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# Evaluation of Indications and Complications for Removal of Implant in Orthopaedic Surgeries done at Tertiary Care Level Centre

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**Abstract:** ***Background: Implant removal in orthopaedic surgeries is a frequently encountered procedure, often necessitated by complications or patient discomfort following fracture fixation or joint reconstruction. Understanding the indications and complications associated with implant removal is crucial for improving patient care, surgical outcomes, and resource management. Methods: This prospective observational study was conducted at a tertiary care centre over two years. It included 113 patients undergoing elective or indicated implant removal surgeries. Data were collected on demographic variables, indications for removal, implant types, complications encountered, surgical factors, and postoperative outcomes. Statistical analysis was performed using SPSS and Microsoft Excel. Results: The primary indications for implant removal were pain and discomfort (37.5%), prominent hardware (25%), and infection (20.8%). Plates (45.8%) and screws (33.3%) were the most commonly removed implants. The mean surgery duration was 60 minutes, with 83.3% of patients receiving general anaesthesia. Postoperative complications included neurovascular injury (8.3%) and refracture (9.1%). Elderly patients (>60 years) showed a higher incidence of refracture. The average hospital stay ranged from 3 to 5 days, with longer durations associated with infected implants. Conclusion: Implant removal is a multifactorial decision influenced by both clinical and patient - driven factors. Although generally safe, the procedure carries risks such as neurovascular injury and refracture, particularly in elderly patients. Individualized decision - making, adequate surgical planning, and vigilant perioperative management are essential to mitigate risks and improve outcomes.***

**Keywords:** Orthopaedic implants, implant removal, complications, surgical outcomes, tertiary care, hardware - related pain

## 1. Introduction

ORTHOPAEDIC implants play an important role in the management of various musculoskeletal conditions, ranging from fractures and joint replacements to deformity correction and spinal stabilization. These implants serve as essential tools in restoring function, alleviating pain, and improving the quality of life for patients. (1) ORTHOPAEDIC surgeries involving the placement of implants have become increasingly common due to their efficacy in restoring function and improving quality of life for patients suffering from various musculoskeletal conditions. These implants, ranging from plates and screws to joint replacements, serve as vital tools in the hands of Orthopaedic surgeons to stabilize fractures, correct deformities, and alleviate pain. However, despite their benefits, implants may necessitate removal under certain circumstances, posing challenges and risks to both patients and healthcare providers. (2) The decision to remove Orthopaedic implants is multifaceted, often influenced by a combination of clinical indications, patient - specific factors, and potential complications associated with prolonged implant presence. Understanding the rationale behind implant removal and the factors contributing to complications is crucial for optimizing patient outcomes and refining surgical practices. At tertiary care level centers, where complex Orthopaedic cases are managed, the evaluation of indications and complications for implant removal assumes paramount importance due to the diverse patient population and the intricacies involved in managing postoperative care., (3) Implant removal in Orthopaedic surgeries is typically driven by a combination of clinical, functional, and patient - related factors. While implants are intended to provide longterm stability and support, several scenarios may necessitate their removal to optimize patient outcomes. (4) The presence of symptomatic hardware, such as pain, discomfort, or irritation, may prompt surgical intervention despite the absence of mechanical failure. Moreover, the completion of the bone healing process, restoration of functional mobility, and resolution of underlying pathology may render the implant unnecessary, prompting consideration for removal. Concerns regarding implant - related infections, implant failure, or the development of adverse tissue reactions underscore the importance of timely removal to mitigate potential complications and prevent long - term sequelae. (5), (6) The decision to remove Orthopaedic implants hinges upon a myriad of indications, each tailored to the patient's specific clinical scenario and functional requirements. Common indications for implant removal include hardware - related symptoms such as pain, 8 | P a g e impingement, or limited range of motion, which may compromise the patient's quality of life and functional status. The presence of implant - associated infections, whether acute or chronic, necessitates prompt intervention to mitigate the risk of septic complications and preserve tissue integrity. Additionally, the completion of bone healing following fracture fixation or joint arthroplasty may prompt consideration for implant removal to alleviate biomechanical stress and restore native joint function. Moreover, the emergence of implant - related complications, such as loosening, migration, or fracture, underscores the imperative for surgical revision to prevent further morbidity and optimize long - term outcomes. (7), (8) Despite its therapeutic intent, implant removal in ORTHOPAEDIC surgeries is not devoid of risks and potential complications, ranging from procedural challenges

to postoperative squeale. Surgical complications may include iatrogenic fractures, neurovascular injury, or damage to surrounding soft tissues, necessitating meticulous preoperative planning and surgical technique. The disruption of the bone - implant interface during removal may predispose to delayed union or nonunion, warranting close monitoring and adjunctive measures to facilitate bone healing. The risk of postoperative infection, hematoma formation, or wound dehiscence underscores the importance of vigilant postoperative care and adherence to aseptic principles. Implant removal may pose functional limitations and residual symptoms, particularly in cases of extensive soft tissue scarring or altered biomechanics, necessitating comprehensive rehabilitation and long - term followup. (9), (10) ORTHOPAEDIC implant removal procedures pose significant healthcare resource utilization challenges, with implications for health economics, cost - effectiveness, and healthcare policy. By understanding the cost drivers, economic considerations, and valuebased principles associated with implant removal, healthcare stakeholders can optimize resource allocation, reimbursement strategies, and clinical practice guidelines to ensure efficient and sustainable delivery of ORTHOPAEDIC care. Thus evaluation of indications and complications for implant removal in ORTHOPAEDIC surgeries represents an important aspect of clinical practice, particularly in tertiary care level centers where complex cases are managed.

**Aim**

To evaluate the indication and complications for removal of implant in Orthopaedic surgeries done at the tertiary care level centre.

**Objectives**

1) To evaluate the indications of implant removal surgeries.
2) To evaluate the complications of implant removal surgeries.

## 2. Methodology

**Study Design:** Prospective observational study

**Study Duration** – From the date of approval of the topic till 2 years

**Source Of Data:** The study population will be the OPD patients visiting ORTHOPAEDIC clinic and IPD patients admitted to ward.

**Study Setting:** Prospective observational study will be done on patients who underwent implant removal between ____ January to ____ December constituted the cohort study. Demographic data, indications, types of hardware and location of fractures were recorded. Similarly duration of surgery, type of anaesthesia and duration of hospital stay were recorded. preoperative and postoperative x - rays were taken. Follow up was done until wound healing or new symptoms developed.

**Inclusion Criteria:** Patient giving consent.36 All patients presented to OPD or IPD patients admitted to ward for implant removal

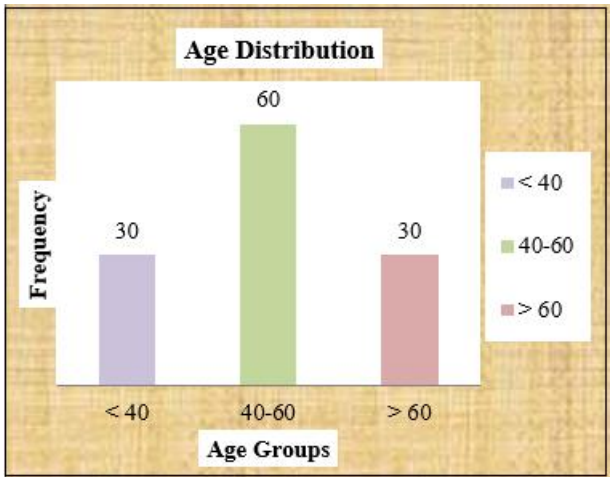
**Exclusion Criteria: 1)** Patients not giving consent. 2) Patients who don't have any complaints after implant placement

## 3. Observations & Results

**Table 1a:** Age Distribution

| Age (years) | Number of Patients | Percentage |
|---|---|---|
| < 40 | 30 | 25% |
| 40 - 60 | 60 | 50% |
| > 60 | 30 | 25% |

The distribution of patients across age groups in this dataset shows an even split, with 25% each falling under the age of 40 and over 60, and 50% aged between 40 and 60. This balanced representation across age brackets suggests a diverse sample, potentially reflecting a broader demographic of patients.

