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Retrospective evaluation of infections occurring in patients undergoing treatment with locking reconstruction plates for fracture of clavicle bone

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Abstract
Background: The treatment of choice for majority of midshaft clavicular fractures was conservative with a sling bandage. This was because the incidence of non union was higher after open reduction as compared to those which underwent closed reduction. With open reduction, there are certain complications associated with it such as risk of implant failure due to bending or breaking of the plate. In the present study we aim to retrospectively analyse the incidence of infection following reconstruction of the clavicle using locking reconstruction plate.
Materials and methods: The present study was conducted in the Department of orthopaedics, Institute, state. The study was conducted over a period of one year i.e. from July 20XX to August 20XX. In this study 110 cases of displaced mid shaft clavicular fractures were retrospectively analysed for occurrence of complications. The demographic details of all the patients were obtained from the medical records of the hospital. All the patients were noted for presence of infection after a month and 3 months after surgery. Presence of pain, sinus discharge and wound dehiscence were considered as the signs of infection. All the data obtained was arranged in a tabulated form and analysed using SPSS software.
Results: A total of 110 patients were evaluated with the mean age of 28.32 +/- 3.45 years. The male to female ratio in our study was 3.4:1. There were 25 females and 85 males in the study group. out of 110 fracture patients, 5 developed infection after follow up period. The incidence of infection was 4.5%. There were 3 cases that presented with discharge and 1 patient had screw loosening.
Conclusion: Reconstruction plates are the treatment of choice because of their adaptability are used for this purpose. The incidence of infection in our present study was 4.5%.

Keywords: Clavicle, fracture, infection, reconstruction

Introduction
Five to ten percent of all fractures comprise of clavicular fractures [1]. Majority of them, 75% of these fractures are occur in middle third of the clavicle and amongst them majority of them are displaced [1, 2]. Previously the treatment of choice for majority of midshaft clavicular fractures was conservative with a sling bandage. This was because the incidence of non union was higher after open reduction as compared to those which underwent closed reduction [3, 4]. But now a day, surgical treatment option that is regularly used for management of displaced midclavicular fractures is plate fixation. It has the advantage of providing immediate stability and enabling early postoperative mobilization [3, 5, 6]. With the advent of the anatomically more advanced preshaped plates, there is a shift in discussion is shifting from the choice of reduction towards the type of plate used for operation [7, 8, 9] Reconstruction plates are of two types locking and non-locking which are frequently used for the fixation of fractures of the clavicle. The characteristics of the plate reduce stiffness thus allowing for ease of contouring in all planes such that it fits into the shape of clavicle [8]. However, there are certain complications associated with it such as risk of implant failure due to bending or breaking of the plate [10, 11]. Various clinical studies have cited advantages of locking plates over more conventional plates but still there is little data about the complication rates [12-14].
Infection is one of the potential complications after surgery of displaced mid clavicular fracture. The rate of infection varies from 0.4% to 7.8%, according to literature [15-18] According to a recent study by Duncan *et al*, the use of reconstruction plates was associated with poor prognosis and was a continuous source of concern for some patients [19]. In the present study we aim to retrospectively analyse the incidence of infection following reconstruction of the clavicle using locking reconstruction plate

Materials and Methods

The present study was conducted in the Department of orthopaedics, Institute, state. The study was conducted over a period of one year i.e. from July 20XX to August 20XX. The study was approved by the Institute's ethical board. All the subjects enrolled in this study were informed about the study and a written informed consent was obtained from all in their vernacular language. In this study 110 cases of displaced mid shaft clavicular fractures were retrospectively analysed for occurrence of complications. All the patients after treatment were prescribed cefazolin and gentamycin for 2 days postoperatively. In all the patients physiotherapy was initiated immediately after surgery and shoulder sling was given for the protection of upper extremities.

The demographic details of all the patients were obtained from the medical records of the hospital. All the patients were noted for presence of infection after a month and 3 months after surgery. Presence of pain, sinus discharge and wound dehiscence were considered as the signs of infection. Culture of the discharge was performed to determine the micro organism responsible for infection. Initially all the patients were prescribed oral antibiotics. Debridement was done in cases where there was uncontrolled infection after use of oral antibiotics. After treatment patients were followed up for a period of 6 months to note any other complication. All the data obtained was arranged in a tabulated form and analysed using SPSS software.

