



AN INTERNAL FIXATION APPLICATION BY MEANS OF TITANIUM CLIPS FOR CLAVICULAR FRACTURES

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Klavikula Kırıkları için Titanyum Klipsleriyle İnternal Fiksasyon Uygulaması

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ABSTRACT

Clavicular fracture (CF) is a common injury. Customary, CF has been treated conservatively even if largely displaced. We describe our experience with a case of traumatic CF who successfully treated with open reduction and internal fixation with rib clips. A 48-year-old man was admitted to our emergency department after falling from height. Radiological examination revealed right clavicle and multiple rib fractures, right hemopneumothorax and lung contusions. Clip was applied to the fracture area. The postoperative course was uneventful, the patient discharged with immobile right arm in a sling two weeks after surgery. There is no consensus on its optimal or standardized operative treatment. It still continues to be controversial in the near future. Open reduction and internal fixation with rib clips in CF is a good and safe alternative to conservative treatment.

Keywords: Open reduction, internal fixation, titanium, clips, clavicle fractures

ÖZET

Klavikula kırıklar (KK), yaygın bir yaralanmadır. Geleneksel olarak, KK belirgin şekilde ayrılmış bile olsalar konservatif olarak tedavi edilir. Travmatik KK olan hastada açık redüksiyon ve kaburga klipsiyle internal tespit yaptığımız ve başarılı bir şekilde tedavi ettiğimiz olgumuzu sunmayı amaçladık. 48 yaşındaki erkek yüksekten düşme sonrası acil servisimize başvurdu. Radyolojik incelemesinde sağ multiple kaburga ve klavikula kırığı, sağ hemopnömotoraks ve akciğer kontüzyonu tespit edildi. Klips, kırık alana uygulandı. Postoperatif dönem sorunsuzdu ve ameliyattan iki hafta sonra immobil sağ kol askısına alınarak taburcu edildi. Optimal ya da standart cerrahi tedavisi konusunda görüş birliği yoktur. Yakın gelecekte de tartışılmaya devam edecektir. KK'larında; kaburga klipsleriyle açık redüksiyon ve internal tespit konservatif tedaviye iyi ve güvenli bir alternatiftir.

Anahtar Kelimeler: Açık redüksiyon, internal fiksasyon, titanyum, klips, klavikula kırıkları

Objective

Clavicular fractures (CFs) occur most often in younger adults with the highest incidence in the second and third decades. These fractures are common injuries accounting for between 2.6 and 4% of adult fractures (1). After the age of 20, its prevalence has been reduced by every decade whereas sex ratios (female to male) are increasing. Anatomically, CFs can be divided into three as medial, mid-shaft and lateral. Mid-shaft fractures are most common type, constituting approximately 82% of all clavicle fractures (2). Customary, CF has been treated conservatively, even if largely displaced. Because of high non-union rates, surgical treatment is gaining more acceptances (3). Wire, plate/screw systems and intra-medullary devices that are most commonly used devices still continue to be problematic. We described our experience with a case of traumatic CF who successfully treated with open reduction and internal fixation with rib clips, as miscellaneous usage.

Case Report

A 48-year-old man was admitted to our emergency department after falling from height. Chest X-ray revealed a right midshaft CF, and was confirmed by thoracic CT (Fig. 1). The fracture was mostly vertical oriented on CT, but fragmented with some angulation and mobilization on fracture sides. CT also showed right clavicle and multiple ribs fractures, right hemopneumothorax. The patient was admitted to the intensive care unit of our clinic. Blood occurred in fibrin in the diagnostic thoracentesis. It was drained through closed underwater drainage. Right arm was bandaged in 8 form. Drug-assisted medical treatment was onset for the severe arm and shoulder pain of the patients. Since the pain continued, the patient was recommended surgical treatment. His medical and surgical history was unremarkable. After talking with pa-

tient for suitable choices, surgery decision was made. For surgery, we chose titanium clips (STRATOS™ Strasbourg Thorax Osteosyntheses System, MedXpert GmbH, Heitersheim, Germany) System as it requires smaller incision, minimal tissue dissection and stripping compared with other techniques. Standard surgical approach was made as an oblique incision on the fracture area of the clavicle. Subcutaneous and deep dissection was carefully carried out through sharp and blunt dissection. After periosteal elevation as in the rib application (4), clip was applied to the clavicle only in the fractured area. Before replacement, clip was reshaped to correspond to bone curved shape. Clip was placed between clavicle and periosteum. Meanwhile, particular attention was paid to keep the surrounding soft tissues and especially neurovascular bundle that may cause post-operative chronic and severe pain inside the implant. Subsequently, clip legs were crimped on each side of the clavicle via using special tools. There was no pain, complication or instability after operation. Arm flexion and abduction was limited during the first 3 weeks. The postoperative course was uneventful and the patients were discharged with immobile right arm in a sling two weeks after surgery. Outpatient physiotherapy was organized and instructions were given to execute pendular exercises within a painless range. Patient was followed up 12 weeks after surgery. Patient was improving well without any pain. He was able to return to his regular daily activities and job he left off. Written informed consent was obtained from the patient who participated in this study.