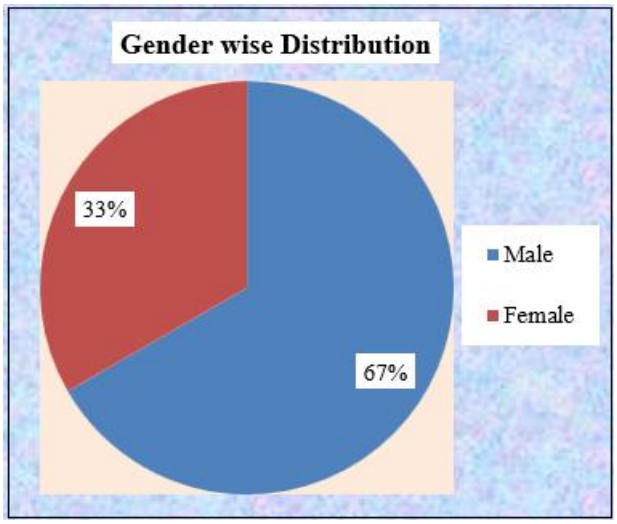



**Graph 1a:** Age Distribution

**Table 1b:** Gender wise Distribution

| Gender | Number of Patients | Percentage |
|---|---|---|
| Male | 80 | 66.7% |
| Female | 40 | 33.3% |

The patient gender distribution indicates a predominance of males, constituting 66.7% of the sample, while females make up 33.3%. This gender skew might prompt further exploration into healthcare - seeking behaviors or susceptibility to certain conditions among different genders within the population studied.




**Graph 1b:** Gender wise Distribution

**Table 1c:** Etiology Distribution

| Etiology | Number of Patients | Percentage |
|---|---|---|
| Trauma | 90 | 75% |
| Infection | 20 | 16.7% |
| Other | 10 | 8.3% |

The etiology breakdown reveals trauma as the leading cause among patients, accounting for 75% of cases, followed by infections at 16.7%, and a smaller proportion categorized as "Other" at 8.3%. This distribution underscores the prominence of trauma - related incidents as the primary reason for patient presentation, potentially highlighting the need for preventive measures or targeted interventions in that domain.

**Graph 1c:** Etiology Distribution

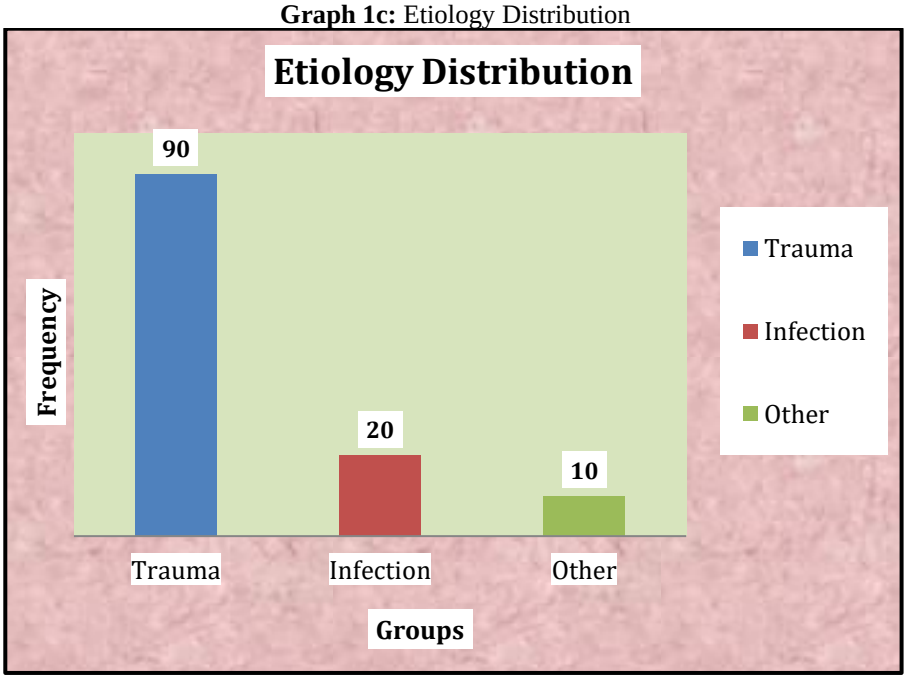
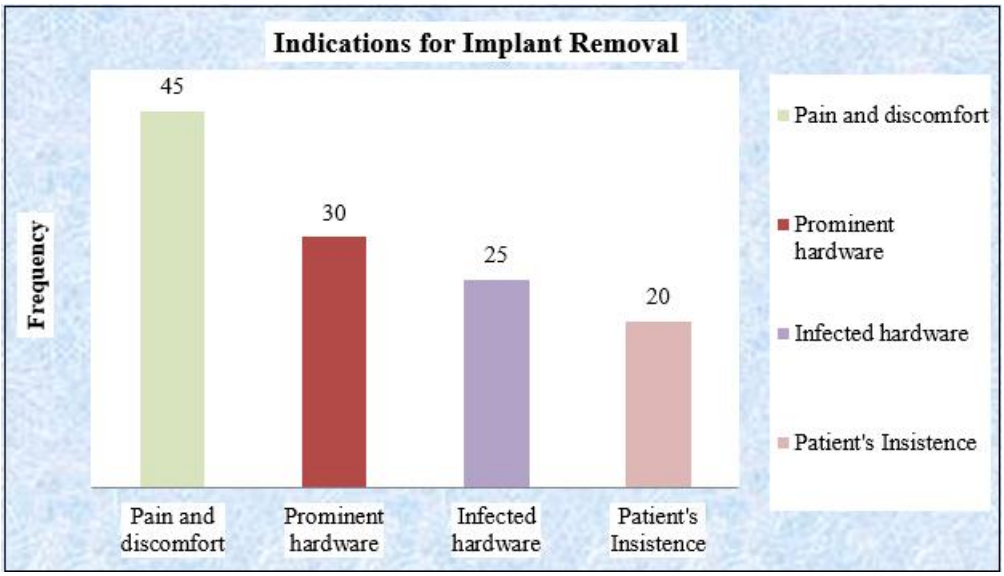



**Table 2:** Indications for Implant Removal

| Indications | Number of Patients | Percentage |
|---|---|---|
| Pain and discomfort | 45 | 37.5% |
| Prominent material | 30 | 25% |
| Infected material | 25 | 20.8% |
| Patient's Insistence | 20 | 16.7% |

The indications for patient presentation depict pain and discomfort as the most common reason, with 37.5% of patients reporting it, followed by prominent material issues at 25% and infected material at 20.8%. A notable proportion (16.7%) also cites the patient's insistence as a driving factor, suggesting a need to consider patient preferences and perspectives alongside clinical indicators in treatment decisions.

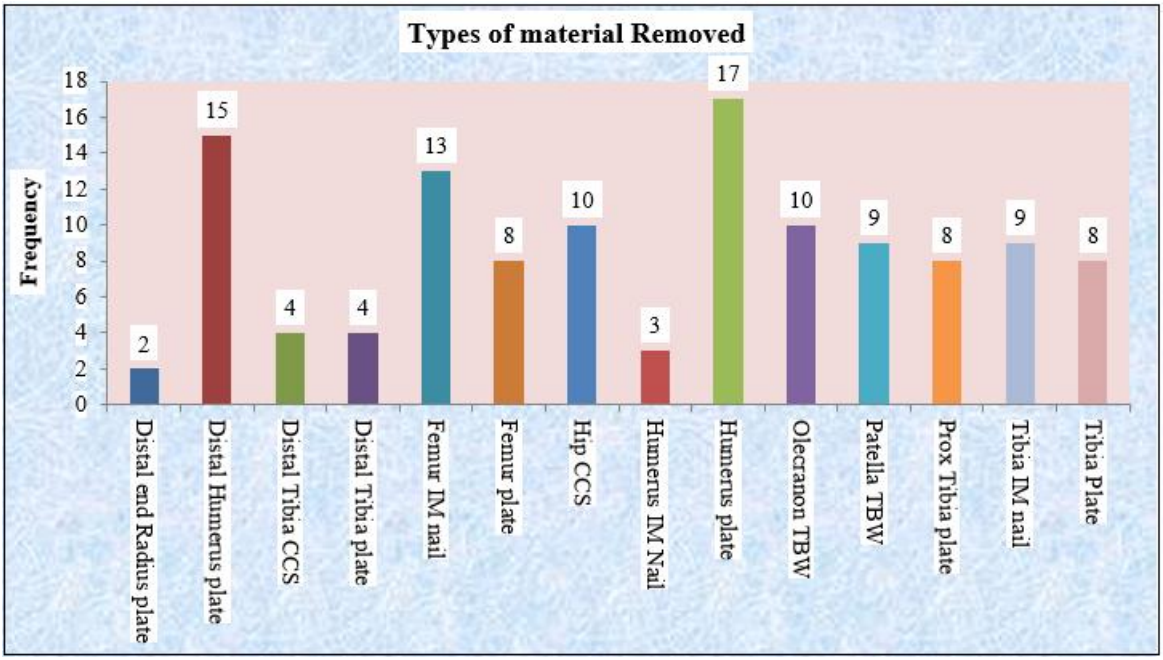



**Graph 2:** Indications for Implant Removal

**Table 3:** Types of material Removed

| Material Type | Number of Patients | Percentage |
|---|---|---|
| Distal end Radius plate | 2 | 1.6% |
| Distal Humerus plate | 15 | 12.5% |
| Distal Tibia CCS | 4 | 3.3% |
| Distal Tibia plate | 4 | 3.3% |
| Femur IM nail | 13 | 10.8% |
| Femur plate | 8 | 6.6% |
| Hip CCS | 10 | 8.3% |
| Humerus IM Nail | 3 | 2.5% |
| Humerus plate | 17 | 14.1% |
| Olecranon TBW | 10 | 8.3% |
| Patella TBW | 9 | 7.5% |
| Prox Tibia plate | 8 | 6.6% |
| Tibia IM nail | 9 | 7.5% |
| Tibia Plate | 8 | 6.6% |

