



RESEARCH ARTICLE

REMOVAL OF FRACTURE FIXATION HARDWARE INDICATIONS AND OPTIMAL TIMING

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ARTICLE INFO

Article History:

Received 6th, November, 2014

Received in revised form 16th, November, 2014

Accepted 8th, December, 2014

Published online 28th, December, 2014

Key words:

ABSTRACT

Background: After fracture healing, the obvious question after primary implant surgery both for the patient and surgeon is whether, when & why to remove the implant fixed during index surgery. This is a prospective study of 310 patients who underwent implant removals at our institution. The aim of our study is to establish clear indication & timing for removal of implants after fracture union.

Materials & Methods: The study protocol included pre operative data collection like nature of fracture & which bone was involved, date of index surgery, type of implant used, recording intraoperative findings & monitoring of the post operative course up to 1 yr following implant removal.

Inclusion criteria: Removal of the following metallic implants used in the index surgery – K wires, screws alone, Intra medullary devices, different types of plates with screws & prosthesis.

Biodegradable screws were excluded.

Results: In all the other studies reviewed, no study specifically separated the absolute from the relative indications. We included absolute indications in our audit in order to answer our first research question. Over all 155 implants were removed for the absolute indications like exposed k wires, Painful implants & / or implants causing local symptoms, broken implants, implants site infection, secondary surgeries being done in the same anatomical region mentioned above which constitutes 50 percentage of the total study group. Timing of Implant removals were assessed in different types of implants at different anatomical sites.

Conclusions: 1. Routine removal of asymptomatic implants in young individuals carries a low rate of complications & yields good functional results. However, implants in the vicinity of nerves are with anticipated major difficulties in their removal are better left alone. 2. The optimal timing for removal of Intramedullary nails & plates in the lower limb 18-36 months, in upper limb is minimum of 24 months since this is associated with the least rate of complications.

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INTRODUCTION

There is an increasing trend among the Orthopaedic community to perform fracture fixation using a variety of implants for restoration of accurate limb alignment & length, anatomical reconstruction of articular fractures & early restoration of function.

The obvious question after primary implant surgery both for the patient and surgeon is whether, when & why to remove the implant fixed during index surgery.

The indications for implant removal are sometimes absolute, but are often in a grey zone where both the surgeon & patient preferences come into play.

There is as of now no universally accepted standard protocol for removal of implants & there is a wide variation in

Surgeons' & patients' perceptions on this subject.

SOME SALIENT OBSERVATIONS ON OUR RESULTS

Indications

Medical indications

Re-osteosynthesis both in Upper & Lower limbs, for reasons like Non unions, implant failures: Total 9: 3 Nails and 6 Plates.

Implant site infection

Total 16 in Upper & Lower Limbs combined – 3 Nails, 10 Plates and 3 Prosthesis.

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Patient Driven Indications

Psychological discomfort with retaining a foreign body

STATISTICS

| IMPLANT REMOVALS | | TYPE OF IMPLANTS | |
|------------------|-----------------|------------------|-----|
| LOWER LIMB (180) | UPPER LIMB (47) | 124 | 145 |
| 53% | 47% | 76 | 8 |
| | | | 0 |

| GENDER RATIO | | AGE DIVISION (IN YRS) | | | | MODE OF INJURY | |
|--------------|-----------|-----------------------|-------|-------|--------|----------------|---------------------|
| FEMALE (96) | MALE (84) | 1-25 | 25-50 | 50-75 | 75-100 | 9% | RTA |
| 53% | 47% | 72 | 166 | 64 | 8 | 43% | LOW VELOCITY TRAUMA |
| | | 1-25 | 25-50 | 50-75 | 75-100 | | NON TRAUMATIC |

Implant Location

Lower Limb

Intramedullary Nails

Total 58 patients: average period for removal 26.094 months i.e. 2.16 yrs. (Longest period: 120 months i.e. 10yrs)

Plates

55 plates removed: Average period for removal 24.61 months' i.e. 2.05 yrs. (Longest period after Index surgery: 144 months (12 Yrs), Proximal Femoral Angle Blade Plate removed at Patient's Request, which was difficult and resulted in Intra-operative breakage.



ABSOLUTE INDICATION

EXPOSED IMPLANTS OF KNEE ARTHRODESIS



BROKEN FEMORAL PLATE REOSTEOSYNTHESIS WITH IM NAIL



RETROGRADE IM FEMORAL NAIL REMOVAL FOR HEMIARTHROPLASTY

which had served its function: 50 patients

Combined Surgeries

2 patients underwent removal of implants combined with other surgeries: one with Arthroscopy of the same knee & another with Arthroplasty of the Ipsilateral knee respectively.



RELATIVE INDICATION

ONLY PROUD, IRRITATING IMPLANTS WERE REMOVED



INCOMPLETE IMPLANT REMOVAL AFTER 3 YEARS OF INDEX SURGERY

Dynamisation

Total Dynamisation done in Intramedullary devices of Femur & Tibia combined were 40, average duration 4 Months after index nailing.

Upper Limb

Plates 45

plates removed: Average duration before removal after



INCOMPLETE IMPLANT REMOVAL AFTER 4 YEARS OF INDEX SURGERY (RELATIVE INDICATION ON PATIENTS REQUEST)



REFRACTURE AFTER 16 MONTHS OF INDEX SURGERY DUE TO EARLY IMPLANT REMOVAL



index surgery 23.56 months i.e.1.97 yrs. (Longest period of removal after index surgery was 72 months (6Yrs), which was removed at patient's request for proud implants and elbow stiffness. It was a difficult removal and also putting the ulnar nerve at risk of injury, hence only proud implants removed. 2 Patients had re-fractured after removal at 24 and 58 months respectively.

