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Original Research Article

Assessment of hardware removal rate in maxillofacial surgery

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ABSTRACT

Background: Infected hardware is populated with bacterial colonies. The present study was conducted to determine hardware removal rate in maxillofacial surgery.
Materials and Methods: This study was conducted on 580 patients of both genders treated by open reduction and internal fixation. Type of bone in which hardware was used and reason for hardware removal was assessed.
Results: Out of 580 patients, males were 320 and females were 260. Hardware removal rate was in 11 out of 132 cases of maxilla, 24 out of 218 cases of mandible, 16 out of 125 cases of zygomatic, 10 out of 75 cases of nasal bone and 2 out of 30 cases of orbit. The difference was significant ($P< 0.05$). The most common cause of removal of hardware was infection in 20 cases, wound in 12, malunion in 11, pain and resorption in 6 each, non union in 5 and refracture in 2 cases. The difference was significant ($P< 0.05$). Table III shows that out of 410 titanium implants, 42 had failure and out of 170 stainless steel implants, 21 showed failures.
Conclusion: Authors found that most common cause of removal of hardware was infection, wound, malunion, pain, resorption, non union and refracture.

1. Introduction

Each year, approximately 5000 patients with craniomaxillofacial (CMF) trauma are treated by open reduction and internal fixation (ORIF).[1] Open reduction and internal fixation can be complicated by hardware exposure, hardware loosening, or infection. Removal of metal plates following oral and maxillofacial surgery (OMFS) is a common procedure, recognised as a source of morbidity ever since metal plates were first introduced into practice.[2] Some surgeons advocate the removal of all metal plates, however, leaving plates in situ has been shown to be safe and cost effective. In our practice, most plate removal procedures require a general anaesthetic therefore this procedure represents a significant source of morbidity to patients.[3] During the consenting process it is important to highlight and, if possible, to quantify risks and possible consequences of surgery. Therefore it is important that everyone involved in gaining consent for OMFS procedures has knowledge of likely rates of plate removal for each type of plate insertion procedure.[4]

Differentiation between hardware exposure and infection is often not obvious and diagnostic tests are limited. Hardware infection is typically associated with redness, warmth, and inflammation. The area is usually painful and may drain pus. Occasionally, the patient develops fever and chills.[5] Leukocytosis, elevated erythrocyte sedimentation rate (ESR) (82% sensitivity, 85% specificity), or elevated C-reactive protein (CRP) (96% sensitivity, 92% specificity) levels may be observed. Infected hardware is populated with bacterial colonies. On the contrary, with hardware exposure, the patient may not experience signs of infection, and ESR and CRP levels may be normal.[6] The present study was conducted to determine hardware removal rate in maxillofacial surgery.

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2. Materials and Methods

This study comprised of 580 patients of both genders treated by ORIF. Total time period for data collection was 1.6 years. Ethical clearance was obtained prior to the study. Patients were well informed regarding the study and written consent was obtained.

Patient's data such as name, age, gender etc. was recorded. Patients were subjected to radiographs. Radiographs were assessed. Type of bone in which hardware was used and reason for hardware removal was assessed.

Results were subjected to statistics. P value less than 0.05 was considered significant

Table 1: Distribution of patients

Total- 580		
Gender	**Male**	**Female**
Number	320	260

Table 1 shows that out of 580 patients, males were 320 and females were 260.

Table 2: Type of bone for hardware

Bone	**Number**	**No. of hardware removal**	**P value**
Maxilla	132	11	
Mandible	218	24	
Zygomatic	125	16	0.05
Nasal	75	10	
Orbit	30	2	
Total	580	63	

Table 2, shows that hardware removal rate was in 11 out of 132 cases of maxilla, 24 out of 218 cases of mandible, 16 out of 125 cases of zygomatic, 10 out of 75 cases of nasal bone and 2 out of30 cases of orbit. The difference was significant ($P< 0.05$).

Table 3: Reason for hardware removal

Reason	**Number**	**P value**
Pain	6	
Refracture	2	
Non union	5	
Infection	20	0.01
Wound	12	
Malunion	11	
Resorption	6	

Table 3 shows that most common cause of removal of hardware was infectionin 20 cases, wound in 12, malunion in 11, pain and resorption in 6 each, non union in 5 and refracture in 2 cases. The difference was significant ($P< 0.05$).

Table 4 shows that out of 410 titanium implants, 42 had failure and out of 170 stainless steel implants, 21 showed failures.

Table 4: Type of implant and failure

Implant type	**Total**	**Failure**
Titanium	410	42
Stainless steel	170	21
Total	580	63

3. Discussion

Hardware may be removed for a number of reasons, both objective and subjective, including pain, infection, dehiscence of soft tissues overlying plate, aesthetic issues, or to allow dental rehabilitation. There are a number of studies of plate removal, both retro and prospective, usually single centre, and with sample sizes which range from 50 to over 800 patients.[7]

Infected hardware leads to hardware exposure, extrusion, fistula formation, bony nonunion, and osteomyelitis. It is widely agreed upon that hardware infection should be managed by debridement of necrotic and infected tissue, and antibiotic administration.[8] However, it is unclear, if the infected hardware needs to be removed or if it is removed, whether it can be immediately replaced with repeat ORIF. Many authors report that the CMF region is considered a privileged site that does not necessarily require hardware removal.[9] The present study was conducted to determine hardware removal rate in maxillaofacial surgery.

In present study, out of 580 patients, males were 320 and females were 260. Hardware removal rate was in 11 out of 132 cases of maxilla, 24 out of 218 cases of mandible, 16 out of 125 cases of zygomatic, 10 out of 75 cases of nasal bone and 2 out of 30 cases of orbit. Murthy et al.[10] found that there were 81 grade II articles included in the meta-analysis. Our meta-analysis revealed that 7503 patients were treated with hardware for CMF fractures in the 81 grade II articles. Hardware infection occurred in 510 (6.8%) of these patients. Of those infections, hardware removal occurred in 264 (51.8%) patients; hardware was left in place in 166 (32.6%) patients; and in 80 (15.6%) cases, there was no report as to hardware management.

We found that most common cause of removal of hardware was infection in 20 cases, wound in 12, malunion in 11, pain and resorption in 6 each, non union in 5 and refracture in 2 cases. Cahill et al.[11] in their study sample was used to determine all plate removal procedures associated with common complications from facial reductions. Some form of open fixation was reported in 4,879 patients. Plate removals associated with complications were reported in 246 patients. The "failure" removal rate as a percentage of the total number of open procedures for the year was 5.0%. Gender, race, age, primary payer, and median income of the patient were determined to significantly affect the likelihood for hardware removal due to complications.

We found that Table III shows that out of 410 titanium implants, 42 had failure and out of 170 stainless steel

implants, 21 showed failures. A prolonged period of hardware exposure leads to contamination and secondary infection. Several studies report better outcomes when definitive management occurs within 2 to 3 weeks. Hernandez et al[12] reported a salvage rate of 83% of prostheses when debridement with soft tissue coverage was performed within 3 weeks. Thus, as a rule, they concluded hardware should be covered if exposed for more than 3 weeks. In the lower extremities, exposed hardware can be treated conservatively by leaving the hardware in situ with soft tissue reconstruction if no gross infection is present. Infected hardware can loosen as well. Hardware loosening is an absolute indication for removal in the extremities. After hardware removal, the bone is managed by either external fixation or replacement of the hardware. Location plays an important role in the salvage of exposed hardware.

4. Conclusion

Authors found that most common cause of removal of hardware was infection, wound, malunion, pain, resorption, non union and refracture.

5. Source of Funding

None.

6. Conflict of Interest

None.

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