A prospective study of indications of Orthopaedic Implant removal

Dr. Tejpal Singh[1], Dr. Paramvir Singh Chib[2], Dr. Suraydev Aman Singh[3], Dr. Abdul Ghani[4], Dr. Mainsh Singh[5], Dr Pankaj Vir Singh[6]

[1,2,3,4,5,6]Department of Orthopaedics, Government Medical College Jammu

Corresponding Author: Dr. Manish Singh, Email ID: drmanish_singh@yahoo.co.in

Abstract

Background: Implant removal is one of most commonly routinely done elective surgerical intervention in Bone and Joint field. However, the need for routine implant removal remains an issue of controversy and debate. This present study was conducted to investigate the indications of implant removal.

Material & Methods: 180 Patients were admitted requiring implant removal in our department, got operated in the main and emergency OT. Follow up was then done for an average 6 months for resolutions of symptoms or appearance of new complications.

Results: Out of 180 patients, 103 were males and 77 were females. 85 patients needed implant removal because of hardware symptoms, 20 patients nneded implant removal because of infected implant in situ. 45 patients needed implant removal on patience's request, 15 patients have implant failure, 12 patients have exposed implants.

Conclusion: From our study we concluded that symptomatic implant needs removal majority of times. We found that hardware pain, discomfort and implant prominence (mechanical symptoms) are the most common indications. patient insistence is the next most common, then followed by Infection, then exposed implant and lastly hardware failure.

Key words: Implant removal, Hardware symptoms, complications.

DOI Number: 10.14704/nq.2022.20.13.NQ88107 **Neuro Quantology 2022; 20(13):836-842**

Introduction

Apart from fixation of fractured bones with implants, surgical removal of implant constitutes major portion of orthopaedic surgeries in day to day practice.[1,2] Other than conservative management of fractures, surgical fixation of fractures needs some implants (nails, plates or screws) for stablisation.[3] These orthopaedic implants used are mainly made up of alloys of titanium and stainless steel.[4] Once the fracture has achieved union, the implant in-situ loses its meaning and it acts as a foreign body and its removal of asymptomatic implant is topic of discussion as its criteria is still not cleared.[5] Now the ongoing debate about the justification of elective implant removal surgery is whether the implant should be removed, and if so, why and when?.[6] On one side, if the hardware removal is done earlier, the risk of re-fracture increases proportionally and on other hand, delayed removal may require more extensive and difficult operation due to over-growth and stronger bony integration on implants.[7] One of the most common indication encountered for hardware removal is patients insistence, which may be due any personal or psychological reason.[8] Other the common indications for implant removal is without any doubt in patients with implant failure, hardware symptoms, surgical site infection, soft tissue compromise or metal allergy.[5] However in children, the removal of hardware becomes mandatory as delayed removal may cause disturbances to the growing skeleton, to prevent bony ingrowth making later removal technically difficult or impossible and to allow planned reconstructive surgery after skeletal maturation.[9] The decision for deciding the indication for implant removal should weighted that whether the removal will be benefitting the patient against harming the patient in asymptomatic cases otherwise removal is unquestioned in case of symptomatic ones that to keeping in mind the potential complications post-operatively and however, benefits should outweigh risks and removal should not require a more extensive operation than insertion.[10] So, we conducted this with the aim in mind to find out the most common indications for implant removal, most common site and post removal complications.

Material & Methods:

A prospective study was conducted on the patients requiring implant removal, the patients were admitted in department of orthopaedics from 2020 to 2022.Patients were admitted who presented in Out Patient Department (OPD) with hardware related complications and those who demanded/requested for the implant removal surgery. All the patients regardless of age and gender are included in the study. Patients excluded from our study were those unfit for surgery and who needed removal of fixation devices proposed to be taken out after a certain interval to start with, like percutaneous K-wires, external fixators and joint prosthesis. At the time of admission, all the possible risks of the surgery and the post operative possible complications present in the literature were discussed with the patients and attendants. Patient shifted to ward, basic examination done followed all baseline investigations, fitness ensured then patient posted in OT list. Consent forms were signed, prophylactic antibiotics were given in non-infected cases 30 minutes before first skin incision. Tourniquet was used wherever meant to be, intra-operative samples for culture sensitivity were taken. Post operatively patients were given intravenous antibiotics and in cases of infected cases antibiotics were given for longer duration and based on culture reports. All the patients were discharged and follow up done on OPD basis.

