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Original article

Comparison between conservative treatment and plate fixation for displaced middle third clavicle fracture: clinical outcomes and complications

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Summary. *Background:* Clavicle fractures are common injuries in adults, especially due to sport activities or road traffic accidents. Most lesions occur at the level of the middle-third presenting some degree of displacement often. Traditionally, non-surgical management was considered the first treatment option for the most clavicle fractures. Nowadays, various authors suggest early surgical fixation of displaced midshaft fractures. The aim of this study is to compare surgical versus non-surgical treatment and to evaluate the outcomes and the incidence of complications following to both treatment options. *Matherial and methods:* 87 patients with 2 displaced clavicle fractures fragments (AO 15.2A) were included in the retrospective study, evaluating the clinical and functional outcomes and the complication rate with a follow-up average of 48 months. *Results:* The risk of nonunion resulted lower in the surgically treated patients. The Constant Score after 1 year was slightly better after the plate fixation (94,36 vs 91,36), while the DASH score resulted better in the conservatively treated patients (3,86 vs 4,63). The delay or revision surgery rates were similar for both groups and most of the complications were associated with the conservative treatment. *Conclusions:* According to our results, the plate fixation does not lead to better clinical and functional outcomes, instead it reduces the risk of nonunion. We suggest to tailor the treatment patient-by-patient considering the functional demand, patient's comorbidity and nonunion risk factor. (www.actabiomedica.it)

Key words: clavicle fracture, plate fixation, figure of eight bandage, complication rate

Introduction

Clavicle fractures represents 2.5-10% of all fractures in adults (1-4). The risk is higher in young male patients aged less than 30 years and patients aged over 70. The main causes are a direct blow to the shoulder or a fall onto an outstretched hand (5), especially during sport activities or road traffic accidents. Middle third fracture represents 69% to 82 % of all clavicle fractures (4, 6, 7) and they often present some degree of displacement (8).

Nonsurgical treatment was considered the best option for most clavicle fractures with a good prognosis and a low incidence of nonunion cases (9-15).

Other authors suggest acute fixation of displaced midshaft fractures (16, 17), reporting more favorable outcomes over the past two decades and a higher patient's satisfaction.

Mandatory indications for surgical fixation of middle third clavicle fractures are open fractures, neurological or vascular compromise, skin tenting, widely displaced and comminuted fractures (18-20). Literature suggest that shortening of more than 2 cm, patients with multiple traumatic injuries, high-energy mechanism, younger athletic patients, and patients at risk of nonunion should address the surgeon's choice to surgical fixation (21-28). Displaced middle third clavicle fractures result in poor clinical outcomes, which in-

clude decreased strength and range of motion (ROM), ongoing pain, and patient dissatisfaction, especially in conservatively treated patients (17, 29). Malunion of middle third clavicle fractures impairs shoulder biomechanics (21, 23, 24, 30, 31) as well as, in some cases, causes neurovascular complications (30, 32).

The aim of our study is to compare the clinical outcomes of surgical and conservative treatment for middle third clavicle fractures in patients with a skeletal maturity, admitted between 2010 and 2017 in our department, evaluating the incidence of complications such as patient's pain, aesthetic skin scarring, patient satisfaction, painful skin scarring and shoulder ROM .

Materials and Methods

This is a retrospective study including patients with 2 displaced clavicle fractures fragments (AO 15.2A) treated at our department. Inclusion criteria: people older than 17 years old evaluated at the Emergency Room and treated with figure of eight bandage or with surgical fixation between January 2010 and November 2017.

Exclusion criteria: comminuted fractures, multiple fragment or pathologic fractures, corrective osteotomies, pediatric patients, intramedullary pin fixation.

Patients with a median follow-up time of 48 months were evaluated clinically, with the DASH questionnaire (33) and the Constant score (34). DASH questionnaire was composed by 30 questions rated 1 to 5 regarding the upper limb ROM. The responses were rated by a scale from 0 to 100, with 0 indicating no loss of ROM and 100 indicating complete loss of ROM. The Constant score, a 100-points scale composed of a number of individual parameter, defines the level of pain and the ability to perform patient's normal daily activities.

Lastly, we considered the complication rate in the non-operative sample and in the group who underwent plate fixation, considering the following: pain, anatomical defects, malunion, secondary fractures, neurovascular injuries, surgical wound dehiscence, and delayed union.

Statistical analysis was executed with an unpaired t-test in order to assess the significant differences between the 2 groups.