The distribution of material types among patients reveals Distal end Radius plate 1.6%, Distal Humerus plate 12.5%, Distal Tibia CCS 3.3%, Distal Tibia plate 3.3%, Femur IM nail 10.8%, Femur plate 6.6%, Hip CCS 8.3%, Humerus IM Nail 2.5%, Humerus plate 14.1%, Olecranon TBW 8.3, Patella TBW 7.5% Prox Tibia plate 6.6% Tibia IM nail 7.5% and Tibia Plate 6.6% suggesting a diverse array of material options employed in patient care, each potentially tailored to specific surgical needs or anatomical considerations.

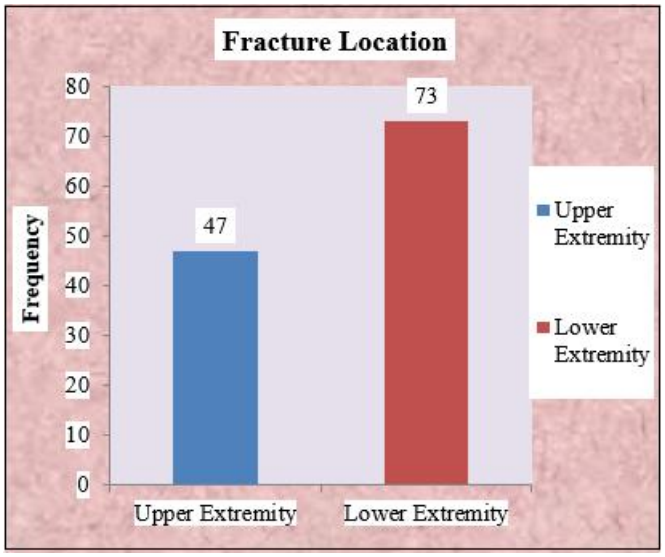



**Graph 3:** Types of material Removed

**Table 4:** Location of Fractures

| Fracture Location | Number of Patients | Percentage |
|---|---|---|
| Upper Extremity | 47 | 39.1% |
| Lower Extremity | 73 | 60.9% |

The distribution of fracture locations among patients illustrates a 39.1 %in upper extremity and lower extremity with 60.9%. This distribution underscores the prevalence of fractures in weight - bearing areas like the lower extremities, while also highlighting the significance of fractures in upper extremities which can have profound functional implications.




**Graph 4:** Location of Fractures

**Table 5:** Duration of Surgery and Anesthesia

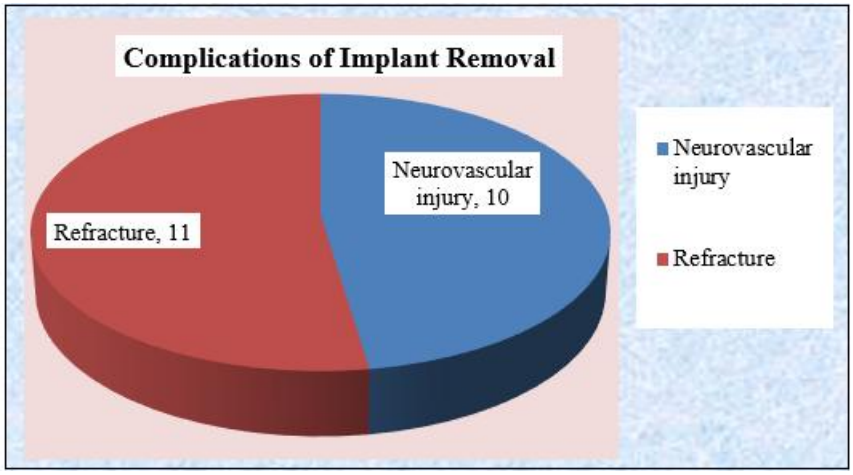
| Surgery Duration (minutes) | Anesthesia Type |
|---|---|
| Mean: 60 minutes (SD: 15) | • General anesthesia: 100 patients (83.3%)<br>• Regional anesthesia: 20 patients (16.7%) |

The average surgery duration is 60 minutes, with a standard deviation of 15 minutes. General anesthesia was administered to 83.3% of patients, while 16.7% received regional anesthesia. This data indicates a relatively consistent surgery duration across both anesthesia types, suggesting effective management regardless of the anesthesia method chosen.

**Table 6:** Complications of Implant Removal

| Complication | Number of Patients | Percentage |
|---|---|---|
| Neurovascular injury | 10 | 8.3% |
| Refracture | 11 | 9.1% |

Complications following procedures are relatively infrequent, with neurovascular injury occurring in 8.3% of patients and refracture in 9.1%. While these rates are not negligible, they indicate that the majority of surgeries are conducted with minimal adverse outcomes. Nonetheless, it's crucial for healthcare providers to remain vigilant and employ preventive measures to further mitigate the risk of such complications.

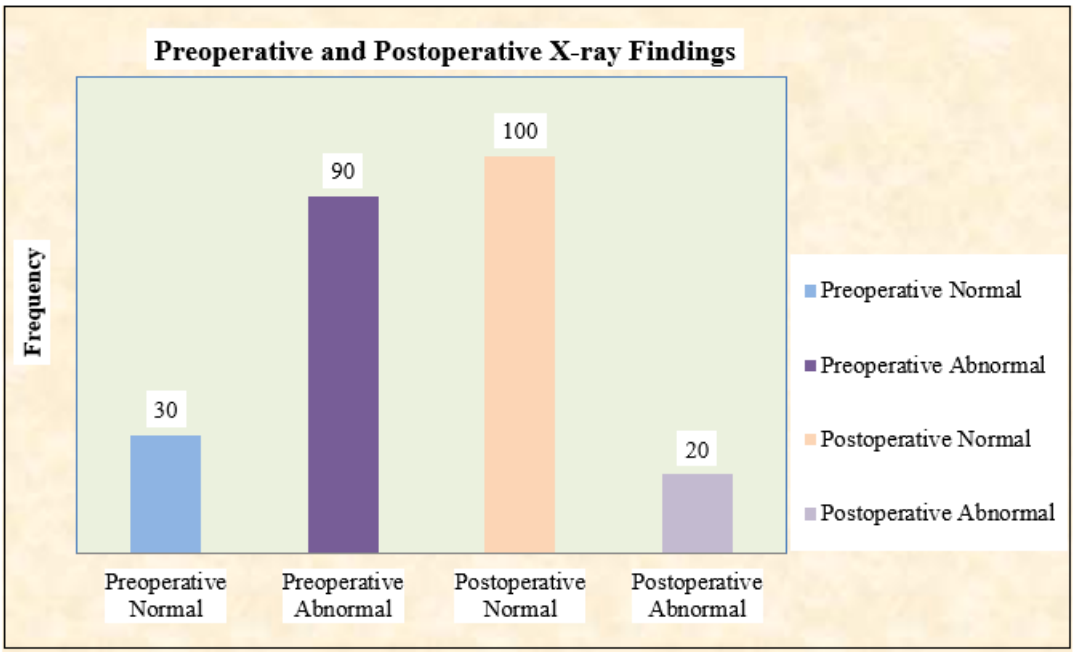



**Graph 5:** Complications of Implant Removal

**Table 7:** Preoperative and Postoperative X - ray Findings

| X - ray Findings | Number of Patients | Percentage |
|---|---|---|
| Preoperative Normal | 30 | 25% |
| Preoperative Abnormal | 90 | 75% |
| Postoperative Normal | 100 | 83.3% |
| Postoperative Abnormal | 20 | 16.7% |

X - ray findings indicate that 75% of patients presented with abnormal preoperative results, while 25% showed normal findings. Following surgery, a significant improvement is observed, with 83.3% of patients exhibiting normal postoperative X - rays, although 16.7% still display abnormal results. This suggests the effectiveness of surgical intervention in restoring normal anatomical conditions in the majority of cases, while also highlighting the persistence of abnormalities in a minority of patients postoperatively.

