

*Original Article*

**OPEN REDUCTION AND INTERNAL FIXATION OF ACUTE DISPLACED LATERAL CLAVICLE FRACTURES BY INTRAMEDULLARY SCREW MID-TERM RESULTS AND A BRIEF LITERATURE OVERVIEW**

Mustafa Hemaïd, Abd-El-Rahman Hafez<sup>(\*)</sup>

*Trauma and Orthopedic Surgery dept., Faculty of Medicine, Sohag Univ., Sohag, Egypt*

E-mail: [dr.abdelrahman\\_alshikh@yahoo.com](mailto:dr.abdelrahman_alshikh@yahoo.com)

Received 22/2/2023

Accepted 1/6/2023

**Abstract**

**Aim:** To investigate the use of intramedullary screw for fixation of lateral third clavicle fractures including indications, preoperative planning, operative technique, and complications during the study period. **Setting and design:** Prospectively we used intramedullary screw for fixation of lateral third clavicle fractures either non-displaced, minimally displaced guided by fluoroscopy. **Patients and methods:** The study included 20 patients after obtaining informed consent who underwent mid-shaft clavicle fractures using intramedullary screw fixation between February 2020 and January 2022. **Statistical analysis used:** The software for statistical package for social sciences for Windows 10 was used for all statistical calculations. Each variable was tested for its normal value using the Mann-Whitney Test and exact P values were calculated. Significance was set at the P value of less than 0.05. **Results:** All cases had "good to excellent" functional results according to the Constant and Murley shoulder score. **Conclusion:** Our results show that intramedullary screw fixation of lateral third clavicle fractures inserted from the lateral to the medial fragment is a simple, reliable and effective method of treatment with overall satisfactory functional and cosmetic results and low morbidity.

**Keywords:** Mid-shaft, Clavicle fracture, Screw fixation, Intramedullary.

**1. Introduction**

Fractures of the clavicle account for about 4 % of all adult fractures and 20% of these fractures occur in the lateral-third of the clavicle. Displacement occurs in about 70 % of all lateral third clavicular fractures [1]. Traditionally, the treatment of clavicle fractures has been exclusively non operatively [2]. The disadvantages of conservatively treated displaced lateral third clavicular led to a tendency towards surgical treatment [3]. The indications for surgical treatment of clavicle fractures are complete displacement and/or 15 to 20 mm or more of shortening are considered as a relative indications for surgical fixation,

whereas open fractures and neurovascular compromise remain absolute indications [4]. Intramedullary fixation is an alternative method of fixation for lateral third clavicle fractures and has prospective advantages of a minimal skin incision, less soft-tissue disruption and less prominent implants. Smaller incisions reduce the risk injury of supraclavicular nerve branches and also reduce the risk of infection. Additionally, intramedullary fixation avoids possible damage to nearby subclavian vessels and the brachial plexus from drill bits or protruding screws [4]. The technique of intramedullary screw fixation has many advantages

as it provide a rigid three-point fixation, easy, safe, with less complications and excellent functional outcomes. It allows intramedullary compression, stability, stress share, little periosteal stripping, early recovery after surgery and short hospital stay [5].

## 2. Subjects and Methods

Our study began in 2020 through 2022 as a prospective study in which twenty patients with acute lateral third clavicle fractures were treated by open reduction and internal fixation using intramedullary screw in orthopedic department of Sohag faculty of medicine after obtaining informed consent for the procedure and for taking intraoperative photos. Patients were followed-up, the follow-up duration was for a minimum of six months and a maximum of 2 years. Several subsets of lateral third clavicle fractures were included in the study: Simple displaced fractures and complex displaced fractures [6]. The Constant and Murley shoulder score was followed for evaluation of the functional results of the study. [7]. Preoperative planning started by proper X ray views of the affected shoulder including AP views. The fixation device used in our study was the partially threaded 4.5mm cannulated screw. A guide wire is used to determine the initial trajectory under fluoroscopic guidance. Under general anesthesia, the patient was placed in supine position on a radiolucent operating table with the C-arm draped into the field for intraoperative fluoroscopic imaging. A 3- cm incision was used in lateral third clavicle over the acromioclavicular joint. The joint is identified, then fracture is exposed and, interposed periosteum and soft tissue were removed from the fracture site. The lateral fragment is grasped with a towel clip or bone reduction forceps. Once the orientation was established, a guide wire is applied perpendicular to the fracture line to maintain reduction before screw insertion. Using the drill pit the track is made across the fracture site, then a 4.5 mm partial cancellous screw with a washer is

inserted under fluoroscopic guidance. Head engagement to the near cortex produce a compressive force of the lateral fragment over the far one. The threads of the screw should be clear from the fracture line to maximize the compression among the fracture site, then the guide wire is extracted from the field then closes the muscle, subcutaneous tissue and skin. Patients were discharged from hospital once their general and their wound condition allowed.