Discussion

CF is a common case, representing less than four percent of all fractures in adults. The main purpose of the treatments is to achieve bone integrity as soon as possible while minimizing dysfunction, morbidity

and cosmetic deformity. Current treatment ranges from conservative to surgical correction. Until recent years CFs are nearly always treated conservatively including manual reduction, correcting tape, plaster and slings, symptomatic pain relief, local ice application and immobilization of the affected upper extremity in a few weeks. According to us; there are two main reasons for the conservative treatment that made it so popular: the first is the reported high non-union rates after surgery and secondly the fear of intra or perioperative complications (3,5). Naturally conservative treatment is not exempted from its complications. However, it is often associated with complications including non-union, shortening, residual pain, cosmetic and progressive deformity with high incidence. In the recent literature, we found it interesting that they were the same or even similar to the conservative and surgical complications (3). That's why surgical treatments are becoming increasingly accepted as treatment for CFs.

On the other hand, there are some current reports of potentially favourable results after surgery with satisfactory outcomes and fewer non-union rates [6]. Surgical fixation including wire, plate/screw systems and intra-medullary devices provide early fracture stability, pain relief and facilitate early shoulder mobilization. Even though, surgical indications of CFs may vary from institution to institution, absolute in-

dications many clinicians defined are open injury, significant skin tenting, more than 20mm shortening, severe displacement/comminution, non-union and neurovascular compromise. Relative indications are multiple trauma, floating shoulder and cosmetic reasons (2,3). Our patient underwent surgery because of the severe shoulder and arm pain.

However there are too many devices options including wire, plate/screw systems and intra-medullary devices, each of which has its own advantages and disadvantages. Up to date plate fixation has been accepted as gold standard by many authorities depending on the immediate rigid fixation and early shoulder/arm mobilization. Depending on the localization, complications and reoperation rates were 34% and 18%, respectively. The most recently published meta-analysis comparing conservative treatment, intramedullary pin and plate fixation has reported lower non-union and infection rates in both surgical groups. In addition, no significant differences in non-union and infection rates were found between the two techniques. Surgical modalities should be selected and performed according to the patient's characteristics such as the age, comorbid diseases, fracture location and own request (7).

Despite the popularity of plating for CFs, fixation optimization remains problematic (1). Titanium clips/rods mainly used for chest wall reconstruction, rib fractures fixation and pectus excavatum end surgery with

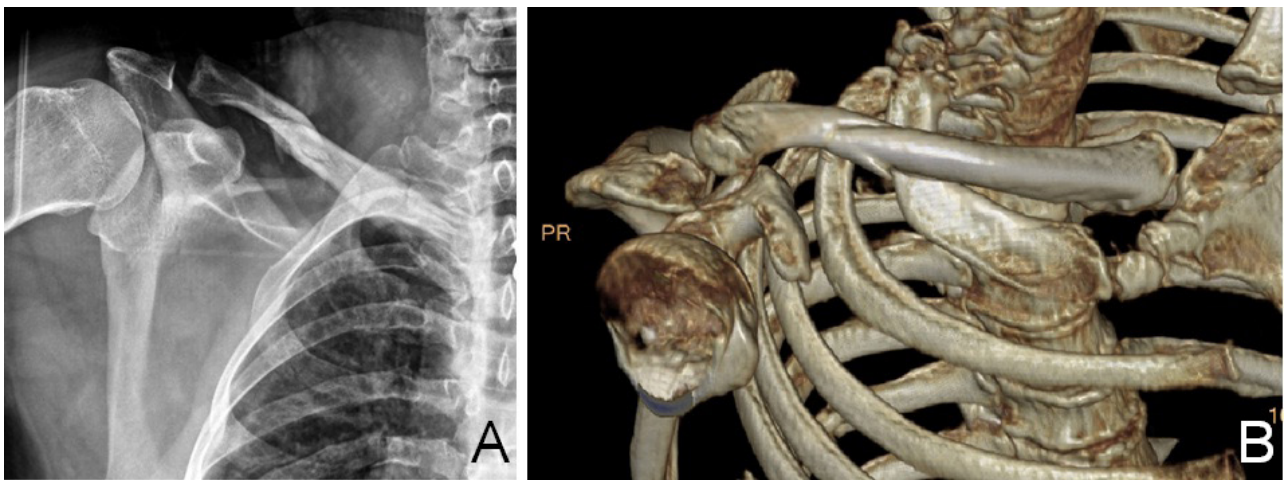


Figure1: A: Clavicle X-ray showed mid-shaft fracture. B: 3D reconstruction image showed mild displaced and angulated midshaft fracture.