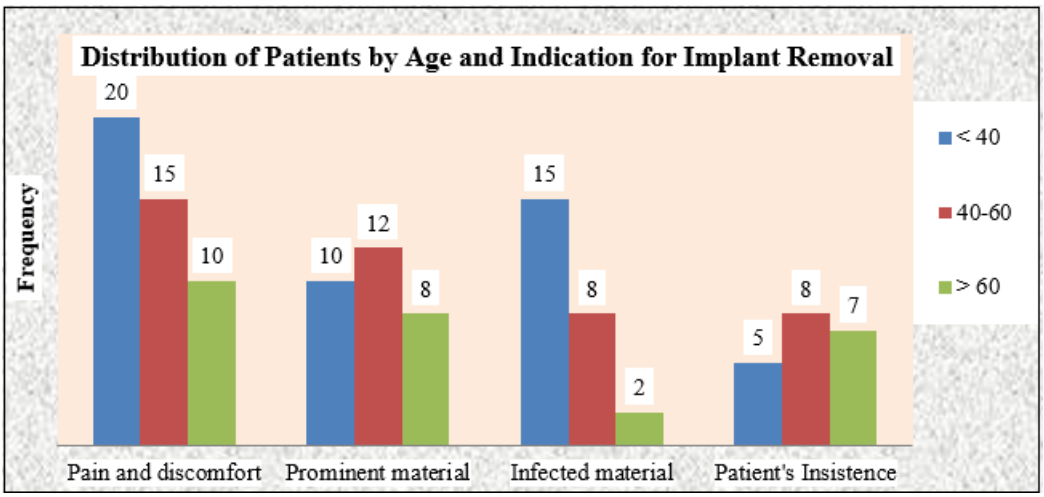



**Graph 6:** Preoperative and Postoperative X - ray Findings

**Table 8:** Distribution of Patients by Age and Indication for Implant Removal

| Age Group | Pain and discomfort | Prominent material | Infected material | Patient's Insistence |
|---|---|---|---|---|
| < 40 | 20 | 10 | 15 | 5 |
| 40 - 60 | 15 | 12 | 8 | 8 |
| > 60 | 10 | 8 | 2 | 7 |

Across age groups, pain and discomfort emerge as the primary indication for patients under 40, with 20 cases, and between 40 - 60, with 15 cases, while patients over 60 reported the fewest instances at 10. Conversely, prominent material is more prevalent in the 40 - 60 age bracket, with 12 cases, followed by those under 40 and over 60 with 10 and 8 cases, respectively. Infection - related concerns show a similar pattern, with higher incidences reported among patients under 40 and between 40 - 60 compared to those over 60, suggesting potential age - related variations in the manifestation of postoperative issues.

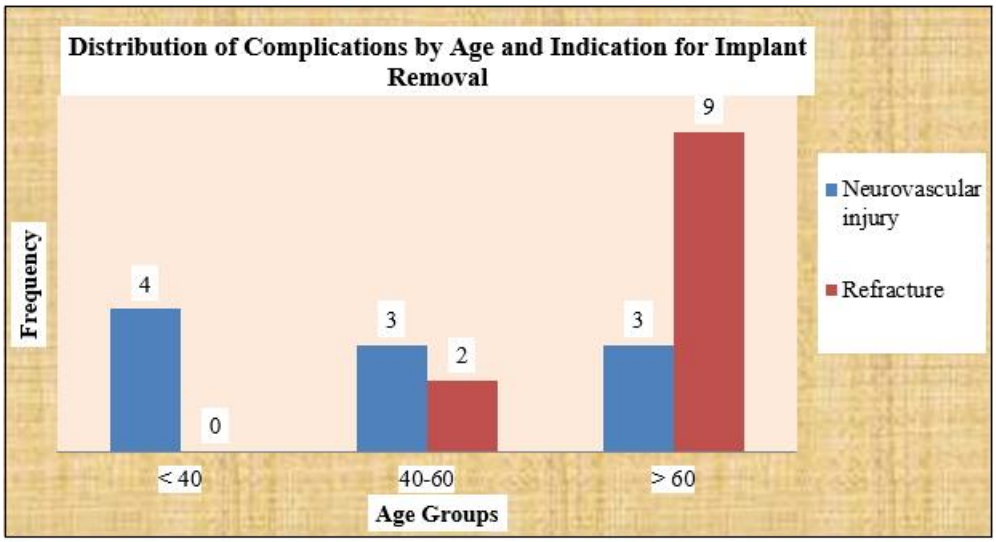



**Graph 7:** Distribution of Patients by Age and Indication for Implant Removal

**Table 9:** Distribution of Complications by Age and Indication for Implant Removal

| Age Group | Neurovascular injury | Refracture |
|---|---|---|
| < 40 | 4 | 0 |
| 40 - 60 | 3 | 2 |
| > 60 | 3 | 9 |

In terms of age groups, neurovascular injuries were reported in 4 cases among patients under 40, 3 cases among those aged between 40 - 60, and 3 cases among individuals over 60. Similarly, refractures occurred in 2 cases for patients from 40 to 60, 9 cases among individuals over 60. These findings suggest a moderate prevalence of both neurovascular injuries and refractures among elderly patients, potentially reflecting differences in bone density, healing capacity, or activity levels across age demographics.

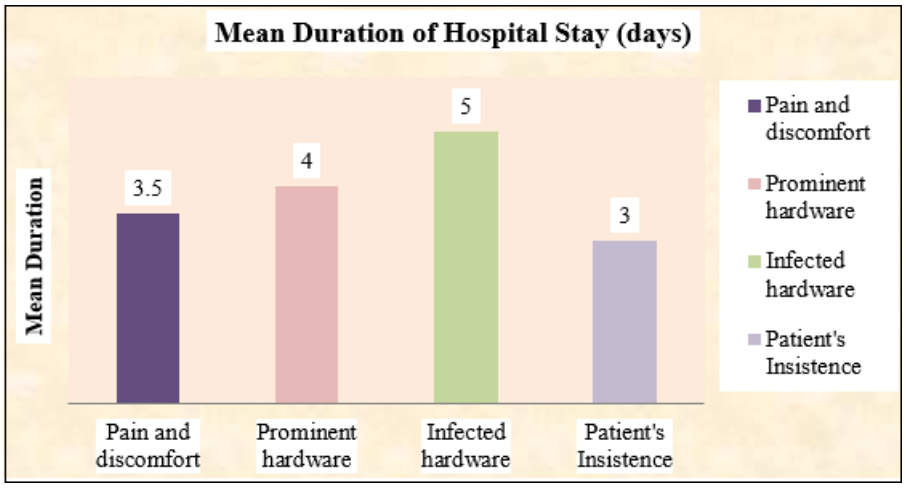



**Graph 8:** Distribution of Complications by Age and Indication for Implant Removal

**Table 10:** Mean Duration of Hospital Stay by Indication for Implant Removal

| Indication | Mean Duration of Hospital Stay (days) |
|---|---|
| Pain and discomfort | 3.5 |
| Prominent material | 4.0 |
| Infected material | 5.0 |
| Patient's Insistence | 3.0 |