Results

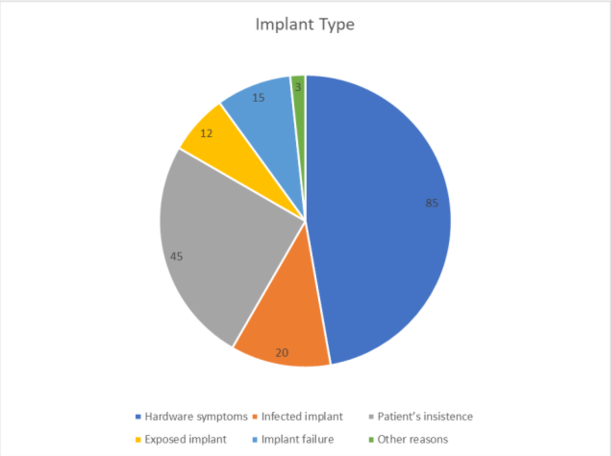
From this prospective study designed, one hundred eighty patients were included in this study and were evaluated. One hundred thirty-three patients were initially included in this study, but due to some reasons, only one hundred twenty patients were left at the end. Implant removal was done and evaluated.

Out of the total number of patients, 103 were males and 77 were females. Their ages ranged from 2 years to 75 years. The reasons for removal of hardware metal are listed in five categories: Pain/discomfort/ prominent hardware (hardware symptoms or mechanical symptoms), infected hardware, implant failure, patient's insistence {request} or elective removal, exposed implants and other reasons and the patients were distributed (Table 1).

S. No.	Implant type	Hardware symptoms	Infected implant	Patient's insistence	Exposed implant	Implant failure	Other reasons
1.	Femur nail/TENS	8	3	5	-	4	Screw migration -3
2.	Femur plates	3	-	2	-	-	
3.	Tibia nail/TENS	15	3	7	3 (locking screws)	4	-
4.	Tibia plates	9	4	1	4	-	-
5.	Ankle hardware	18	7	10	2	-	-
6.	Arthroplasty	-	2	-	-	-	-

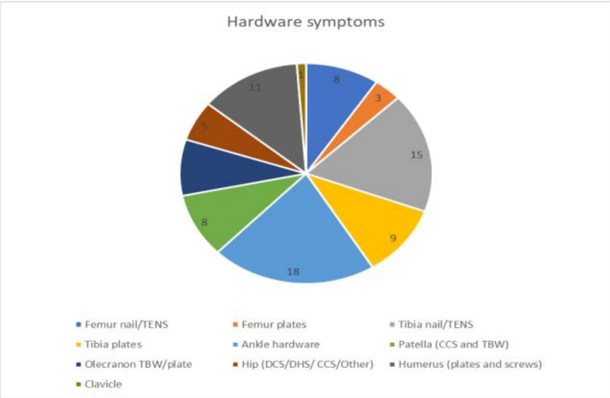
	(hip)						
7.	Patella (CCS and TBW)	8	-	4	-	-	-
8.	Olecranon TBW/plate	7	-	5	-	-	-
9.	Hip (DCS/DHS/ CCS/Other)	5	1	1	-	-	-
10.	Humerus (plates and screws)	11	-	4	3- (distal humerus)	7	-
11.	Clavicle	1	-	1	-	-	-
12.	Forearm implants	-	-	5	-	-	-
13.	Total	85	20	45	12	15	3

Table 1. Distribution of implant removal patients



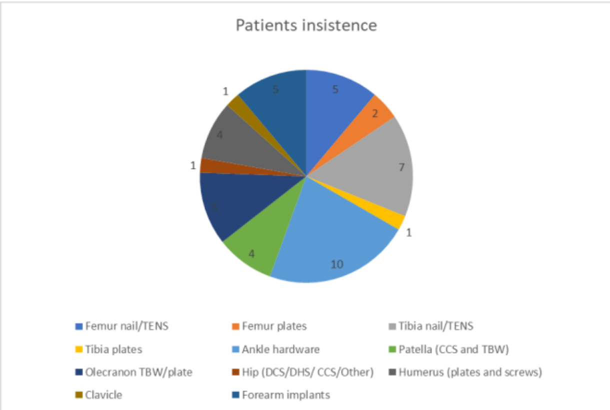
Flow chart showing indications for implant removal.

