

Results of the treatment of adult olecranon fractures used to two different tension band technique

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SUMMARY

Olecranon fractures occurs by forced hiperextantion, avulsion of triceps tendon or direct trauma. In this study was evaluated 25 men, 13 women of 38 patients. We have used two different surgical technique for treatment. They are modified AO technique (MAOT) and conventional AO technique (CAOT). We evaluated postoperative quality of reduction, range of motion, relation between development of arthrosis, surgical technique, K-wires migration, functional results. According to applied to both technique for reduction quality were achieve results good 63.2 % (24), moderate 28.9% (11), poor 7.9% (3). While loss of extension of elbow were observed of five patients with good reduction, in ten patients with moderate and poor reduction ($p=0.005$). The relationship between the development of arthrosis and reduction quality was significant ($p=0.001$). Functional results with MAOT of 16 patients had excellent results in the 11, as well as with CAOT of 22 patients had excellent results in 16 ($p>0.05$). As a result there is no difference between MAOT and CAOT in terms of functional results and development of arthrosis and K-wire migration. Reduction quality to be good was significantly reduced development of arthrosis and loss of extantion.

Key words: Olecranon process, intraarticular fractures

The olecranon fractures represents 10 % in fractures of upper extremity. It occurs by forced hiperextantion, avulsion of triceps tendon or direct trauma. If appropriate reduction can't be done, limitation of joint motion and early arthritis may occur. The aim of surgical treatment provides a normal contour of troclear notch, protection of extensor force and early motion. Tension band method in surgical treatment of olecranon fractures frequently used due to low cost and biomechanical superiority. After the surgical treatment of olecranon fractures K-wire migration, arthrosis and loss of range of motion are common complications. In this study, we reveiwed different two surgical technique and

ÖZET

Erişkin olekranon kırıklarının tedavisinde kullanılan iki farklı gergi bandı tekniğinin sonuçları

Olekranon kırıkları güçlü hiperkestansiyon, trisepsin avulsiyonu veya indirek travma sonucu meydana gelir. Bu çalışmada 25 erkek, 13 kadın, 38 hasta incelendi. Tedavi için iki farklı cerrahi teknik kullandık. Modifiye AO tekniği ve konvansiyonel AO tekniği. Postoperatif redüksiyon kalitesi, eklem hareket açıklığı, artroz gelişimi, uygulanan cerrahi teknik, K-teli migrasyonu, fonksiyonel sonuçları inceledik. Uygulanan her iki tekniğe göre sonuçlar; iyi % 63.2 (24), orta % 28.9 (11), zayıf % 7.9 (3) idi. İyi redüksiyon elde edilen beş hastanın, orta ve zayıf redüksiyon elde edilen on hastanın dirseğinde ekstansiyon kaybı görüldü ($p=0.05$). Artroz gelişimi ile redüksiyon kalitesi arasındaki ilişki anlamlıydı ($p=0.001$). MAOT uygulanan 16 hastanın 11'inde, CAOT uygulanan 22 hastanın 16'sında mükemmel sonuç elde edildi ($p>0.05$). Sonuç olarak uygulanan MAOT ile CAOT arasında fonksiyonel sonuçlar, artroz gelişimi ve K-teli migrasyonu bakımından fark görülmedi. Redüksiyon kalitesinin iyi olması artroz gelişimini ve eklem hareket kaybını azaltmaktadır.

Anahtar kelimeler: Olekrenon süreci, eklem içi kırıklar

other results of olecranon fractures.

MATERIAL and METHODS

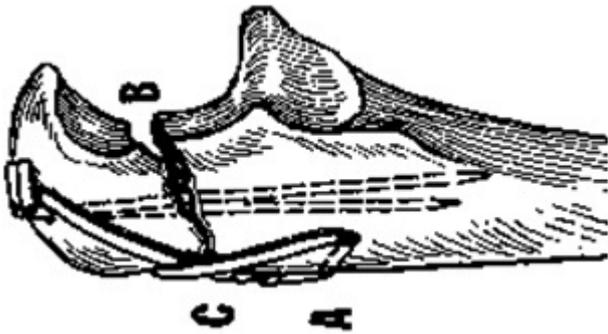
All patients had prospective evaluated with olecranon fractures between 2002-2010 years. This study included 25 men, 13 women of 38 patients. Patients were evaluated by sex, age, follow up period, effected side, mechanism of injury, fracture type, amount contained in the joint, fracture classification (it was evaluated according to Mayo classification), length of hospital stay, technique of operation^(1,2). We have used two different surgical technique. They are modified AO technique