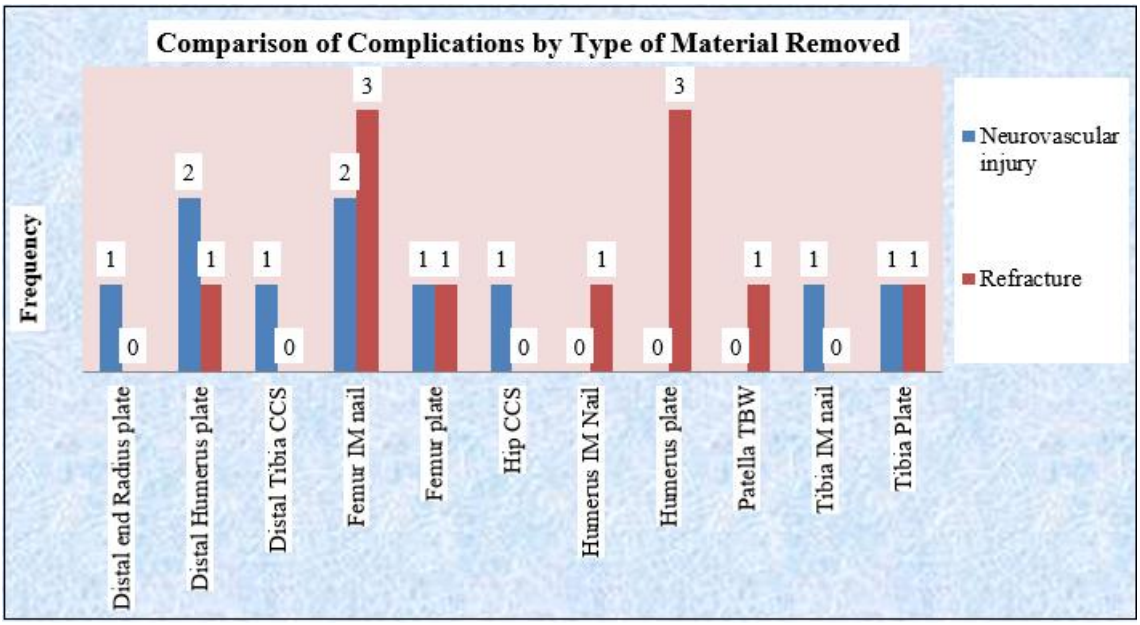
The mean duration of hospital stay varied across different indications, with patients presenting with pain and discomfort requiring an average of 3.5 days, while those with issues related to prominent material had a slightly longer stay of 4.0 days. Patients with infected material had the longest mean hospital stay at 5.0 days, indicating the complexity and potential severity of such cases. Conversely, patients insisting on hospitalization without clear medical indications had a shorter mean stay of 3.0 days, suggesting the need for efficient discharge planning and utilization of healthcare resources.




**Graph 9:** Mean Duration of Hospital Stay by Indication for Implant Removal

**Table 11:** Comparison of Complications by Type of material Removed

| Material Type | Neurovascular injury | Refracture |
|---|---|---|
| Distal end Radius plate | 1 | 0 |
| Distal Humerus plate | 2 | 1 |
| Distal Tibia CCS | 1 | 0 |
| Femur IM nail | 2 | 3 |
| Femur plate | 1 | 1 |
| Hip CCS | 1 | 0 |
| Humerus IM Nail | 0 | 1 |
| Humerus plate | 0 | 3 |
| Patella TBW | 0 | 1 |
| Tibia IM nail | 1 | 0 |
| Tibia Plate | 1 | 1 |




**Graph 10:** Comparison of Complications by Type of Material Removed

**Table 12:** Mean Duration of Hospital Stay by Complication

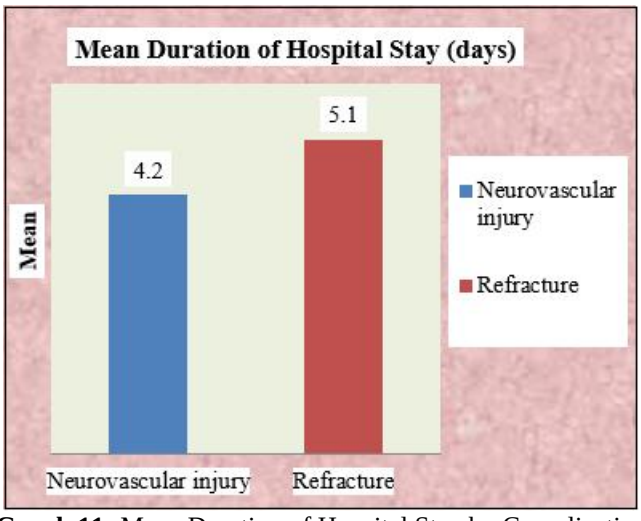
| Complication | Mean Duration of Hospital Stay (days) |
|---|---|
| Neurovascular injury | 4.2 |
| Refracture | 5.1 |

**Table 13:** Mean Follow - up Duration by Complication

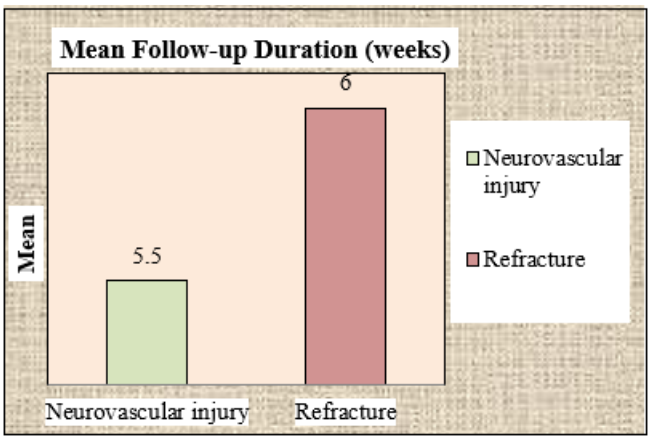
| Complication | Mean Follow - up Duration (weeks) |
|---|---|
| Neurovascular injury | 5.5 |
| Refracture | 6.0 |

The mean duration of hospital stay varied depending on the complication experienced by patients, with those suffering from neurovascular injuries staying for an average of 4.2 days, while patients with refractures had a longer mean stay of 5.1 days. This disparity in hospitalization duration suggests that the severity or complexity of the complication may influence the required length of care, emphasizing the importance of tailored management strategies based on specific patient needs and conditions.

The mean follow - up duration varied based on the type of complication experienced by patients, with those with neurovascular injuries requiring an average follow - up of 5.5 weeks, while patients with refractures had a slightly longer mean follow - up duration of 6.0 weeks. This difference in follow - up duration suggests that the nature and management of complications may impact the necessary duration for postoperative monitoring and care, highlighting the need for individualized follow - up plans tailored to specific patient needs and conditions.