Eighty- five patients (47.22%) out of the total number (n=180) had implant removal done because of hardware or mechanical symptoms (pain, discomfort, implant prominence, impairment of function). The implants responsible for hardware symptoms in order of frequency were ankle hardware (CCS, TBW, plates) (n=18), tibia nail/ TENS (n=15), humerus hardware(PHILOS plate, DCS,LCP Plates) (n=11), tibia plates (proximal and shaft plates) (n=9), patella hardware (CCS &TBW) (n=8), femur nail/TENS (N=8), olecranon hardware (CCS, Plate & TBW) (n=7), Hip hardware (DCS/DHS/ CCS/Other) (n=5), Femur plates (n=3), Clavicle hardware (n=1). 79 patients (92.94%) on post-operative follow up had relief in mechanical symptoms. Fortunately, no patient complained of increase in mechanical symptoms. The average pain visual analogue scale (VAS) score decreased on follow-up up to 6 months. No patient had refracture, infection or any other complain. The mean duration of hospital stay in these patients is 5 days. Patient is discharged after third post operative day after antiseptic dressing.



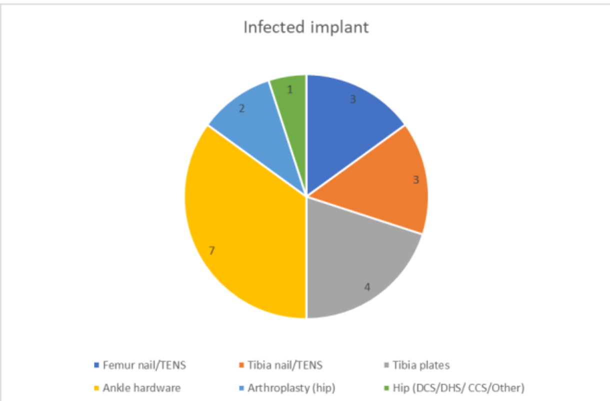
Flow chart showing distribution of patients having hardware removal with hardware symptoms.

Forty-five patients out of total number had got their implant removal done on the patients request/demand/insistence and the hardware removed commonly responsible in order of frequency were Ankle hardware (n=10), Tibia nail/TENS hardware (n=7), forearm hardware (n=5), Olecranon hardware (TBW/plate) (n=5), Femur hardware (nail/TENS) (n=5), Patella hardware (CCS and TBW) (n=4), Humerus hardware (plates and screws) (n=4), Femur plates (n=2), Hip (DCS/DHS/ CCS/Other) (n=1), Clavicle hardware (n=1). The mean duration of hospital stay in these patients was 5 days. No patient developed infection in their follow ups.



Flow chart showing distribution of patients having hardware removal on patient's insistence.

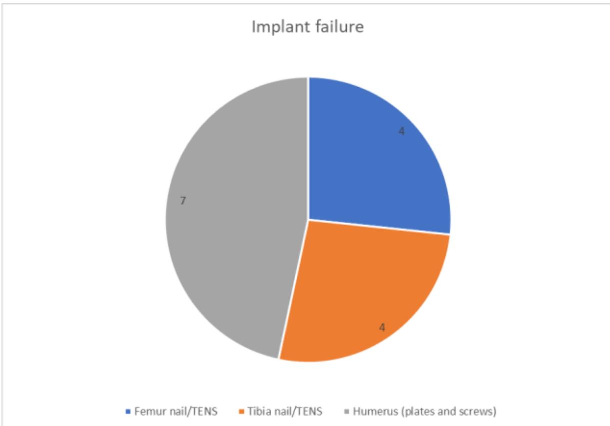
Twenty patients had infected implants in situ removal done commonly responsible in order of frequency were ankle hardware (n=7), tibia plates (n=4), tibia nail/TENS hardware (n=3), Femur nail/TENS hardware (n=3), Tibia nail/TENS hardware (n=3), Arthroplasty (hip) hardware (n=2), Hip hardware (n=1). Implant removal was done, tissue and pus sample collected intra operatively and sent for antibiotic and culture sensitivity, intra venous antibiotics were started, in some cases antibiotics beads were used to control the infection.



