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Healing of screw holes after implant removal used for fracture fixation, a clinical and radiological observational study

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Abstract

Purpose: A significant portion of orthopedic elective procedures involve implant removal. The clinical outcomes of removing metal implants following fracture healing are uncertain, and the topic of whether or not to do so is one that is discussed globally. As a result, the present study was designed to analyse the clinical, radiological, functional outcome and complication rates in patients undergoing implant removal surgery in department of Orthopaedics, Government Medical College Kozhikode and to assess the results of improvement of symptoms for which implant removal was indicated.

Methodology: This was a prospective cohort study conducted on 60 patients who reported to department of Orthopaedics, Government Medical College Kozhikode and were indicated for implant removal surgery.

Results: The population's mean age was found to be 30.33 years, with men (67%) making up the majority. 88.3% of removed implants were plates. Patient's request (73.3 %) was the primary reason for implant removal. In cases when implant removal was indicated, 75% of patients experienced no problems following surgery. Partial implant removal accounted for the majority of complications (13.3%) after implant removal surgery. None of the instances in the population under study exhibited full healing of the screw holes even after three months. Merely 13.3% of the cases exhibited near healing (hazy) screw whole healing.

Conclusion: Unwanted complications may arise after surgery in circumstances where implant removal is not recommended. In indicated cases of implant removal, a good post-operative outcome is seen. Care should be taken to prevent refractures even after three months of implant removal, as screw holes were observed to not have healed when evaluated radiologically at that time. Screw whole repair occurs more quickly in younger age groups.

Keywords: Implant removal, surgical site infection, radiological outcome, plate

Introduction

In the field of orthopaedics, surgical implant removal is among the most frequently performed procedures. Alloys like titanium and stainless steel are typically utilized in fracture fixation. It is imperative to remove internal hardware from children as soon as the fracture heals to prevent any disruptions to their developing bones. However, the removal of orthopaedic implants in adults has always been a contentious topic for the following reasons: first, the field of internal fixation biomechanics is very dynamic due to the development of better and more advanced fixation devices, and second, the criteria for removal are not well defined ^[1]. The purpose of the implant is no longer served after fracture union; it now only functions as an external object inside the patient's body. Consequently, the question of whether, when, and why to remove the implant arises ^[2].

According to AO/ASIF guidelines, implant removal is advocated for the following reasons

Volume factor: The presence of implant in a small area may irritate the soft tissues and alter their mechanics. It may also result in tendon irritation, nerve entrapment, or skin irritation

Compatibility factor: Various immunological, toxic, or teratological effects related to wear particles in bone structure are observed as a result of the biological effects of implants or their constituents.

Altered bone structure: Changes in vascularity or the underlying bone's altered stresses can lead to osteonecrosis, stress shielding, osteoporosis, and refracture.

There is debate worldwide about whether or not to remove metal implants following fracture healing, as the clinical outcomes are uncertain. Since there has never been any prior research on the subject of screw hole healing following implant removal, we are presenting the design of a prospective clinical and radiological cohort study to ascertain the indications for and expectations of implant removal on complaints and incidence of surgical complications, as well as socioeconomic consequences of implant removal.

Aims and Objectives

To analyse the clinical, radiological, functional outcome and complication rates in patients undergoing implant removal surgery in department of Orthopaedics, Government Medical College Kozhikode.

To assess the results of improvement of symptoms for which implant removal was indicated.

Materials and Methods

This was a prospective cohort study conducted in the orthopaedics department at Government medical college Kozhikode. A total of 60 patients reporting to the OPD and advised various implant removal surgeries were selected for the study. The risks and benefits of the study were explained to the patients and informed consent was obtained from those willing to participate in the study. A questionnaire was provided to the surgeon and patient.

Inclusion Criteria

Age \geq 10 years, undergoing plate or intramedullary nail removal of upper extremity (radius, ulna, humerus, clavicle) or lower extremity (fibula, femur, tibia) with an ASA classification of 1, 2 or 3.

Exclusion Criteria

1. Age < 10 years.
2. Patients unwilling for follow up.
3. Healed fractures of the hand, acetabulum or spine were left out of the study because of the low incidence.
4. ASA classes 4 and 5.

Methodology

Prior to surgery, pre-anaesthetic checkup was conducted. Fitness for surgery was obtained in the case of comorbidities. Radiographs of the fracture site were taken in both AP and lateral views to confirm the union of the fracture site. The patients were informed about intraoperative and postoperative complications.

Antibiotic cover was given during the post-operative period. Once the culture and sensitivity results were obtained, antibiotic coverage was optimized for the patients who had developed surgical site infections during the post-operative phase. Following uneventful recovery during the post-operative period, functional outcome scores were calculated using mayo wrist score/ mayo elbow score/ tegner lysholm score. During discharge, patients were explained about the mobilization of joints to avoid stiffness.