Results

We analyzed 50 patients who underwent plate fixation (Fig. 1) within 2 weeks from the injury (45

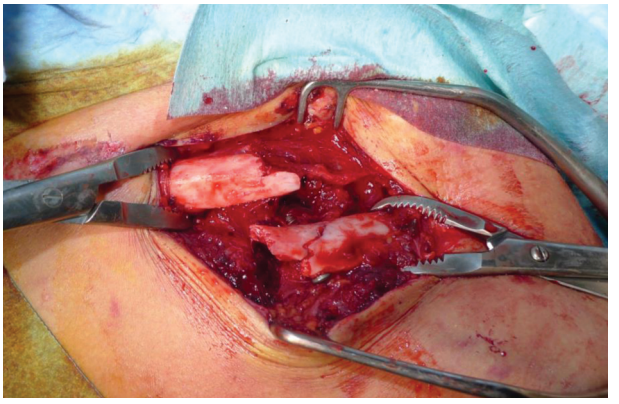

Figure 1A. Intraoperative picture of patients treated with ORIF technique

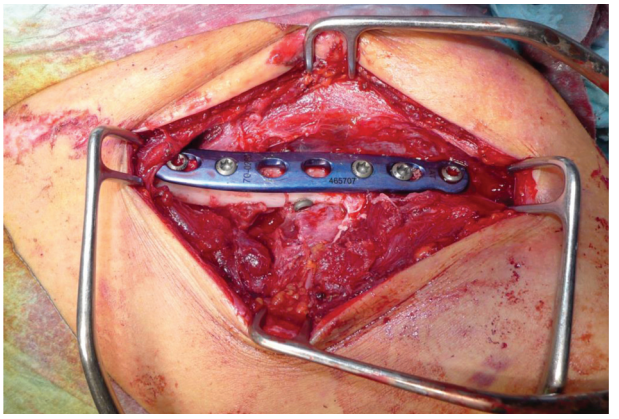

Figure 1B. Plate positioning

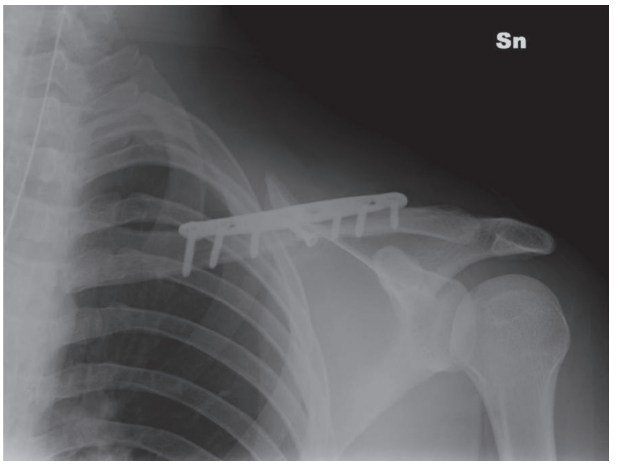

Figure 1C. Postoperative x-ray

males and 5 females) and 37 patients who underwent conservative treatment (9 females and 28 males) (Fig. 2). The mean age at the time of the injury, respectively for the first and second group, was 36.8 years old (ranging between 17 and 71 y/o) and 46.8 years old (ranging between 17 and 86 y/o).

In our cohort of patients, the mean Constant Score was 94.36 ± 9,85 for surgical fixation, while it was 91.56 ± 14,66 for figure of eight bandage treated patients. Considering the DASH score, the first group reported a mean score of 4.63 ± 5,21; whereas the second group reported a mean score of 3.86 ± 5,84. No correlation was found among the two groups despite our analysis and the p-value resulted of >0.5 in both DASH and Constant score.

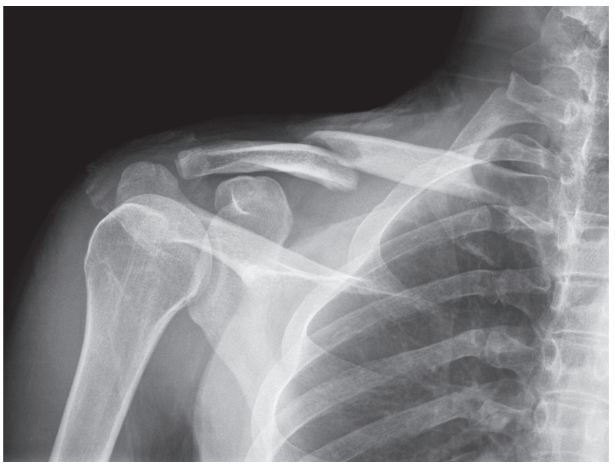

Figure 2A. Clavicle fracture treated conservatively (group 2)

Figure 2B. Patient with figure of eight bendage

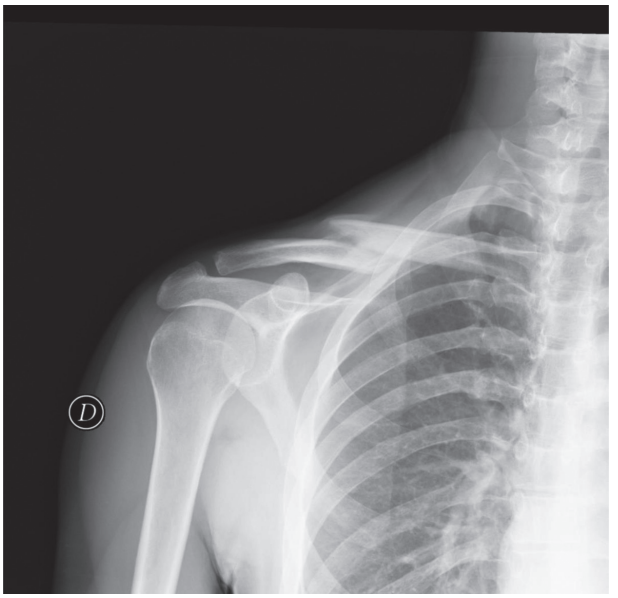

Figure 2C. X-ray control after conservative treatment.

