THE PROCEDURE WITH LESS INTEREST THAN IT IS DONE IN ORTHOPEDIC PRACTICE: IMPLANT REMOVAL

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ABSTRACT

Introduction*: Implant removal surgery became a common procedure in orthopedics due to increase in internal fixation of fractures to obtain early mobilization. The aim of this study is to present indications, epidemiological results, difficulties, and complications of implant removal procedure.*

Materials and methods*: Between January and December 2016 all implant removal operations performed in our clinic were evaluated. Localization of the implant, type of the implant, indications of implant removal surgery, interval between fixation and removal surgeries, operation time, incisions, type of anesthesia, difficulties during surgery and complications were listed.*

Results*: A total of 192 patients and 218 implant removal surgeries enrolled in the study. The rate of extended incisions were 17%, the rate of different incisions were 4% for all implant removal surgeries while the others were performed with previous incisions. In children, most common indication for implant removal surgery was age and growing skeleton. Range of motion loss, skin and soft tissue irritation, pain and tenosynovitis were common causes of removal for adults. Complication rate of children was 11% while it was 23% for adults. Bony overgrowth, difficulty of implant accessibility, damaged screw recess, jammed screws and breakage of implants was recorded difficulties during implant removal surgery.*

Conclusion*: Orthopedic implant removal takes a big portion in daily orthopedic practice. Surgeons should be aware of difficulties and complications of this procedure and determine the indications carefully.*

Keywords*: implant removal, orthopedic hardware, complications, internal fixation.*

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Introduction

Open reduction and internal fixation of the fractures provides early mobilization when stable fixation obtained and patients gain maximal range of motion early. The increase in internal fixation surgery results as the increase in implant removal surgery and implant removal surgery becomes a common elective surgery for orthopedic surgeons[(1-8)].

Various implant removal indications is present like infections, pain, soft tissue irritation and there are various difficulties like screw breakage, buried implants nonetheless, there is not much knowledge about implant removal surgery in the literature[(6-13)]. Beside this, it is not rare to have difficulties and complications in implant removal surgery especially when this procedure underestimated. The aim of this study is to present indications, epidemiological results, difficulties, and complications of implant removal procedure.

Methods

Between January 2014 and December 2016 implant removal surgeries in our department were evaluated retrospectively. Patients with less than six months follow up and fixation devices, which can be removed without incision or only with a stab incision like Kirschner wires and external fixators, were excluded from the study.

Patients' records were evaluated according to demographic data, localization of the implant, type of the implant, indications for implant removal

surgery, interval between fixation and removal surgeries, operation time, incisions, type of anesthesia, difficulties during surgery and complications. Multiple indications, difficulties or complications counted separately for all cases.

For statistical analysis, the SPSS 16.0 software package (SPSS, Chicago, Ill., USA) was used. Mean values and standard error of the mean were given unless otherwise indicated for continuous variables. Discrete data are presented as counts and percentages. A two-tailed values $P < 0.05$ was considered statistically significant.

Results

A total of 192 patients and 218 implant removal surgeries enrolled in the study. For 179 cases only implant removal was performed while for 39 cases additional surgical process was needed (17%). The duration of surgery was 118±62 minutes when additional surgery was required and 58±44 minutes when only removal was performed ($p<0.005$). Seventy-two implant removals were done in children and 179 implant removals were done in adults. The duration of surgery was 45±34 minutes in children and 80±55 minutes for adults and this difference was considered as a result of easy removable implants in children like titanium elastic nails.

The time between fixation surgery and removal surgery was 15±13 months in children and 17±16 months in adults. The time to removal was 17±17 months for only removed cases and 10±9 months for others ($p<0.005$). These differences were due to indications like avascular necrosis, nonunion, or implant breakage for patients who needed additional surgical interventions.

Implant removal incisions were categorized as same, extended or different to the previous incisions. In children 60 (83% of children) incisions were the same with the previous incisions and 12 (17% of children) extended incisions needed. There were no children who needed different incision. In adults 109 same incisions (75% of adults), 27 extended incisions (18 % of adults) and 10 different incisions (7% of adults) were needed. The rate of extended incisions were 17%, the rate of different incisions were 4% for all implant removal surgeries.

In children most common indication for implant removal surgery was age and growing skeleton. Skin irritation and patients' choice were other common indications. Range of motion loss, skin and soft tissue irritation, pain and tenosynovitis were common causes of removal for adults (Table 1).

	Children	Adults	Additional procedure	Single Procedure
Skin/Soft tissue irritation	9	36	1	44
Age	70	0	2	68
Loss of ROM*	2	40	5	37
Pain	1	34	4	31
Infection	0	13	3	10
Implant malposition	3	15	9	9
Tenosynovitis	2	23	3	22
Nerve injury	0	4	0	4
Cosmetic	3	4	0	7
Implant loosening	0	10	3	7
Patient's choice (or family)	9	12	0	21
Intra articular implant	0	3	1	2
Temporary arthrodesis	0	7	1	6
Implant breakage	0	6	6	0
Nonunion	0	8	8	0
Avascular necrosis	0	5	5	0

Table1: Indication of implant removal surgeries. *ROM: range of motion.

