Precontoured Plate Fixation With Interfragmentary Lag Screw Use in a Middle Third Clavicle Fracture Fixation

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Summary: Middle third clavicle fractures are common injuries that need surgical fixation in a certain subset of patients. The use of precontoured clavicle plates facilitates intraoperative fixation and can reduce soft tissue irritation and hardware removal rates. Lag screw fixation is a well-established technique for the treatment of oblique fractures. Empirical application of this method in clavicle fracture fixation and clavicle nonunion treatment has been reported previously. A recent biomechanical study supports the use of a lag screw technique in clavicle fracture fixation when possible. We report a 46-year-old patient with a mid-shaft right clavicle fracture who was treated with this technique, which resulted in an excellent clinical outcome.

Key Words: clavicle, lag screw, precontoured plate

INTRODUCTION

Clavicle fractures are one of the most common upper limb fractures. The annual incidence of this fracture is 29 per 100,000 with young active men of younger than 20 years of age having the highest incidence. The most common location of fracture is the middle third of clavicle in 80% of cases. The usual mechanism of injury is direct trauma to the shoulder or fall on tip of the shoulder. Typically, the distal fragment is displaced inferiorly, anteriorly, and medially. Classically, this injury was believed to be a benign, uneventful fracture with minimal long-term disability. However, multiple recent studies have shown a high rate of complications after conservative management of this injury. The rate of nonunion (15%) and patient dissatisfaction (31%) has been found to be significantly higher than that reported in older studies. Recent high-quality randomized clinical trials, demonstrating superior functional outcome in the surgical group, have revived the interest in surgical fixation of this fracture in a certain group of patients. In addition to classic indications for fracture surgery (ie, open fractures), shortening of >2 cm, displacement of >2 cm, and significant comminution are now considered relative indications for surgical fixation of a closed, isolated clavicle fracture. The current trend for surgical management of acute clavicle fractures favors application of a precontoured 3.5-mm plate with 3 bicortical screws in each fragment. This technique decreases the need for intraoperative plate contouring and has a high union rate, low incidence of complications, and a reduced rate of hardware removal.

CASE REPORT

A 46-year-old male patient presented with right shoulder pain and limited range of motion. He had sustained a closed middle third right clavicle fracture 10 weeks before presentation, after a direct fall on his right shoulder. This fracture was initially managed conservatively with a sling. The patient complained of ongoing pain and visible deformity of his shoulder. Clinically, the deformity of his right shoulder was quite obvious with overriding of the fracture fragments and also shortening and protraction of the shoulder. The fracture site was still tender and mobile. Range of motion of the right shoulder was moderately restricted in all directions, especially in flexion and abduction, mainly because of pain. His medical history was significant for hypothyroidism, treated medically with a daily dose of thyroid hormone replacement. He was a right hand dominant nonsmoker individual working in an office job. Radiographs showed a long oblique middle third fracture, extension of the fracture through both cortices, and shortening of the clavicle by 2 cm. The patient was scheduled for surgery 10 weeks after his initial injury. The patient was not a candidate for plating because he was not an active person and did not wish to have a plate in his shoulder. The patient was offered precontoured 3.5-mm plates at a certain hospital. The patient was given a total of 3 plates and 3 lag screws to fix the fracture with. The patient was given a total of 3 plates and 3 lag screws to fix the fracture with. The patient was given a total of 3 plates and 3 lag screws to fix the fracture with. The patient was given a total of 3 plates and 3 lag screws to fix the fracture with. The patient was given a total of 3 plates and 3 lag screws to fix the fracture with.
clavicle fracture with 100% displacement, 3 cm of shortening, and minimal evidence of healing at 10 weeks (Figs. 1 and 2).

Considering the amount of deformity, ongoing disability, and the delayed healing response, we elected to manage this case surgically. Our method of choice for the surgical fixation of a midshaft clavicle fracture is an anterosuperior surgical approach in the beach-chair position with fixation of the reduced fracture using a precontoured superior clavicle plate. In this case, the long oblique nature of the fracture presented an opportunity for lag screw fixation. After debridement of the fracture ends and anatomic reduction, we used a 2.7-mm anteroposterior lag screw to hold the reduction and achieve interfragmentary compression before applying the plate. Then, a 3.5-mm precontoured 6-hole clavicle plate was fixed on superior aspect of clavicle with 3 bicortical screws distally and 2 bicortical screws proximally (Fig. 3). The arm was kept in a sling for a week after surgery; then, active range of motion exercises was initiated. At 6 weeks, resisted activities and strengthening were allowed, followed by unrestricted activities and sports at 12-week postoperatively. At 1-year postoperatively, the patient was asymptomatic, had minimal hardware irritation, and had returned to full function.

**DISCUSSION**

Recent studies have shown benefits of surgical fixation of midshaft clavicle fracture in selected patient groups. Surgical intervention for isolated, closed mid-shaft clavicle fractures is best reserved for relatively healthy, young patients who have significant shortening and displacement. These patients have a high chance of developing nonunion, mal-union, and unsatisfactory results after nonoperative care. The use of a precontoured 3.5-mm plate on the superior aspect of the clavicle is a well-established technique for acute and delayed fixation of clavicle fractures and nonunions. Interfragmentary lag screw is a common technique for fixation of oblique noncomminuted fractures. A lag screw provides mechanically stable fixation with the added benefit of compressing the fracture ends together. Lag screw utilization and anteroinferior plate fixation have been described for treatment of clavicle nonunions. A recent biomechanical finite model study has shown the significant mechanical advantage of using a lag screw in clavicle fracture fixation. This added strength was enhanced when used with clavicle-specific plates.

This finding encourages the use of interfragmentary compression technique in clavicle fracture surgery, especially in noncomminuted, oblique fractures. The added lag screw not only helps with maintenance of reduction but also adds to overall strength and stability of the construct and provides fracture site compression as well. Considering the size of the clavicle, we typically use 2.7-mm lag screws to avoid potential splitting of the fragments.

**CONCLUSIONS**

This case report supports the use of a lag screw in clavicle fracture fixation, whenever feasible, as advocated in recent biomechanical studies. It also emphasizes the importance of early

**FIGURE 1.** Standing anteroposterior (AP) view of the right clavicle. Note complete displacement and significant shortening of the shoulder.

**FIGURE 2.** Standing upshot view of right clavicle. This view reveals more details, including minor comminution not visible on anteroposterior (AP) view.
recognition of patients who would benefit from surgical intervention: this can prevent an unnecessary delay in treatment and shorten the overall period of morbidity.

REFERENCES


FIGURE 3. Standing anteroposterior (AP) view 6 months after surgery shows anatomical fixation with restoration of length.