We listed the number of potential disadvantages following to both treatment options to calculate the complication rate.

In particular, 15 out of the 38 patients who underwent conservative treatment (39,5%) were unsatisfied regarding the aesthetic appearance of the shoulder, however regarding the surgically treated patients, 6 out of 50 patients reported cosmetic dissatisfaction (12%)

In the first group, the 13,9th % of patients (5 out of 36) had to be treated surgically to solve the malunion.

In the second group, 10 out of the 50 patients (20%) had to undergo secondary surgery in order to remove the metallic implant.

Surgical wound dehiscence was present in 1 case among surgically treated patients, while hyperesthesia around the scar was reported by 7 patients.

Discussion

The aim of this study was analyzing whether patients with a displaced midshaft clavicular fracture are better managed with a plate fixation or a non-surgical treatment considering clinical results, functional outcomes and complication rate in patients treated at our department and comparing them to the literature.

In the last decades of 20th century, the conservative treatment was considered the gold standard because of the high rates of non union following both treatments reported in the past. In fact, according to Neer and Rowe in 1960, non union rate was less than 1% in patients conservatively treated, whereas the rates in surgically treated patients were higher (2, 14).

More recent studies show the changes of the indications, evaluating the reduction of nonunion cases in surgically treated inpatients. In the literature, multiple studies report lower rates of nonunion after plate fixation than conservative treatment (35), reporting a relatively higher incidence of non unions following to conservative treatment, causing a shift towards surgical treatment. Robinson et al. (36) performed secondary plate fixation in 81% of patients with non union fracture after 6 months. In Schemistch series for Canadian Orthopedic Trauma Society (COTS), all patients with a non union after 1 year follow-up period, underwent plate fixation (37). Melean et al. described secondary plate fixation in all 4 patients with a non union, but the timing was not listed (38). In the study by Woltz et al. (39), 5 patients were operated with a nonunion within a follow-up period of 1 year, underlining that the patients with a non union, who were about to undergo surgery, had a lower functional score than patients with a united fracture.

Our analysis confirms the results reported in more recent studies, showing less rates of nonunion in surgical group than in the conservative treatment group, all solved by secondary delayed surgery.

We reported that 10 patients in the operative group had to undergo secondary surgery to remove metallic implants, which is usually technically simpler, imposes less risk of complications, and provides shorter recovery time than other surgical procedures, such as secondary plate fixation with bone-grafting.

Considering the clinical scores in the previous studies, the Constant and DASH scores showed better results in the surgically treated group, than in the conservative group although the differences were only respectively 4.4 and 5.1 points, largely less than the 10 to 15 points, generally defined as the minimal difference for the clinical relevance (40-42). It remains controversial whether shortening of the clavicle after non-surgical treatment of a middle third fracture can affect shoulder ROM: in literature, there is no correlation between shortening and functional outcomes, even though the difference exceeds 2 cm (41).

Finally, the cosmetic issues were considered just in a few studies but, as well as we recorded in our cohort of patients, even in 2007 Canadian Orthopedic Trauma Society study, the surgically treated group of patients was more likely satisfied with the appearance of the shoulder (42) than the conservative group of patients.

In fact, although the surgical scar is largely visible over the shoulder, patients are more likely to consider the good clinical outcomes and rapid functional recovery, disregarding the cosmetic defect.

There were several limitations in our study: first we were not able to find statistically significant differences, probably because of the small sample size. Then, we did not evaluate the shortening of the clavicle. In conclusion, we noticed that the difference in the mean age between the two groups can affect the results, although very little. A larger number of patients and a longer follow-up timeframe is preferred in the future in order to assess a statistically significant difference between the 2 groups

Conclusions

Plate fixation of a displaced clavicular fracture does not result in improved clinical and functional outcome at 4 year follow-up period, but significantly reduces the risk of non union.

Therefore, we suggest an individualized patient-by-patient treatment, taking into consideration the functional demand, the general clinical diseases, the fracture characteristics and the nonunion risk factors such as large displacement.

We suggest surgical treatment as gold standard in young patients, who demand a fast recovery and a good upper limb ROM and should non union risk factors be <present, whereas conservative treatment can be considered a good option for elderly or less active patients, especially in case of risk factors that can contraindicate surgery.

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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