

Epidemiological and Outcome Analysis of Orthopedic Implants Removal in Kathmandu University Hospital

Shrestha R, Shrestha D, Dhoju D, Parajuli N, Bhandari B, Kayastha SR

Department of Orthopedics and Traumatology
Kathmandu University Hospital - Dhulikhel Hospital
Kathmandu University School of Medical Science
Dhulikhel, Kavre

Corresponding Author

Rohit Shrestha
Department of Orthopedics and Traumatology
Kathmandu University Hospital - Dhulikhel Hospital
Kathmandu University School of Medical Science
Dhulikhel, Kavre
Email: rohitshrestha79@gmail.com

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ABSTRACT

Background

Orthopedic Implant removal is one of the commonly performed elective orthopedic surgeries. Implants are generally removed after the purpose of keeping implant is solved by healing of the fracture, but there is no consensus whether routine implant removal should be a policy for all fractures that were fixed.

Objective

This study aims to analyze the epidemiology and outcome of implant removal surgery carried out in the past three years in Kathmandu University Hospital.

Methods

Patients who underwent implant removal between 2010 January to 2012 December constituted the study cohort. Demographic data, indications, types of hardware and location of fractures were recorded. Similarly, duration of surgery, type of anesthesia and duration of hospital stay were recorded. All the patients who had undergone implant removal in this three years period were called for follow up examination but those who were not able to come were interviewed on telephone.

Results

There were 275 implant removals constituting 7.8% of total orthopedic operations and 26.3% of fracture fixations. Male to Female ratio was 189: 86. Pediatric age group (34.5%) had the highest incidence of implant removal. Moderate sized implants were the commonest hardwares removed (63.2%). Femur (27.3%) followed by radius (26.9%) were the commonest bone for implant removal. Average operative time was 47.3 minutes with average hospital inpatient stay of 2.6 days. Commonest indication for the implant removal procedure was pain (45%).

Conclusion

Implant removal procedures are one of the most commonly performed elective orthopedic surgeries. Though, after orthopedic implants removal, pain relief can be expected but it is not so predictive and hence patient should be well counseled before and the indications for implant removal has to be evaluated for better patient satisfaction and safety.

KEY WORDS

Fracture Management, internal fixation, implant removal, orthopedic hardware, re-surgery

INTRODUCTION

The goal of fracture management is to obtain union of fracture with maximal functional return and that too as early as feasible hence, internal fixation of fractures is being more popular and there is increasing trend to it.¹⁻³ Consequently, those hardware removal after the fracture heals becomes a common elective orthopedic operations for indications like persistent pain in the region of implanted hardware or concerns regarding the systemic and local effects of retained hardware.³⁻⁷ However, there are no evidence-based guidelines available in literatures and the routine removal of orthopedic fixation devices after fracture healing remains an issue of debate.⁸ On one hand, issue of pain relief, local irritative symptoms, ease of management if refracture occurs, economic benefits to the surgeon in their private practice and to the residents in developing operative proficiency and surgical skills favor implant removal procedures but, on the other hand potential complications associated with the removal like neurovascular injuries, refracture, anesthesia and surgery related complications, economic burden to the patient, increased workload to the hospitals and ethical issues discourage the routine procedure.⁶ In absence of local data on implant removal procedure and its outcome, we have undertaken this study to evaluate the current epidemiology in Dhulikhel Hospital, Kathmandu University Hospital and the patients reported outcome status following the procedure.

METHODS

After ethical approval from institutional review committee, this hospital based retrospective descriptive epidemiological study was conducted. Patients presenting to Dhulikhel Hospital from January 2010 to December 2012 primarily for implant removal with healed fracture, previously treated with closed or open reduction and internal fixation with orthopedic hardware were included in the study. Implant Removal done in delayed or non union fracture with the intention of dynamization or restabilization or refixation (example exchange nailing) and implants (eg kirschner wires) primarily kept projecting from skin and external fixators (eg AO fixators or Ilizarov) for fracture stabilization were excluded from the study.

Patients file were retrieved from the medical record section and demographic data, indication for implant removal, type of hardware and location of fracture were recorded. Similarly, per operative parameters like duration of surgery, type of anesthesia, any post operative complication, like wound infection and neurovascular injury etc, and duration of hospital stay were recorded.

All the patients had their follow up at two weeks for stitches removal and then next follow up at six weeks, three months and then at six months subsequently after which patient were followed up only for some specific reasons.

All the patients who had undergone implant removal in these three years period were called for follow up examination and those who were not able to come by themselves were interviewed on telephone regarding i) fulfillment of their expectations (reduction in pain perception), ii) whether they would have undergone the implant removal procedure if they had known this situation previously and iii) whether they were satisfied with their decision of removing the hardware. Data were recorded in Microsoft Excel and analyzed with SPSS.