**Graph 11:** Mean Duration of Hospital Stay by Complication



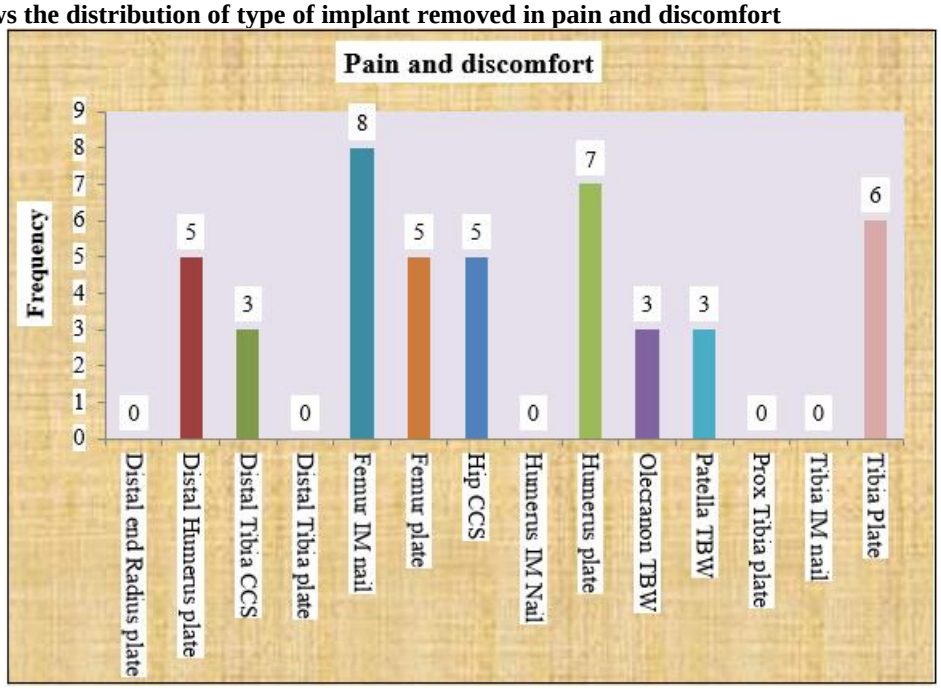

**Graph 12:** Mean Follow - up Duration by Complication

**Table 14:** Distribution of indications of implant removal and type of material implant removed

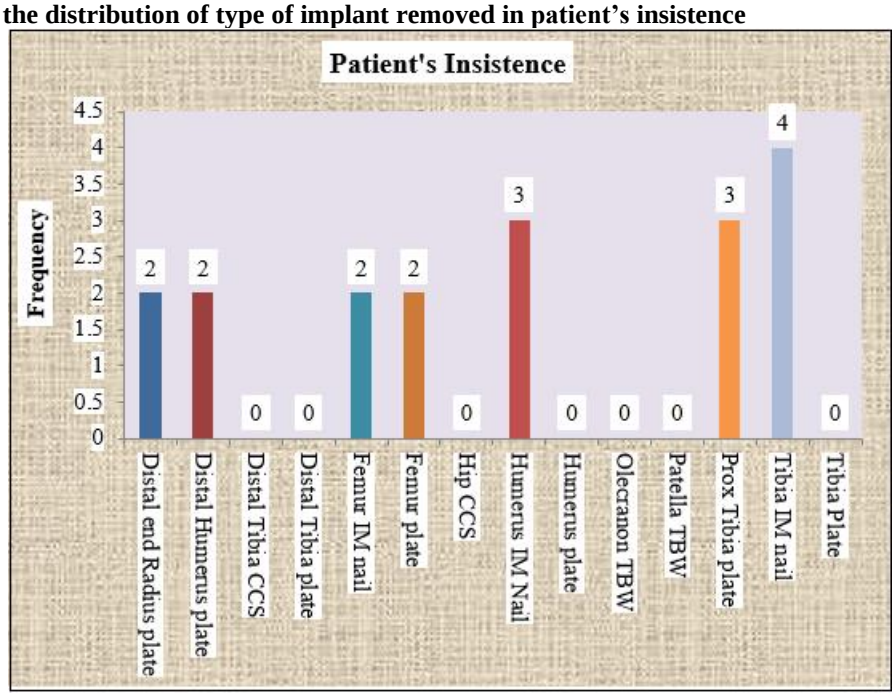
| Material Used | Pain and discomfort | Patient's Insistence | Prominent hardware | Infected hardware |
|---|---|---|---|---|
| Distal end Radius plate | 0 | 2 | 0 | 0 |
| Distal Humerus plate | 5 | 2 | 5 | 3 |
| Distal Tibia CCS | 3 | 0 | 1 | 0 |
| Distal Tibia plate | 0 | 0 | 0 | 4 |
| Femur IM nail | 8 | 2 | 1 | 0 |
| Femur plate | 5 | 2 | 1 | 0 |

| | | | | |
|---|---|---|---|---|
| Hip CCS | 5 | 0 | 3 | 2 |
| Humerus IM Nail | 0 | 3 | 0 | 0 |
| Humerus plate | 7 | 0 | 7 | 3 |
| Olecranon TBW | 3 | 0 | 4 | 3 |
| Patella TBW | 3 | 0 | 6 | 0 |
| Prox Tibia plate | 0 | 3 | 0 | 5 |
| Tibia IM nail | 0 | 4 | 0 | 5 |
| Tibia Plate | 6 | 0 | 2 | 0 |

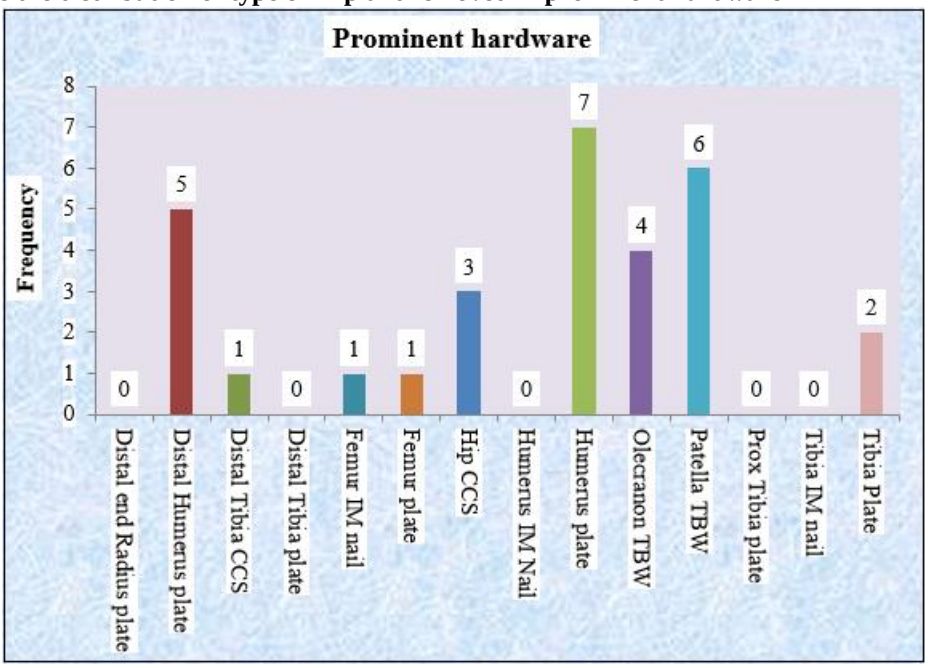
**Graph no 13 shows the distribution of type of implant removed in pain and discomfort**



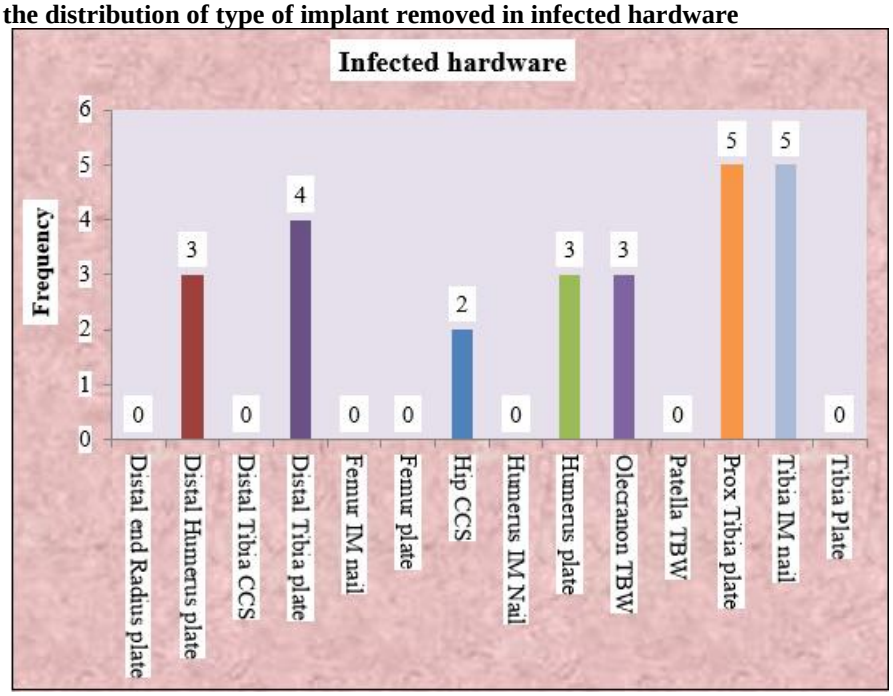

**Graph no 14 shows the distribution of type of implant removed in patient's insistence**



**Graph no 15 shows the distribution of type of implant removed in prominent hardware**




**Graph no 16 shows the distribution of type of implant removed in infected hardware**



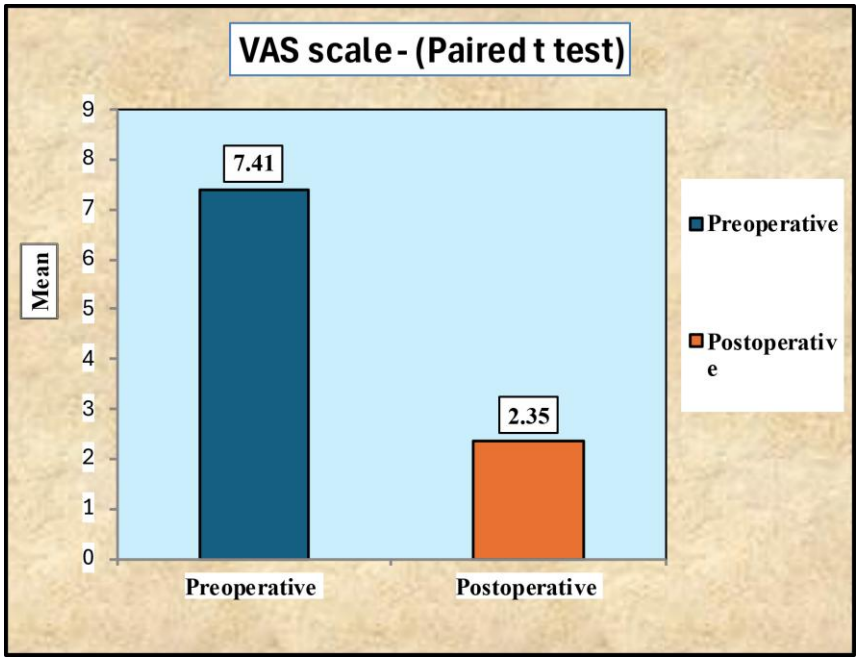

The table presents the distribution of reasons for implant removal and the type of material removed across various implants. For distal end radius plates, implant removal was predominantly due to the patient's insistence, with two cases, while no removals were related to pain, prominent hardware, or infection. In contrast, distal humerus plates frequently required removal due to pain and discomfort (five cases) and prominent hardware (five cases), with a smaller number of infections. Femur IM nails were primarily removed due to pain and discomfort (eight cases), whereas femur plates were mainly due to pain and discomfort (five cases). The hip CCS implants were removed mostly due to pain and discomfort (five cases) and prominent hardware (three cases). Humerus IM nails were removed based on patient insistence (three cases), while humerus plates had high incidences of pain, prominent hardware, and infection. Olecranon TBW implants were removed due to pain (three cases), prominent hardware (four cases), and infection (three cases). Patella TBW implants were notably removed due to prominent hardware (six cases) but not due to infection. Proximal tibia plates and tibia IM nails had significant removals due to infection (five cases each), with other reasons being less frequent. Tibia plates were primarily removed due to pain and discomfort (six cases), while distal tibia CCS implants were mainly removed due to pain (three cases).