Follow up was conducted at 1, 3 and 6 months interval. The patients were evaluated for the presence of any new symptoms related to the implant removal surgery and necessary treatment was advised. Bone tenderness and range of movements were assessed. AP and lateral radiographs were

obtained to assess the healing of screw holes and to check if any fracture lines were visible at screw whole sites / previous fracture site.

The questionnaire provided to the surgeon evaluated details of pre and post-operative function based on mayo wrist and elbow score, harris hip score etc; radiological outcome based on width of bone, diameter of screw, plate bone gap, size of screw hole, screw hole healing by 1, 3 and 6 months interval.

Results

Patient's request was the reason for implant removal in 73.3% cases followed by pain in 15% cases. (Fig. 1) Implant removal was done in 8.3% cases due to infection, in 1.7% case due to implant prominence and in 1.7% case due to implant failure. (Table 1) Most common implant used in the study was DCP followed by 1/3rd tubular plate. 7 cases of IMN were also included in the study. (Table 2).

Out of the 44 cases who requested implant removal, 30 did not develop any complication following surgery, 2 developed superficial surgical site infection, 6 had partial implant removal and 3 presented with refracture between

16-24 weeks post implant removal, 2 patients developed edema and 1 patient developed pain which remained during the follow up period), (Table 3).

Discussion

Most of the patients of the present study belonged to the younger age group. This was similar to the results obtained in studies conducted by of Onche *et al.* [2], Haseeb *et al.* [1], Kuubiery *et al.* [3] and Kadir BM *et al.* [4].

In the present study, patient's request was the most common indication for implant removal (Figure 1) followed by pain. Similar results were obtained in studies conducted by Onche *et al.* [2] and Kuubiery *et al.* [3]. However contrasting results were obtained with studies of Ogundele [5], and Reith *et al.* [6] who reported implant failure and doctor's recommendation respectively as the most common indication for implant removal. Shrestha *et al.* [7], Haseeb *et al.* [1] reported pain to be the most common reason for implant removal in their studies. This could be attributed to the psychological impact of presence of a foreign body in their body and the urge to get it removed.

Plates were observed to be the most commonly removed implant (Table 1) in the present study which was consistent with the data obtained by Haseeb *et al.* [1] and Onche *et al.* [2]. However, in a study by Shrestha *et al.* [7], IMN was found to be the most commonly removed implant. Most common complication (Table 2) following implant removal was observed to be partial implant removal followed by infection. Similar results were obtained in the study conducted by Nwosu *et al.* [8]. Most common complication after implant removal in studies done by Reith *et al.* [6], Shrestha *et al.* [7] and Kadir *et al.* [4] was impaired wound healing, nerve injury and wound infection respectively. The rate of complications following implant removal surgery depends on the skill and expertise of the surgeon. Damage to screw head and thread during the fracture fixation surgery also affects implant removal.

In indicated cases of implant removal, patients showed good results post-surgery. Similar results were obtained in studies of Reith *et al.* [6] and Nwosu *et al.* [8] Out of 22 forearm shaft fractures 13.6% had refractures. All refractures occurred with low velocity injuries. In the study by Chi-Kuo Yao *et al.* [9], 12.9% re-fractures were due to low velocity injury and 2.7% due to high velocity injury in a total of 122 patients. In

another study by Hidaka *et al.* [10], 31.8% of 22 patients suffered from refractures in the forearm. Low velocity injury itself can result in refractures following the removal of forearm implants. Our study's lower refracture rate might be the result of patients adhering more closely to the surgeon's recommendations and receiving better post-operative counseling about the possibility of refracture. Additionally, fracture rates differ based on the duration of the follow-up.

Radiographic observations revealed that screw healing was faster in younger patients. There is no significant difference in healing of screw holes of metaphyseal and diaphyseal fractures. After removal, there was no significant difference in the screw hole healing between implants with 3.5mm and 4.5 mm. There was no significant difference between the upper and lower limb screw holes in terms of healing. None of the cases in the population under study had screw holes completely healed even after three months. In just 13.3% of the cases overall, the screw hole had nearly healed. Therefore, in order to avoid refractures, patients must protect their limbs for a longer amount of time. (Table 3) Prior research on the radiological consequences of screw hole healing has not been published.

Conclusion

Patients request is the common reason for implant removal. Unwanted complications may arise after surgery in circumstances where implant removal is not recommended. In indicated cases of implant removal, a good post-operative

outcome is seen. Care should be taken to prevent refractures even after three months of implant removal, as screw holes were observed to not have healed when evaluated radiologically at that time. Screw hole repair occurs more quickly in younger age groups. Late removal years after fracture union may leads to failure of implant removal.