RESULTS

In the specified period of three years, total number of orthopedic and trauma surgeries, operative management for fracture fixation and orthopedic. (Table 1)

Table 1. Shows number of patient undergoing Implant Removal in relation to number of fracture fixation and total orthopedic and trauma surgery.

	2010	2011	2012	Total	Percentage
Implant Removal	79	98	98	275	
Fracture stabilization with potential Implant removal	298	382	365	1045	26.31%
Total Orthopedic & Trauma surgery	1053	1220	1236	3509	7.83%

The volume of implant removal work constituted about 26.31% when compared with the volume of work for fracture stabilization with orthopedic hardware which is the potential candidate for implant removal in future, however, it constituted about 7.83% when compared to total work load of Orthopedic and Trauma surgery.

The overall implant removal rate was 26.3% and the range was 7.9% (lowest in elderly) to 34.5% (highest in Pediatric age) (table 2) and the males seemed to outnumber the females in implant removal procedures however there was no statistical differences when gender matched population was considered. (table 3)

Table 2. Age wise distribution.

Age Distribution	Implant Removal	Age matched Total population of Fracture Fixation with orthopedic Implants	Percentage
Pediatric (≤16years)	111	321	34.5%
Young Adult (17 to 39 years)	114	407	28.0%
Middle aged (40 to 59 years)	42	215	19.5%
Elderly (≥60 years)	8	101	7.9%

Table 3. Gender wise distribution.

	Implant Removal	Gender matched total population of Fracture Fixation	Percentage	P value - 0.3028
Male	189	683	27.6 %	
Female	86	361	23.8 %	

Table 4. Types of Orthopedic Hardware removal.

Types	Examples	Number	Percentage
Small	Burried K wires, Tension Band Wiring and Screws	81	29.5%
Medium	Intramedullary Nails	119	63.2%
	Plates	55	
Large	Dynamic Hip Screws and Dynamic Condylar Screws and Multiple Implants	20	7.3%

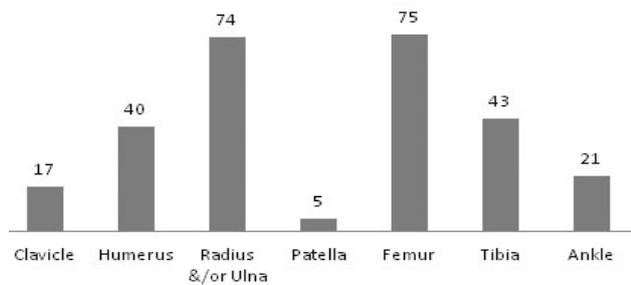


Figure 1. Distribution of Implants according to bones.

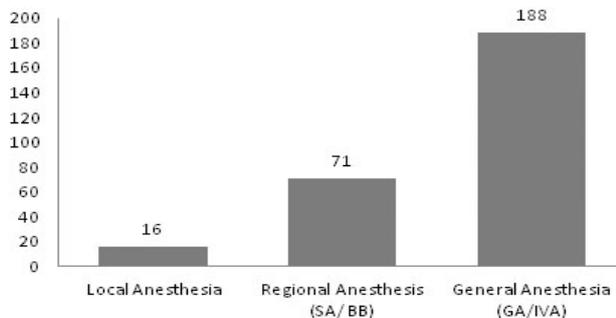


Figure 2. Types of Anesthesia used.

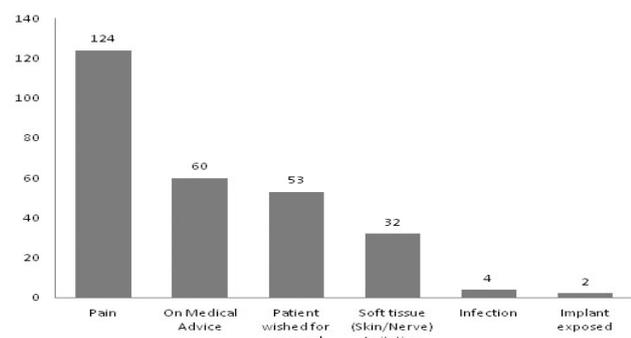


Figure 3. Indications for Implant removal

The most common operations for implant removal were rush pin removal for healed femur fracture followed by healed radius and or ulna fracture. The details of types of orthopedic hardware removal and distribution of anatomic location (table 4)(fig 1) The average operation time was 47.3 minutes±31.15 and (range 15- 330 min), average inpatient stay after the procedure was 2.6 days±1.71 (range 0- 20 days), average interval from fracture fixation to implant removal was 28.3 months and most commonly general anesthesia was used (68.4% cases) for the procedure (fig 2) and nerve injury was the most common complication associated with the procedure.(table 5)

Out of 275 patients who underwent implant removal procedures within three years period, 85 patients were available for follow up examination or interview for at least six months. (table 6)

Table 5. Complication associated with Implant Removal Procedure.