Flow chart showing distribution of patients having hardware removal with infected implant in situ.

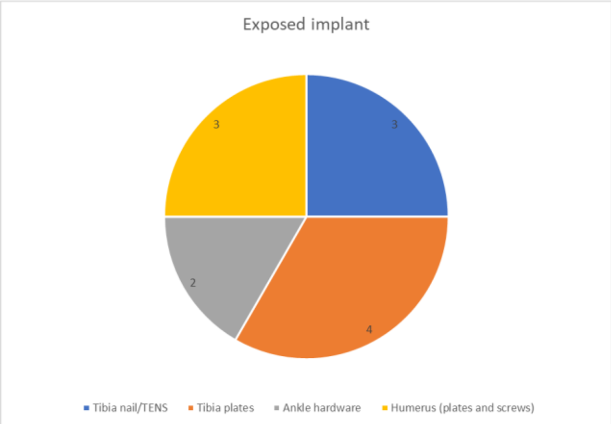
Picture shows Infected implant removal. a,b showing infected femur nail, c,d showing infected PHILOS, e,f showing infected arthroplasty removal.

Fifteen patients had implant failure which became the reason for implant removal, removal done commonly responsible in order of frequency were Humerus plates (n=7), femur and tibia nails (n=4 each, total = 8). Exchange nailing and revised plating was done with bone grafting in such cases to achieve union. Three patients required implant removal due to screw migration which disturbed principle of fixation.



Flow chart showing distribution of patients having hardware removal with implant failure.

Twelve patients have their implant done because of implant exposure/prominence being the main indication for the removal, removal done commonly responsible in order of frequency were Tibia plates (n=4), Humerus (plates and screws) (n=3), Tibia nail locking screws (n=3), Ankle hardware (n=2). In pediatric population, TENS removal done in case of tibia and femur cases, CCS removal done in case of lateral condyle fracture cases. No patients have developed infection post implant removal in paediatrics age group. Implant removal did not come without any hindrance and it sometimes become too tedious while operating. This was seen especially in locked plates at various sites, with ingrowth of bone everywhere the plate/screws and slippage of screw driver due to distortion of screw head.



Flow chart showing distribution of patients having hardware removal with exposed implants.

Picture showing implant exposure.

Discussion

Orthopaedic Implant removal is one of the regularly done surgerical procedure and it is not a cake walk every time to get out the procedure easily, as poses a serious challenge to the surgeon, especially when the integrity of the screw head and threads are not intact, overgrowth of bone over implant, struck nails, broken implant and ingress of bone into all possible crevices of the implants.[11] And also of the fact that there is no single technique that is universally used for the successful removal of same case every time and several different methods may be employed during the same case.[12] Hence pre-operative planning which includes thorough study of data regarding type of implant and duration of implant saves percoid operative time and reduces intra operative struggle.[13]

Popular consensus still is that implant removal should not be considered a routine procedure in a healed fracture.[5,13,14,15] Opinions and decisions not only vary between surgeon-related factors (e.g., differences between countries), but also patient-related factors (e.g., differences between children and adults, anatomical locations) and implant-related factors (e.g., stainless steel versus titanium alloys).[4]

Our study concludes male preponderance which is also supported by following studies Haseeb et al.,[6], Kuubiere et al.,[8], Shrestha et al.,[10] and Kadir et al.,[16] Nwosu et al.,[20] and Abidi et al.,[21]. However, Onche et al.,[17] who reported female preponderance.

The most common implant removed in this study were plate and screws, which is supported by the findings of Haseeb et al.,[6], Kadir et al.,[16] and Onche et al.,[17] Nwosu et al.,[20]. However, it is other way around with the findings of Shrestha et al.,[10] who reported intramedullary nail as the most common.

Hardware symptoms is main and most common indication for implant removal in our study which is similar to Minkowitz et al.,[22], Haseeb et al.,[6], Reith et al.,[18] and Ogundele et al.,[19], who reported pain, doctor's recommendation and implant failure, respectively, as the most common indication for removal. This may be due to cultural and religious beliefs. It may also be psychological due to the presence of the implant. Patient's request is the most common indication for the removal in this study. This is similar to the findings of Onche et al.,[17] and Kuubiere et al.,[8] and Nwosu et al.,[20].