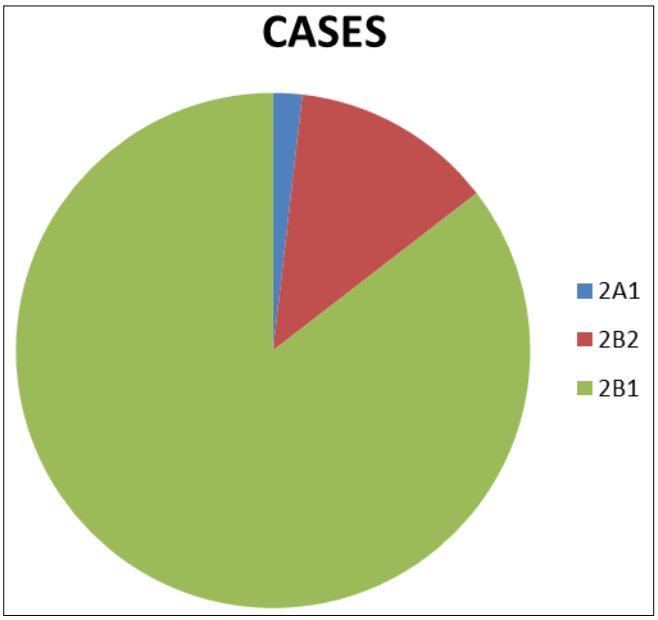
Results

Table 1 shows the demographic details of the study population. A total of 110 patients were evaluated with the mean age of 28.32 +/- 3.45 years. The male to female ratio in our study was 3.4:1. There were 25 females and 85 males in the study group. There were 2 fractures who belonged to 2A1 type and 94 who belonged to 2B1 category. There were 14 fractures of 2B2 category according to Edinburgh classification. (Graph 1)

Table 2 shows that out of 110 fracture patients, 5 developed infection after follow up period. The incidence of infection was 4.5%. There were 3 cases that presented with discharge and 1 patient had screw loosening. There was 1 case of screw loosening. Antibiotics were prescribed in all the cases. There was 1 patient who underwent debridement followed by plate removal. Rest of the patient just underwent plate removal.

Table 1: Demographic details of the patients.

Demographic detail		Study characteristics
Total number of fractures		110
Age (years)(Mean+/-SD)		28.32 +/- 3.45
Male: female		3.4:1
Fracture type (Edinburgh classification)	2A1	2
	2B1	94
	2B2	14



Graph 1: Type of fracture

Table 2: Presenting signs and symptoms of patients with infection.

Case	Presenting sign and symptom	treatment
1	Discharge	Plate removal
2	Screw loosening	Palte removal
3	Discharge	Debridement and Plate removal
4	Discharge	Plate removal
5	Wound dehiscence	Plate removal

Discussion

The present study was conducted to evaluate the risk of infection after the use of reconstruction locking plates. In our study, out of 110 fracture patients, 5 developed infection after follow up period. The incidence of infection was 4.5%. There were 3 cases that presented with discharge and 1 patient had screw loosening. There was 1 case of screw loosening. Antibiotics were prescribed in all the cases. There was 1 patient who underwent debridement followed by plate removal. Rest of the patient just underwent plate removal. In a study conducted by Glide *et al* in the year 2014, a failure rate of 8.5% was observed while managing 71 patients. There were 5.6% cases that required reoperation [20]. In a study conducted by Shin *et al* over 125 patients, they found the implant failure rate to be 12% with reoperation to be 8% [21]. It is difficult to compare reconstruction plate with other types of plating system for the management of midclavicular fractures due to various reasons. A vast majority of studies use more than one type of plate for fixation of clavicular fractures. The studies do not find any differences in failure rate amongst different plating system. The studies do not establish the exact reason for reoperation, whether it was due to implant failure or due to complications like infection of it was elective [7, 22, 23]. As per the study by Duncan *et al*. [17] if there is infection following surgical management of clavicular fractures then there should be thorough debridement of the dead and necrotic tissues, then all the non resorbable sutures and implants should be removed. In his study there was poor prognosis with regard to bony union after infection. According to him, the causative organisms reported for causing infection after open reduction of clavicle were *Propionibacterium acnes* and *Staphylococcus aureus.*

According to a study by Hill *et al*, there is a high risk of non union and abnormal shoulder function following conservative management of clavicle fractures [24]. The absolute indications for surgical management and internal fixation of midshaft clavicular fractures include more than 20 mm shortening, discontinuity of overlying skin, loss of neurologic function, pathologic fractures, vascular alterations, shoulder dislocation [25]. there are two types of plates that are generally used for fixation, they include dynamic locking plate or reconstruction plates. The use of reconstruction plates is recommended as clavicle is a 3D structure and adaptation of the plate to the shape of bone is difficult. Reconstruction plate had notches that allows for easy bending according to the plane of the bone. Therefore it is widely used in complex reconstructions [26]. the few limitations of our retrospective study design are short follow up period. Patients should be followed up atleast after an year to determine any further cases of infections. There was no standardization in the follow up period. Postoperative xrays were only taken in patients with infections.

Conclusion

In order to reduce the incidence of malunion or non union, open reduction and internal fixation is the best treatment of choice for displaced mid shaft clavicular fractures. Reconstruction plates because of their adaptability are used for this purpose. The incidence of infection in our present study was 4.5%.

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