures. Three participants, however, had subpar outcomes because of delayed union and infection, highlighting the need to attain total anatomical reduction and uphold sterile postoperative care. According to the study's overall findings, Hoffa fractures can be successfully managed and kept from being disregarded with prompt diagnosis and surgical intervention utilizing these fixation approaches.

Recommendations

Future research using a comparative group could aid in improving the determination of surgical strategy.

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Source of Funding

This study received no external funding.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Author Contributions

[Author 1] conceptualized the study and performed surgeries.
[Author 2] collected and analyzed data.
[Author 3] drafted the manuscript.
All authors reviewed and approved the final version of the manuscript.

Data Availability

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

List of Abbreviations

SD- Standard Deviations
SCB- Srirama Chandra Bhanja
CT- Computed Tomography

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