Retained hardware is the most common complication following implant removal in this study, which is similar to the findings of Nwosu et al.,20 and Haseeb et al.,[6] but is at variance with the findings of Kadir et al.,[16] Shrestha et al.,[10] and Reith et al.,[18] who reported wound infection, nerve injury and impaired wound healing, respectively.

Conclusion

From our study we conclude, hardware symptoms followed by patients request followed by infected implant were three main indications encountered in the study. Implant removal is a very challenging surgery as no universally accepted and reproducible technique is there for every case. Hence,we also concluded that proper study of literature, implant type and pre operative planning must be done before surgery. From our study we also concluded that symptomatic implant needs removal majority of times.

References

1. Bostman O, Pihlajamaki H. Routine implant removal after fracture surgery: a potentially reducible consumer of hospital resources in trauma units. J Trauma. 1996;41(5):846–9.
2. Sidky A, Buckley RE. Hardware removal after tibial fracture has healed. Can J Surg 2008;51:263-8.
3. Zbigniew G, Ronald WL. Removal versus retention of orthopedic trauma implants. Orthop Knowl Online J 2015;13:2.
4. Vos DI, Verhofstad MH. Indications for implant removal after fracture healing: A review of the literature. Eur J Trauma Emerg Surg 2013;39:327-37.
5. Busam ML, Esther RJ, Obremskey WT. Hardware removal: Indications and expectations. J Am Acad Orthop Surg 2006;14:113-20.
6. 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 (Qassim) 2017;11:1-7.
7. Marintschev I, Rausch S, Fujak A, Klos K, Hofmann GO, Gras F, et al. Removal of a femoral nail with osseous overgrowth at the end-cap: A navigated and cannulated minimally invasive technique. Comput Aided Surg 2013;18:41-6.
8. Kuubiere CB, Mogre V, Alhassan A. Incidence and indications for orthopedic implant removal: A retrospective analysis. J Life Sci Res 2015;2:76-86.
9. Hanson B, van der Werken C, Stengel D. Surgeons' beliefs and perceptions about removal of orthopaedic implants. BMC Musculoskelet Disord 2008;9:73.
10. 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 (KUMJ) 2013;11:139-43.
11. Varunjikar MD, Joshi SC, Varunjikar AM, Joshi CR. Implant removal: An unsolved challenge to the orthopedician. J Evol Med Dent Sci 2014;3:4282-6.
12. Hak DJ, McElvany M. Removal of broken hardware. J Am Acad Orthop Surg 2008;16:113-20.
13. Hanson B, van der Werken C, Stengel D. Surgeons' beliefs and perceptions about removal of orthopaedic implants. BMC Musculoskelet Disord 2008 24;9:73.
14. Krettek C, Müller C, Meller R, Jagodzinski M, Hildebrand F, Gaulke R. Is routine implant removal after trauma surgery sensible?. Unfallchirurg 2012;115:315-22.
15. Matthew LB, Robert JE, William TO. Hardware Removal: Indications and Expectations. J Am Acad Orthop Surg. 2006;14(2):113-20.
16. 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.
17. Onche II, Osagie OE, INuhu S. Removal of orthopaedic implants: Indications, outcome and
18. economic implications. J West Afr Coll Surg 2011;1:101-12.
19. 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.
20. Ogundele OJ, Ifesanya AO, Adesanya AA, Alonge TO. Removal of orthopaedic

841

implants from patients at the university college hospital, Ibadan. Afr J Med Med Sci 2013;42:151-5.

21. Nwosu C, Adeyemi TO, Salawu ON, Mejabi JO, Fadimu AA. Orthopaedic implant removal: Epidemiology and outcome analysis. Niger J Orthop Trauma 2018;17:12-6
22. Abidi SA, Umer MF, Ashraf SM, Mehdi SH, Ahmed SK, Shaikh IA. Outcome of painful implant removal after fracture union. Pak J Surg 2012;28:114-7.
23. Minkowitz RB, Bhadsavle S, Walsh M, Egol KA. Removal of painful orthopaedic implants after fracture union. J Bone Joint Surg Am 2007;89:1906-12.