1 Patient had peri-implant fracture 3 months after index surgery.

13 Clavicle plates removed. Average duration before removal after index surgery was 21.84 months (1.82 yrs).

9 Hook Plates removed. Average duration before removal after index surgery was 5.8 months.

Nails

Only 1 case of TENS nail in both bones forearm, removed at 4 months.

Lower Limb

Intramedullary Nails

Total 58 patients: average period for removal 26.094 months i.e. 2.16 yrs. (Longest period: 120 months i.e. 10yrs)

Plates

55 plates removed: Average period for removal 24.61 months' i.e.2.05 yrs. (Longest period after Index surgery: 144 months (12 Yrs), Proximal Femoral Angle Blade Plate removed at Patient's Request, which was difficult and resulted in Intra-operative breakage.

Dynamisation

Total Dynamisation done in Intramedullary devices of Femur & Tibia combined were 40, average duration 4 Months after index nailing.

Upper Limb

Plates

45 plates removed: Average duration before removal after index surgery 23.56 months i.e.1.97 yrs. (Longest period of removal after index surgery was 72 months (6Yrs), which was removed at patient's request for proud implants and elbow stiffness. It was a difficult removal and also putting the ulnar nerve at risk of injury, hence only proud implants removed. 2 Patients had re-fractured after removal at 24 and 58 months respectively.

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Nails

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CONCLUSIONS

A) What proportion implants are removed for absolute indications & for relative (grey zone) indications?

Certain indications for implant removal are absolute. These include:

Removal of K wires protruding from the skin surface. K wires in general have a high risk of migration & breakage if left in situ indefinitely & arguably k wires in all anatomical situations need to be removed even they are deep seated. In our series, a total of 66 K- wires were removed.

Painful implants & / or implants causing local symptoms like skin breakdown exposing the underlying implant, painful bursitis etc. In our study 20 implants were removed for pain, 17 for local irritation. Only one implant in our study was exposed due to breakdown of the overlying skin following infection of a plate used for Arthrodesis of the knee.

Broken implants in fractures showing delayed union or non union. This would be followed by exchange to a second implant in most cases with supplementary bone grafting in most of these situations. There were 16 broken implants removed, 6 implants removed for delayed union, followed by Reosteosynthesis.

Implants site infection in which the implant is loose and / or non functional, painful & impeding the management of the

infection. In our study 13 infected implants were removed and 5 TJR prosthesis were removed for aseptic loosening.

Secondary surgeries being done in the same anatomical region (e.g. Implants used for fracture fixation in the distal femur would need to be removed to perform a total knee replacement for advanced Degenerative Joint Disease in the ipsilateral knee). 9 implants were removed for secondary surgeries in same anatomical region in our study.

Implants in special situations which are designed to be temporary e.g. syndesmotic screw or Hook plate used for fractures of distal clavicle or AC joint pathologies. Dynamisation in a non self dynamising intramedullary nail is needed to prevent fracture site distraction & delayed union.

Overall 155 implants were removed for the absolute indications mentioned above which constitutes 50% of the study group.

In all the other studies reviewed, no study specifically separated the absolute from the relative indications. We included absolute indications in our audit in order to answer our first research question.

Routine removal of asymptomatic implants in young individuals carries a low rate of complications & yields good functional results. However, implants in the vicinity of nerves or those with anticipated major difficulties in their removal are better left alone.

B) Should asymptomatic implants be removed?

The research question about whether removal of asymptomatic implants was surgeon driven or requested by the patient yielded interesting results. In our study, 61 out of 160 patients with asymptomatic implants (38%) requested implant removal while the surgeon advised removal of implants in 62% of cases. The surgeon driven removals were mainly due to their individual philosophy & perception while the patients requested removal for a variety of reasons such as fear of long term problems by leaving a foreign body in situ after it had served its useful purpose to a general perception that leaving the implant inside is bad for them. The issues of allergy to metal & implant carcinogenesis or implant-associated tumours are other concerns. In this era of heightened security at venues ranging from airports and sporting events to hospital emergency departments and high schools, patients frequently enquire about the possibility that an implant will set off a metal detector

C) What is the appropriate timing for removal of implants based on their anatomical location & implant type?

The timing of removal of implants is an important consideration for the surgeon & the patient. Concerns about leaving an implant for too long include bone overgrowth leading to difficult implant removal, corrosion at the implant site & local osteopenia increasing the risk of refracture in the peri-implant location. Some implants by their very nature dictate the timing for removal. For e.g., removal of hook plates is recommended within 8 or 9 months of their insertion. Dynamisation needs to be carried out within 6-8 weeks of the primary surgery in most clinical situations. The perception that implants removed after being in situ for several years are more difficult to remove is borne out in our study. In the 8 cases of difficult removal in our study, the average time from index surgery was 54 months, compared with 24 -26 months being the common time frame for uncomplicated implant removals in our study. Similarly the average time-frame after index surgery for patients in whom only part of implant could be removed was 39.7 months and those in whom implant broke during removal was 67 months, both higher than the uncomplicated cases.

Based on our findings, we recommend

18-36 months after index surgery as the optimal window in adults for planned implant removal of asymptomatic intramedullary nails for both upper limbs and lower limbs, and lower limb plates.

Asymptomatic upper limb plates, especially of the forearm bones and clavicle to be left in-situ for a minimum of 24 months to reduce-fracture risk.

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