Table 1: Type of implant removed

Type of implant used	Frequency	Percentage
DCP	24	40
1/3 rd Tubular Plate	12	20
Locking Plate	10	16.7
Calcaneal Plate	3	5
Ellis Plate	4	6.7
IMN	7	11.7
Total	60	100

Table 2: Complications after implant removal surgery

Complications after implant removal surgery	Frequency	Percentage
Nil	42	70.0
Surgical site infection	4	6.7
Edema	2	3.3
Pain	1	1.7
Partial implant removal	8	13.3
Refracture	3	5
Total	60	100

Table 3: Radiological outcome at 3 months

3 Months	Frequency	Percentage
Hazy	8	13.3
Well seen with sclerotic border	46	76.7
Well seen with normal bone edge	6	10
Total	60	100

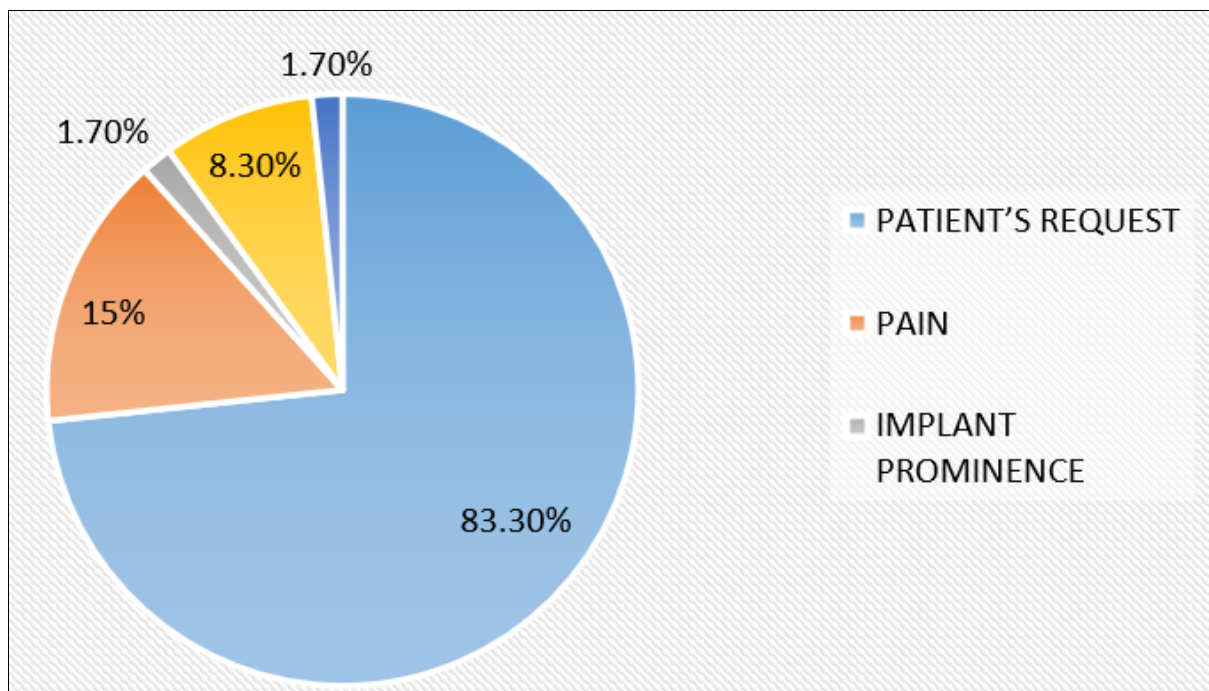


Fig 1: Reason for implant removal



Fig 2: Refractures after implant removal Case 1



Fig 3: Refractures after implant removal case 2



Fig 4: Partial implant removal case 1



Fig 5: Partial implant removal case 2



Fig 6: Case 1 (Measurement at 1 month)