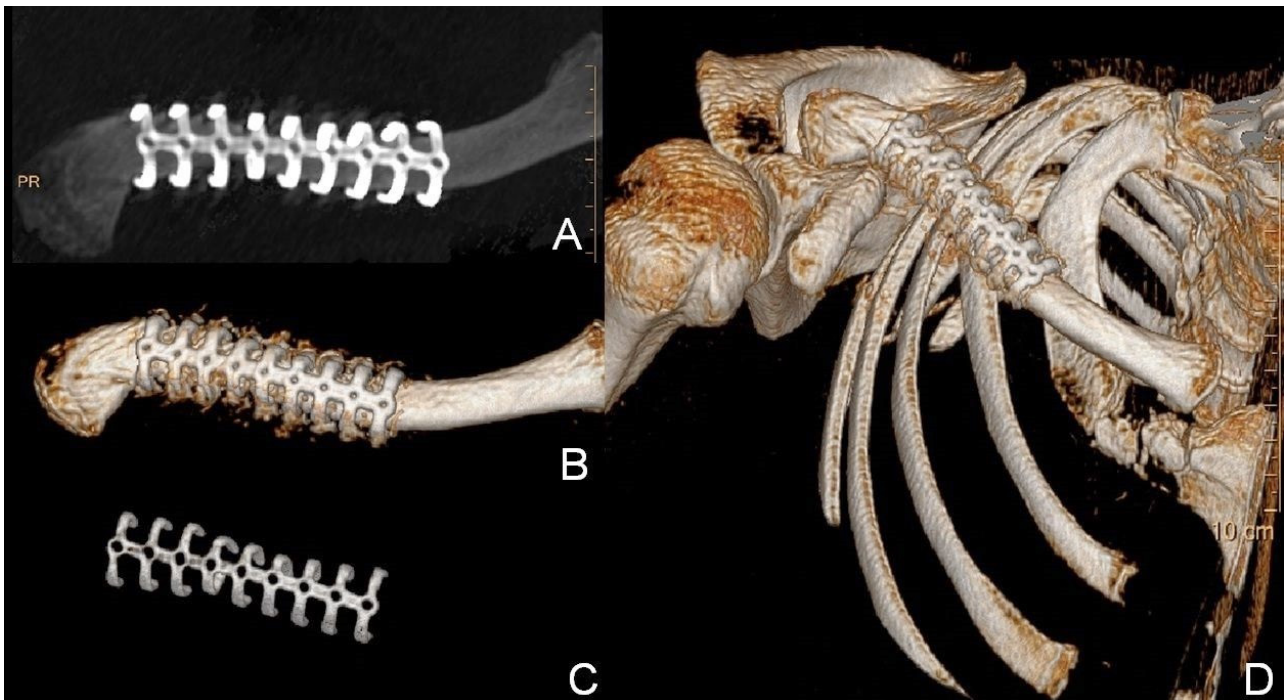


Figure 2: Axial orientated 2D MIP(A), 3D volume rendering (B) and filtered 3D for prosthesis imaging (C) showed STRATOS which is adapted to bone shaped and fixed the fracture sides. 3D volume rendering image on the left side (D) showed normal angulation of clavicle after reconstruction.

good results (4,8). The clip is clung to the clavicle through "small handles", which surround it without injuring or compressing the surrounding tissues, especially underlying neurovascular structures. Also, it is less weakened than plate/screw systems and intra-medullary devices. To our knowledge, this case is the first case underwent internal fixation and stabilization of the clavicle with titanium clips. Although we lack the experience and knowledge of literature how to use in osteoporotic patients, we think titanium clips will be more successful than the plate/screw system that distorts and undermines small handles bone integrity. Moreover, sigmoid shape of clavicle makes them difficult to use these devices for CFs. Compared to the other material; titanium is easily adaptable to the bone shape that required to be fixated. Since titanium content has lesser artefact in CT and no magnetic effect, it makes postoperative imaging possible with CT and MRI (8). In our case, Titanium clips provided sufficient bone fixation, rapid pain control and early return to daily life without complications. We believe that it has advantages over current surgical techniques to avoid the intraoperative and future complications.

Conclusion

There is no consensus on its optimal or standardized operative treatment. It still continues to be controversial in the near future. Treatment, especially in surgery, should be individualized based on fracture characteristics, surgeon's experience, hospital facilities and patient expectations (2-4,9). More research and patient application are required to produce guidelines to find out whether fixation is suitable for all CFs or not.

According to our best knowledge it is the first report employing this system for clavicle fractures. Open reduction and internal fixation with rib clips in clavicle fractures is a good and safe alternative to conservative treatment.

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Conflict of Interest

The author declares that he has no conflict of interest