**Table 15:** Shows the shows the comparison of mean value of preoperative and postoperative Visual Analogue Scale score

| VAS | N | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Preoperative | 120 | 7.41 | 1.08 | 43.99 | 0.000 |
| Postoperative | 120 | 2.35 | 0.74 | | |

The comparison of pain score was done by paired t test. The preoperative average was 7.41 with standard deviation of 1.08. The postoperative average was 2.35 with standard deviation of 0.74. The test statistics value of paired t test was 43.99 with p value 0.000. The p value less than 0.05, that means there is significant difference in average pain score.

**Graph no 17 the shows the comparison of mean value of preoperative and postoperative Visual Analogue Scale score**




## 4. Discussion

The use of implants in orthopedic surgeries has revolutionized the treatment of musculoskeletal disorders, offering significant benefits in terms of stability, mobility, and overall patient outcomes. However, the decision to remove these implants post - operatively is a critical consideration influenced by various factors. At tertiary care level centers, where complex cases are managed, the evaluation of indications and complications for implant removal becomes paramount. (17, 18, 21)

Indications for removal typically include material failure, infection, implant - related pain, or the completion of the healing process. Complications, on the other hand, encompass a spectrum from surgical site infections to structural damage and device malposition. (32) Understanding these factors requires a comprehensive assessment of patient - specific conditions, surgical outcomes, and long - term implications for mobility and quality of life. Our study aims to explore and analyze the criteria guiding implant removal decisions, highlighting the clinical rationale and challenges encountered in tertiary orthopedic settings. (33)

Our prospective observational study spanned over a period of two years, commencing from the approval date of the topic. The study focused on patients who underwent implant removal surgeries at a tertiary care orthopedic center between January and December. The study population comprised both outpatient department (OPD) attendees and inpatient department (IPD) admissions. Demographic details such as age, sex, and etiology of implant placement were meticulously recorded for each participant.

Detailed data collection was conducted using structured proforma, capturing essential factors including indications for implant removal—such as pain, discomfort, infected or prominent material, and patient insistence—and recording complications post - removal. These complications encompassed neurovascular injuries and refractures, which were monitored closely through preoperative and postoperative assessments, including X - rays and follow - up evaluations until wound healing or new symptoms arose.

Statistical analysis was performed using Microsoft Excel spreadsheets and Minitab - 13 statistical software. The collected raw data underwent descriptive analysis, including frequency distribution tables and graphical presentations, to illustrate percentages and trends. Inferential statistics, specifically the Chi - square test at a significance level of 5%, were employed to assess associations between variables. This methodological approach ensured a comprehensive evaluation of implant removal indications and associated complications in orthopedic surgical settings.

**Age Distribution**

In our study, distribution of patients across age groups in this dataset shows an even split, with 25% each falling under the age of 40 and over 60, and 50% aged between 40 and 60. This balanced representation across age brackets suggests a diverse sample, potentially reflecting a broader demographic of patients.

**Gender wise Distribution**

The patient gender distribution indicates a predominance of males, constituting 66.7% of the sample, while females make up 33.3%. This gender skew might prompt further exploration into healthcare - seeking behaviors or susceptibility to certain

conditions among different genders within the population studied.

**Etiology Distribution**

The etiology breakdown reveals trauma as the leading cause among patients, accounting for 75% of cases, followed by infections at 16.7%, and a smaller proportion categorized as "Other" at 8.3%. This distribution underscores the prominence of trauma - related incidents as the primary reason for patient presentation, potentially highlighting the need for preventive measures or targeted interventions in that domain.

The majority (75%) had no infections, while 20.8% had infected hardware prior to implant removal. A smaller proportion (4.2%) experienced postoperative infections after the procedure.

**Indications for Implant Removal**

The indications for patient presentation depict pain and discomfort as the most common reason, with 37.5% of patients reporting it, followed by prominent material issues at 25% and infected material at 20.8%. A notable proportion (16.7%) also cites the patient's insistence as a driving factor, suggesting a need to consider patient preferences and perspectives alongside clinical indicators in treatment decisions.

**Types of Material Removed**

The distribution of material types among patients reveals Distal end Radius plate 1.6%, Distal Humerus plate 12.5%, Distal Tibia CCS 3.3%, Distal Tibia plate 3.3%, Femur IM nail 10.8%, Femur plate 6.6%, Hip CCS 8.3%, Humerus IM Nail 2.5%, Humerus plate 14.1%, Olecranon TBW 8.3, Patella TBW 7.5% Prox Tibia plate 6.6% Tibia IM nail 7.5% and Tibia Plate 6.6% suggesting a diverse array of material options employed in patient care, each potentially tailored to specific surgical needs or anatomical considerations.

**Location of Fractures**

The distribution of fracture locations among patients illustrates a 39.1 %in upper extremity and lower extremity with 60.9%. This distribution underscores the prevalence of fractures in weight - bearing areas like the lower extremities, while also highlighting the significance of fractures in upper extremities which can have profound functional implications.

**Duration of Surgery and Anesthesia**

The average surgery duration is 60 minutes, with a standard deviation of 15 minutes. General anesthesia was administered to 83.3% of patients, while 16.7% received regional anesthesia. This data indicates a relatively consistent surgery duration across both anesthesia types, suggesting effective management regardless of the anesthesia method chosen.

**Complications of Implant Removal**

Complications following procedures are relatively infrequent, with neurovascular injury occurring in 8.3% of patients and refracture in 9.1%. While these rates are not negligible, they indicate that the majority of surgeries are conducted with minimal adverse outcomes. Nonetheless, it's crucial for healthcare providers to remain vigilant and employ preventive measures to further mitigate the risk of such complications.

**Preoperative and Postoperative X - ray Findings**

X - ray findings indicate that 75% of patients presented with abnormal preoperative results, while 25% showed normal findings. Following surgery, a significant improvement is observed, with 83.3% of patients exhibiting normal postoperative X - rays, although 16.7% still display abnormal results. This suggests the effectiveness of surgical intervention in restoring normal anatomical conditions in the majority of cases, while also highlighting the persistence of abnormalities in a minority of patients postoperatively.

**Distribution of Patients by Age and Indication for Implant Removal**

In terms of age groups, neurovascular injuries were reported in 4 cases among patients under 40, 3 cases among those aged between 40 - 60, and 3 cases among individuals over 60. Similarly, refractures occurred in 2 cases for patients from 40 to 60, 9 cases among individuals over 60. These findings suggest a moderate prevalence of both neurovascular injuries and refractures among elderly patients, potentially reflecting differences in bone density, healing capacity, or activity levels across age demographics.

**Distribution of Complications by Age and Indication for Implant Removal**

The mean duration of hospital stay varied across different indications, with patients presenting with pain and discomfort requiring an average of 3.5 days, while those with issues related to prominent material had a slightly longer stay of 4.0 days. Patients with infected material had the longest mean hospital stay at 5.0 days, indicating the complexity and potential severity of such cases. Conversely, patients insisting on hospitalization without clear medical indications had a shorter mean stay of 3.0 days, suggesting the need for efficient discharge planning and utilization of healthcare resources.