Complication	Number	Comments
Nerve injury	4	Radial nerve neuropraxia in two cases in plate removal shaft of humerus fracture, posterior interosseous nerve neuropraxia in two cases of both bone forearm fracture. All recovered in three months time.
Difficult removal	3	Damaged screw head, Incarcerated Re-chard screw, Short titeneum elastic nail tip
Traumatic refracture following implant removal	2	Within six months of implant removal, one case managed with open reduction and internal fixation with dynamic compression plate (fig 4A and B)and other, undisplaced fracture managed with long arm cast.

Table 6. Patient’s response after implant removal at follow up evaluation.

Questions asked to the patients on follow up	Yes	No	Some	Does not remember
1 “Has your pain decreased now as compared to what you were having before the operation?”	35 (76%)	3 (6.5%)	5 (10.8%)	3 (6.5%)
Total Respondent: 46 Patients				
2 “Would you have undergone implant removal procedure if you had known previously your present condition will be like this (as that of present condition)?”	69 (81.2%)	16 (18.8%)		
Total respondents : 85				
3 “Are you satisfied with the implant removal procedure?”	79 (92.9%)	6 (7.1%)		
Total respondents : 85				



Figure 4. A Xray showing refracture of ulna after the plate was removed. **B** Xray showing the fracture has been refixed with Dynamic Compression Plate.

DISCUSSION

The finding of this study shows that orthopedic implant removal procedures accounted for 7.8% of all the orthopedic and trauma operations carried out in the Kathmandu University Hospital, and this volume of work constitutes about one-fourth (26.31%) when compared to the volume of work for fracture stabilization with orthopedic implants which is the potential candidate for implant removal later, meeting the inclusion criteria in this study. Literatures show that the overall implant removal rate is 4.9% in United States and 6.3% in Finland, however, the Bostman et al reports that their implant removal rate was 81% in relation to number of internal fracture fixation performed, much more than what we found in our set-up(26.31%).^{3,9}

In our study, mean age of the patients undergoing Implant removal procedure was 24.6 years (SD : 15.6 yrs), however, more than half of the patients (62.5%) were of pediatric age group or young adult and only small percentage (7.9%) of elderly age group showing increased tendency of implant removal in the younger age group than in the elderly. Similarly, there is increased numbers of males than females undergoing implant removal procedures however, if we look into gender matched population of the patients undergoing implant removal procedure or fracture fixation then there is no significant difference between the gender wise distribution. (P value = 0.3028; Chi Square test)

Other literature reviews report varying responses from the patients who have undergone implant removal procedures. Most of the studies are only limited to specific type of surgeries unlike the one which we have undertaken accounting all types of implant removal. Jacobsen et al reported improvement after the hardware removal in 75% of patients who had previously undergone open reduction and internal fixation of the ankle.¹⁰ Dodenhoff et al noted that 11 out of 17 who underwent femoral nail removal experienced pain relief in their study.¹¹ Similarly, 45% of complete pain relief, 35% of partial pain relief and 20% no pain relief after the tibial nail removal were shown by Keating et al in patients complaining of knee pain.¹²

However, 17% of patients noted an increase in knee pain after tibial nail removal in Boerger et al series and only 11 out of 22 patients (50%) reported improvement in pain in Brown et al series of painful hardware removal from ankle.^{13,14} In this study, 76% of the patients responded complete and 10.8% of them had partial pain relief after implant removal procedures while 6.5% of them had no relief and 6.5% of them could not respond, indicating the limitation of this retrospective nature of the study (fig 3 and table 6). Moreover, the present study is based on overall every type of implant removal and in all anatomic locations as the study done by Minkowitz et al which also shows the similar findings as the present study.¹⁵ The findings on pain relief are, though encouraging, but weak to provide enough support for the routine implant removal for the sake of pain relief alone. Regarding the procedure of implant removal, 92.9% of them were satisfied and 83% said that they would approve for the procedure if they knew about this kind of outcome before as opposed to 100% in both the cases in Minkowitz et al series.¹⁵ Lack of medical insurance and having to stay away from job leading to financial constraints were the main issues among our group of patients.

This is a single institute based report with limited number of case, a larger multicentric prospective study would give us the clear picture of the epidemiology of the procedure in the country, along with the economical and social burden of the implant removal procedures. The treating surgeons are the investigator in the case, so some biasness can not be ruled out.

CONCLUSION

Implant removal procedures are one of the most commonly performed elective orthopedic surgeries. Though pain relief after orthopedic implants removal can be expected but it is not so predictive, hence patients should be well counseled before the procedure and the indications for implant removal has to be evaluated for better patient satisfaction and safety.

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