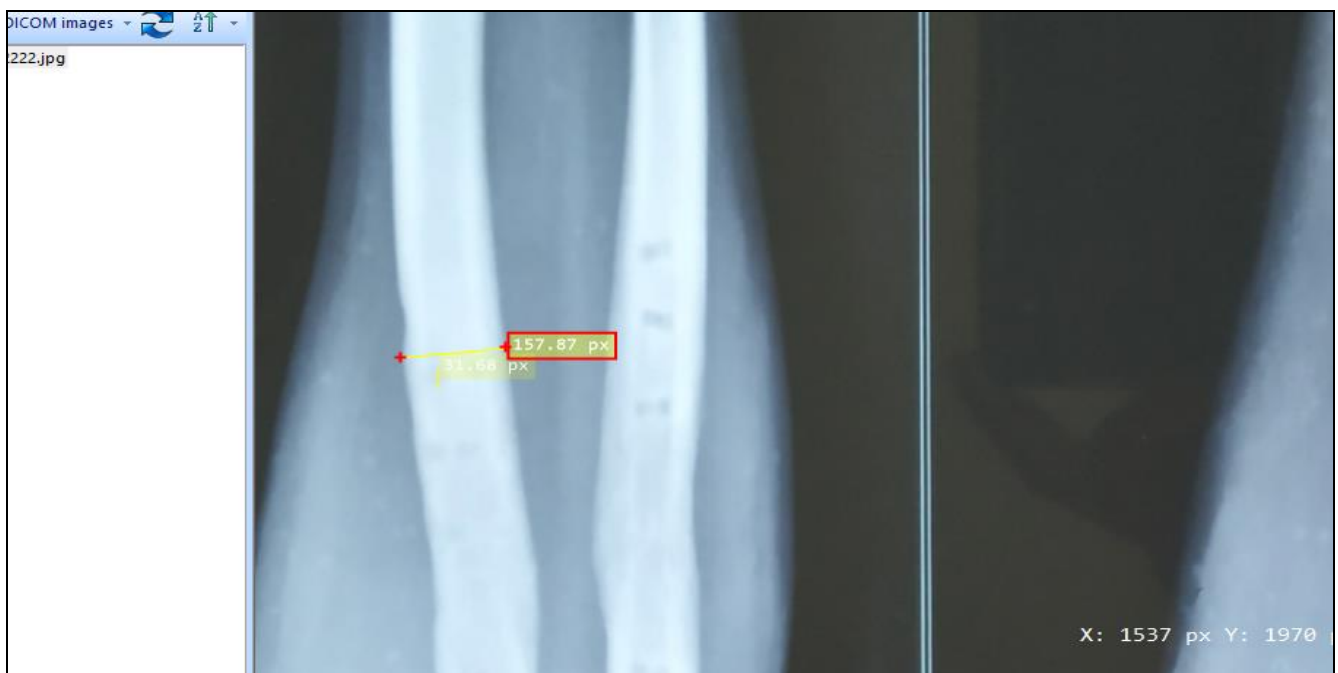


Fig 6.2: Screw whole measurement using microdicom software



Fig 7: Measurement at 3 months (Case 2)



Fig 8: Radiological observation of screw hole healing



Fig 9: Case 1: Both bone forearm implant removal showing a hazy screw hole after 3 months



Fig 10: Case 2: IMN tibia implant removal after 3 months-screw hole well seen with sclerotic border

Abbreviations

IMN: Intramedullary nail

DCP: Dynamic compression plate

Conflict of Interest

Not available

Financial Support

Not available

References

1. Haseeb M, Butt MF, Altaf T, Muzaffar K, Gupta A, Jallu A, *et al.* Indications of implant removal: a study of 83 cases. *Int J Health Sci.* 2017;11:1-7.
2. Onche II, Osagie OE, Inuhu S. Removal of orthopaedic implants: indications, outcome and economic implications. *J West Afr Coll Surg.* 2011;1:101-12.
3. Kuubiere CB, Mogre V, Alhassan A. Incidence and indications for orthopedic implant removal: a retrospective analysis. *J Life Sci Res.* 2015;2:76-86.
4. Kadir BM, Ibraheem GH, Yakub S, Onuchukwu NS, Olawepo K, Babalola OM, *et al.* Removal of orthopedic hardware: a five year review. *Niger J Orthop Trauma.* 2013;12:113-8.
5. Ogundele OJ, Ifesanya AO, Adesanya AA, Alonge TO. Removal of orthopaedic implants from patients at the university college hospital, Ibadan. *Afr J Med Sci.* 2013;42:151-5.
6. Reith G, Schmitz-Greven V, Hensel KO, Schneider MM, Tinschmann T, Bouillon B, *et al.* Metal implant removal: benefits and drawbacks – a patient survey. *BMC Surg.* 2015;15:96.
7. Shrestha R, Shrestha D, Dhoju D, Parajuli N, Bhandari B, Kayastha SR, *et al.* Epidemiological and outcome analysis of orthopedic implants removal in Kathmandu university hospital. *Kathmandu Univ Med J.* 2013;11:139-43.
8. Nwosu C, Adeyemi OT, Salawu ON, Mejabi JO, Fadimu AA. Orthopaedic implant removal: epidemiology and outcome analysis. *Niger J Orthop Trauma.* 2018;17(1):12-16.
9. Yao CK, Lin KC, Tarng YW, Chang WN, Renn JH. Removal of forearm plate leads to a high risk of refracture: decision regarding implant removal after fixation of the forearm and analysis of risk factors of refracture. *Arch Orthop Trauma Surg.* 2014;134:1691–1697.
10. Hidaka S, Gustilo RB. Refractures of the bones of forearm after plate removal. *J Bone Joint Surg Am.* 1984;66(8):1241-3.

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