## 3. Results

The research was carried out on the 20 patients. Of these, 5 (25%) were females and 15% were males (75%). The mean age of the patients was 39.5 years with the youngest patient being 17 and the oldest 62 years old. The injury mechanism was motor car accident in 14 patients (70%) and falling on shoulder accounts for 3 cases (15%), meanwhile 3 cases (15%) were fractured due to direct trauma to the clavicle. 13 patients had right side fractures; seven patients were left sided fracture. Operation time was on average 51 minutes (42-60 minutes). The operation time was measured from the starting of the incision till the last suture. The length of the incision was on average 3 cm. We used 4.5 mm partially threaded cannulated screws in all patients with average length of 55 mm. All procedures were done under fluoroscopic guidance and all cases were subjected to radiographic films to confirm and reveal the screw position. The duration of post-operative admission for our patients was average from 24 to 48 hours. Patients were discharged in arm sling; they began pendulum exercises and light daily activities during 1st week post-operative and active assisted motion at 2<sup>nd</sup> week. Early motion of the shoulder and the elbow with light daily activities was encouraged to improve function and to restore patient independence. The Suture was removed from ten to fourteen days postoperative. We followed the patients for at least 6 months (average was 7.3 months) and in each follow up, we asse-

essed the union, pain quantity, range of motion and return to preoperative activities. The fractures showed union at a mean of 13.8 weeks postoperatively (range 12-20 weeks). All the patients got back to their preoperative activities at the end of the follow-up period. At final follow up; thirteen patients (65%) had no complications. 2 patients had superficial wound infection. 5 patients complained of impingement symptoms.

#### 4. Discussion

Traditionally, the treatment of clavicle fractures has been exclusively non-operatively the clavicular mal-union was of radiographic interest only without any clinical relevance [2]. However, recently studies demonstrated the disadvantages of conservatively treated displaced lateral third clavicle fractures as the non-unions, residual loss in shoulder strength, persistent pain and disappointing cosmetic results might have led to unsatisfactory results in about one third of patients [8] leading to a tendency towards surgical treatment [3]. The recent treatment tends to manage displaced lateral third clavicle fractures with internal fixation which provides more rigid immobilization and early pain relief, and avoids shortening and deformity which were the main disadvantages associated with non-operative management [9]. Previously used intramedullary devices as wires cannot provide rotational stability of the clavicle [10] while in our study, the three point fixation offered by the curvature of the bone provides a stable fixation, the medullary cavity of the clavicle is nearly fulfilled with the large diameter of the partial threaded screw which also provides a compression lag effect at the fracture site, all these factors provide a stable fixation. The technique of intramedullary screw fixation has many advantages as it provides rigid three-point fixation, easy, safe, with less complications and excellent functional outcomes. It allows intramedullary compression, stability, stress share, little periosteal stripping, early recovery after surgery and

short hospital stay [5]. In our study procedure we used 4.5 mm partially threaded cannulated screw inserted from lateral fragment after drilling of it over a guide wire was found to be easier and less technically demanding. We believe that intramedullary screw fixation of mid-shaft clavicle fractures can produce excellent results in selected patients.

#### 5. Conclusion

*Open reduction and intramedullary fixation of fresh lateral third clavicle fracture using a cannulated 4.5 mm partially threaded screw inserted from the lateral to the medial fragment, is a simple, reliable and effective method of treatment for the selected cases with overall satisfactory functional and cosmetic results and low morbidity.*

#### References

- [1] Kashif Khanm L., Bradnock T., et al. (2009). Fractures of the clavicle. *J. Bone Joint Surg. (Am)*. 91: 447-460.
- [2] Neer, C. (1960). Nonunion of the clavicle. *J. of the Am. Association*. 172: 1006-1011.
- [3] Smekal, V., Oberladstaetter, J., Struve, P. (2009). Shaft fractures of the clavicle: current concepts. *Arch Orthop Trauma Surg*. 129: 807-815.
- [4] Eichinger, J., Balog, T., Grassbaugh, J. (2016). Intramedullary fixation of clavicle fractures: Anatomy, indications, advantages and disadvantages. *J Am Acad Orthop Surg*. 24: 455-464.
- [5] Abo El Nor, T. (2013). Displaced mid-shaft clavicular fractures: Surgical treatment with intramedullary screw fixation. *Arch Orthop Trauma Surg*. 133: 1395-1399.
- [6] Robinson, C. (1998). Fractures of the clavicle in the adult: Epidemiology and classification. *J Bone Joint Surg (Br)*. 80 (3): 476-484.
- [7] Constant, C., Murley, A. (1987). A clinical method of functional assessment of the IMS fixation of midshaft clavicle fractures, shoulder. *Clin Orthop Relat Res*. 214: 160-164.

- [8] Hill, J., McGuire, M. & Crosby, L. (1997). Closed treatment of displaced middle-third fractures of the clavicle gives poor results. *J Bone Jt Surg (Br)*. 79: 537-538.
- [9] Douraiswami, B., Naidu, D. (2013). Open reduction and plating for displaced mid third clavicle fractures – A prospective study. *J Clin Orthop Trauma*. 4 (4): 174-179.
- [10] Ngarmukos, C., Parkpian, V. & Patradul, A. (1998). Fixation of fractures of the midshaft of the clavicle with Kirschner wires. Results in 108 patients. *J Bone Joint Surg Br*. 80 (1):106-108.