Bone overgrowth, difficulty to get access to implant, damaged screw recess, jammed screws and breakage of implants were recorded difficulties during implant removal surgery. Bone overgrowth was the most common difficulty in children and damaged screw recess and difficulty to get access to implant were the most common in adults (Table 2).

	Children	Adults	Additional procedure	Single Procedure
Bone overgrowth	11	16	8	19
Hard access to implant	6	26	5	27
Damaged screw recess	7	27	8	26
Hard to remove	3	9	2	10
Implant breakage	0	3	2	1

Table 2: Difficulties in implant removal surgeries.

Complications of implant removal surgery were not rare. Infection, hematoma, and refracture were complications recorded in children. In adults additional to these, residual range of motion loss, nerve injury, cosmetic scar, intraoperative fracture, and residual pain were recorded (Table 3). Complication rate of children was 11% while the rate was 23% in adults. Patients who needed additional surgical interventions after implant removal faced complications more and complication rate was 50%.

	Children	Adults	Additional procedure	Single Procedure
Residual ROM* loss	0	12	3	9
Infection	1	7	6	2
Nerve injury	0	5	0	5
Cosmetic scar	0	8	4	4
Hematoma	1	3	3	1
Intraoperative fracture	0	2	0	2
Residual pain	0	7	5	2
Refracture	2	1	0	3

Table 3: Complications after implant removal surgery. *ROM: range of motion.

The most common bone that implant removal surgeries done was femur in children. Especially due to proximal femoral osteotomies in pediatric hip problems proximal femur is the most common surgical site. The surgical site was femur in 39 patients (24 proximal), followed by tibia in 14 patients, radius in 12 patients, ulna in 9 patients and navicular bone in one patient. Thirty-nine plates, 27 titanium elastic nails and 6 cannulated screws were removed in these surgeries. In adults, surgical sites were radius in 28 patients, femur in 26 patients, ulna in 23 patients (15 olecranon), and malleolus in 22 patients. Other sites were clavicle, tibia, hand, foot and pelvis. The removed implants during surgeries were fixation plates in 122 patients, screws in 33 patients, and intramedullary nails in 24 patients.

Discussion

Routine orthopedic practice comprises implant removal surgery with high frequency. Although it seems to be an easy procedure, it can be challenging as other major orthopedic surgeries. Indications of implant removal are not clear and depended on the surgeons' or patients' choice[9,14]. This study counted all implant removal surgery indications in two years period and demonstrated real frequency of these indications. Immature skeleton was the most common indication in children and skin or soft tissue irritation was the most common indication in adults. Loss of range of motion, pain and tenosynovitis were the other common indications. Indications varied according to the localization. Soft tissue and skin irritation was common indication in clavicle, olecranon, or malleoli while loss of range of motion was common indication around the joints (Figure 1). Similar to this temporary arthrodesis was the indication in the hand.

Fig. 1: 26 year old male who had skin irritation due to clavicle locked plate fixation.

Implant removal is not a complication-free surgery and major complications as infection, refracture, or nerve injury can occur. Overall complication rate reported in orthopedic implant removal surgery was up to 20%, but more recent studies found lower complication rates[7,13,15-20]. In our study 20% of patients experienced at least one complication after implant removal. Davids et al. reported 11.4% complication rate in children, and Kovar et al reported 14.39% complication rate in proximal femoral implant removal surgery[17,19]. Relatively higher complication rate in our study was because of including almost every implant removal surgery in the study even patients who needed additional procedures.

Schwarz et al. reported 20% technical difficulty risk rate in locking compression plate removal surgery and most common causes were jammed screw head and damaged screw head[9]. They found different rates of difficulties in different bones. Inappropriate insertion of the screws especially in locking plates found to be the cause of these difficulties. Cross threading of the screw and application of torque over limiting capacity to the screw facilitates screw jamming and damage of screw head. But, these damaged screw head can be seen also for the screws of intramedullary nails or cannulated screws as well as locking plates and removal of these implants also included in this study. Also, in this study we did not find any difference according to the bone localization. The most common difficulties that we encountered were jammed screws and damaged screw heads. Bone overgrowth was another common difficulty in this study and related to the long period from fixation and removal surgery risk of bone overgrowth found increased[9].

Incisions never became a topic in the studies evaluating implant removal surgery.

In this study we grouped incisions as same, extended, and different. Approximately 80% of incisions were the same with the previous surgery. The rate of extended incisions were 17%, the rate of different incisions were 4% for all implant removal surgeries.

The main limitations of this study are retrospective design, which can be cause false information, but we strictly excluded patients with incomplete data to avoid this limitation. Although including different bones and different implants to the study can be seem as limitation, to demonstrate the real rate of indications, difficulties, and complications we planned this way.

In conclusion, orthopedic implant removal takes not a small portion of daily orthopedic practice. Additionally it is not an easy procedure and not away from difficulties or complications. Preventing complications and difficulties of implant removal surgery depends on to determine proper indications and meticulous surgery and implant removal should not be made as a routine surgery.

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