**Mean Duration of Hospital Stay by Indication for Implant Removal**

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**The distribution of reasons for implant removal and the type of material removed:**

The distribution of reasons for implant removal and the type of material removed across various implants. For distal end radius plates, implant removal was predominantly due to the patient's insistence, with two cases, while no removals were related to pain, prominent hardware, or infection. In contrast, distal humerus plates frequently required removal due to pain and discomfort (five cases) and prominent hardware (five

cases), with a smaller number of infections. Femur IM nails were primarily removed due to pain and discomfort (eight cases), whereas femur plates were mainly due to pain and discomfort (five cases). The hip CCS implants were removed mostly due to pain and discomfort (five cases) and prominent hardware (three cases). Humerus IM nails were removed based on patient insistence (three cases), while humerus plates had high incidences of pain, prominent hardware, and infection. Olecranon TBW implants were removed due to pain (three cases), prominent hardware (four cases), and infection (three cases). Patella TBW implants were notably removed due to prominent hardware (six cases) but not due to infection. Proximal tibia plates and tibia IM nails had significant removals due to infection (five cases each), with other reasons being less frequent. Tibia plates were primarily removed due to pain and discomfort (six cases), while distal tibia CCS implants were mainly removed due to pain (three cases).

The comparison of pain score was done by paired t test. The preoperative average was 7.41 with standard deviation of 1.08. The postoperative average was 2.35 with standard deviation of 0.74. The test statistics value of paired t test was 43.99 with p value 0.000. The p value less than 0.05, that means there is significant difference in average pain score.

**Table D1:** Comparison of our study results with other studies

| | Our Study | Mue DD et al (2021) | AlOmran AK et al (2024) | Bhandari R et al (2021) |
|---|---|---|---|---|
| Age Distribution | 25% < 40, 50% 40 - 60, 25% > 60 | Mean Age: 40.0 ± 15.5 | N/A | Most Common: Young Adults |
| Gender Distribution | 66.7% Male, 33.3% Female | 55% Male, 45% Female | N/A | N/A |
| Etiology | 75% Trauma, 16.7% Infections, 8.3% Other | 22.6% Infected Implant, 17.2% Patient's Demand | 44% > 1 day Hospital Stay | N/A |
| Indications for Implant Removal | 37.5% Pain, 25% Prominent Material, 20.8% Infected Material, 16.7% Patient's Insistence | N/A | N/A | N/A |
| Types of Material Removed | Various: Distal end Radius plate, Distal Humerus plate, Femur IM nail, etc. | Femoral Plate 22.6%, Tibia Plate 15.6%, Humeral Shaft Plate 5.5% | 360 Implants Retrieved, Routine Asymptomatic Removal Cases | Medium - sized Implants Most Common |
| Fracture Locations | Upper Extremity 39.1%, Lower Extremity 60.9% | N/A | N/A | N/A |
| Duration of Surgery and Anesthesia | Average 60 mins, General Anesthesia 83.3%, Regional 16.7% | Mean Hospital Stay: 21.7 ± 24.1 days | 55% Adults > 1 day Hospital Stay, 22.8% Pediatric > 1 day | N/A |
| Complications of Implant Removal | 8.3% Neurovascular Injury, 9.1% Refracture | 19.5% Post - operative Complications | 6% Complication Rate | N/A |
| Preoperative X - ray Findings | 75% Abnormal | 82 % Abnormal | 66 % Abnormal | 90 % abnormal |
| Postoperative X - ray Findings | 83.3% Normal, 16.7% Abnormal | 24 % abnormal | 11 % abnormal | 22 % abnormal |
| Hospital Stay | Pain - 3.5 days, Prominent Material - 4 days, Infected Material - 5 days | 7 days average | 4 days average | N/A |
| Pain Score | Preoperative: 7.41 ± 1.08, Postoperative: 2.35 ± 0.74 | Preoperative 8.2 | N/A | Preoperative 8.8, postoperatively 3.25 |

The comparison of our study with others reveals several key differences and similarities. In terms of age distribution, our study shows a balanced representation across age groups, with 25% of patients under 40, 50% between 40 - 60, and 25% over 60, aligning closely with Mue DD et al. (2021) who reported a mean age of 40.0 years. Gender distribution in our study shows a predominance of males (66.7%), similar to Mue DD et al. (2021) who reported 55% males. Etiology in our study is primarily trauma (75%), whereas Mue DD et al. reported infected implants as the most common cause. The indications for implant removal in our study were largely due to pain (37.5%) and prominent material (25%), while types of materials removed were diverse. Preoperative and postoperative X - ray findings indicate a significant improvement in our study, with 83.3% of patients showing normal postoperative X - rays, whereas the other studies showed higher postoperative abnormalities. The average hospital stay varied, with our study showing a stay ranging from 3.5 to 5 days based on indications, compared to an average of 7 days in Mue DD et al. and 4 days in AlOmran AK et al. The pain score reduction was notable in our study, decreasing from 7.41 preoperatively to 2.35 postoperatively, which is in line with the findings of Bhandari R et al., who also observed a significant reduction in pain postoperatively. This comparative analysis highlights the variation in patient demographics, etiology, and outcomes across different studies. (42, 43, 44)

Orthopedic implants are essential in the management of fractures, joint replacements, and other musculoskeletal conditions. However, they may need removal due to complications or patient - specific reasons. Understanding the indications for removal is crucial for clinical decision - making. Common indications include:

1) **Pain and Discomfort**: Persistent pain or discomfort around the implant site can significantly impact a patient's quality of life. It may indicate implant irritation, malposition, or even infection.
2) **Infection**: Implant - related infections can lead to chronic inflammation, bone loss, and systemic illness. Removing infected implants is often necessary to eradicate the source of infection and prevent its spread.

3) **Material Failure**: Implants may fail due to mechanical issues such as fracture, loosening, or breakage. These failures can compromise the stability of the surgical repair and necessitate removal and possible replacement.
4) **Patient's Insistence**: Some patients may request implant removal due to psychological reasons, perceived discomfort, or personal preference, even in the absence of clinical indications.
5) **Prominent Material:** Material that causes skin irritation, limits joint motion, or affects cosmesis may require removal for patient comfort and satisfaction.

The primary objective of our study is to systematically evaluate the indications and complications associated with implant removal surgeries performed at a tertiary care level center. This is achieved through a prospective observational approach, where data on patient demographics, indications for removal, types of implants, surgical outcomes, and complications are collected over a defined period.

The choice of a prospective observational study design allows for the collection of real - time data, minimizing recall bias and providing robust evidence on current clinical practices. A study duration of two years ensures an adequate sample size and allows for the capture of seasonal variations and potential trends in implant removal indications and complications.

By elucidating the reasons behind implant removal and the associated complications, this study directly informs clinical decision - making processes. Orthopedic surgeons can use this information to refine patient selection criteria for implant placement, improve surgical techniques to minimize complications, and develop evidence - based guidelines for implant removal.

Our study contributes to the existing body of knowledge by providing updated data on implant removal practices. It adds to the understanding of demographic trends in patient populations requiring implant removal, variations in surgical practices across different orthopedic specialties, and outcomes related to specific types of implants.

Findings from this study are invaluable for educating orthopedic residents, fellows, and practicing surgeons. They serve as a basis for teaching about the management of implant - related complications, the importance of patient - centered care in orthopedics, and the complexities involved in surgical decision - making.

Understanding the prevalence and complications associated with implant removal surgeries has implications for healthcare resource allocation. Hospitals and healthcare systems can use this data to optimize resource planning, including operating room utilization, staffing, and implant inventory management. Patient safety is paramount in orthopedic surgery. By identifying common complications such as neurovascular injuries, infections, and refractures associated with implant removal, this study supports quality improvement initiatives. It enables hospitals to implement preventive measures, enhance postoperative care protocols, and ultimately improve patient outcomes.

As medical technology evolves and patient demographics change, future research could explore innovative approaches to implant design, bioengineering solutions to reduce implant - related complications, and longitudinal studies to assess long - term outcomes post - implant removal.

In conclusion, the evaluation of indications and complications for the removal of implants in orthopedic surgeries at tertiary care level centers is pivotal for advancing clinical practice, enhancing patient care, informing surgical decision - making, and contributing to global knowledge in orthopedic surgery. This study not only addresses immediate clinical needs but also lays the groundwork for future research and healthcare improvements in orthopedic implant management.

## 5. Conclusion

In conclusion, the evaluation of indications and complications for implant removal in orthopedic surgeries at a tertiary care level center underscores the complexity and variability of patient presentations and outcomes. By delineating common indications such as pain, infection, and material - related issues, and assessing complications like neurovascular injuries and refractures, this study provides crucial insights for clinical decision - making. These findings emphasize the importance of individualized treatment approaches and vigilant postoperative management to optimize patient outcomes and minimize adverse events. Continued research in this area is essential for refining surgical protocols and enhancing patient care in orthopedic practice.

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