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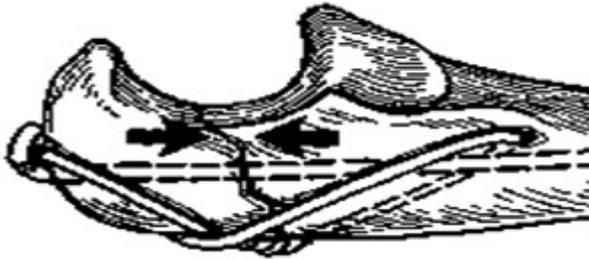
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(MAOT) and conventional AO technique (CAOT). In classic AO technique, K-wires were removed anterior cortex and tension band was passed posteriorly of K-wires. In modified AO technique, K-wires were stabilized as intramedullary and tension band was passed anteriorly of K-wires (Fig. 1 and 2). We evaluated postoperative quality of reduction from X-ray, range of motion, relation between development of arthrosis (developed by Graves at al), surgical technique, K-wires migration. Functional results were evaluated according to Mayo Elbow Performance Score (MEPS) (max., 100 points) Accordingl elbow were examined by Pain (max., 45 points), Range of motion (max., 20 points), Stability (max., 10 points), Function (max., 25 points). To evaluate the relationship between Mayo Elbow Performance Score and surgical technical. As statistical analysis was used Pearson Chi-square.



Figür 1.



Figür 2.

Surgical Technique

All of patients were operated with general anesthe-

sia and tourniquet application. Surgeries were performed by three senior author. Posterior longitudinal incision was performed and then hematoma was drained. Open reduction was performed subsequently two pieces kirschner wire and appropriate length tension band was used. K-wires were placed intramedullary in the modified AO technique (MAOT). Whereas in conventional AO technique (CAOT), K-wires removed from anterior cortex. Subsequently a hole was opened to the distal portion of the fracture line, tension band passed from hole inside then it placed on the dorsal face of ulna. Tension band was tightened and tied.

RESULTS

Patients mean age was 36.9 (9-69) and all of them (65.8 %) 25 were male, (34.2 %) 13 were female. Mean follow-up period of 43 months (4-115 months). All of patients was right-dominant side, effected side of right olecranon 16, left 22. The mechanisim of injury was direct trauma in 15 of patients, traffic accident of 10 patients, heigh fall of 9 patients. In 4 of patients were open fractures. All of the fractures had displacement more than 2 mm. Fractures were evaluated in three groups which are oblique (8), transverse (17), comminute (13). Fractures were included consisted of joint (% 40-60) in 13 of patients, (% 20-40) in 11 of patients. According to Mayo classification there are 3 Type I, 20 Type IIa, 2 type IIb, 2 Type IIIa fractures. They were operated on (0-7) day period of 25 patients, (7-14) day period of 7 patients, (later 14 th) day period of 6 patients. Postoperatif case brace was used 20 day.

In operation was used two basic technics. While conventional AO technique (CAOT) was used in 16 patients, modified AO technique (MAOT) was used in 22 patients. According to MEPS, in CAOT had excellent 10/16, in MAOT had excellent 15/22 (no differant as a statistically between two groups. Pearson Chi-square $p>0.05$).

Quality of reduction were evaluated in postoperati-

ve radiographs. If there is no displacement it was considered as good, if there is displacement less than 2 mm it was considered as moderate, if there is displacement more than 2 mm it was considered as poor. According to applied to both technique for reduction quality were achieved results good 63.2 % (24), moderate 28.9 % (11), poor 7.9 % (3). While loss of extension of elbow were observed of five patients with good reduction, in ten patients with moderate and poor reduction. (Pearson Chi-square $p=0.005$).

The relationship between the development of arthrosis and surgical techniques were evaluated. In MAOT technique was found in five patients with arthrosis (grade 1) while in CAOT technique was found in six patients with arthrosis (grade 1). (Pearson Chi-square $p>0.05$). In MAOT technique was K-wires migration in seven patients, in CAOT technique was found of eight patients (Pearson Chi-square $p>0.05$).

The relationship between the development of arthrosis and reduction quality was evaluated. In patients with good quality reduction were observed increasing arthrosis of four cases whereas in patients with moderate and poor reduction of ten cases. (Pearson Chi-square $p=0.001$).

Clinical results were evaluated according to the Mayo Elbow Performance Score which were excellent in 27 patients (71,1 %), good 7 (18.4 %), moderate 1 (% 2.6), poor 3 (% 7.9). 27 of patients with excellent results according to Mayo classification were 16 of type 2a fractures. 3 of patients with poor results according to Mayo classification were 1 of type 2a fracture, 1 of type 2b fracture, 1 of type 3b fracture. There was no difference between the two techniques. In MAOT of 16 patients had excellent results in the 11, as well as in 22 CAOT of 22 patients had excellent results in 16 (Pearson Chi-square $p>0.05$). Fracture type and the percentage of the joint that affect outcome no statistically significant difference was found. (Pearson's Chi-square $p>0.05$).

In this study as complications were found to be infection in one patient, positive tinell's sign in two patients, radioulnar synostosis in one patient, loss of pronation in ten patients (less than ten degrees), reoperation because of metal overhang under skin in five patients.

DISCUSSION

Fractures of olecranon are intraarticular fractures. Therefore anatomical reduction is very important and joint movement should be started as early as pain allows. Studies have been done to prevent for K-wire migration and arthrosis of elbow joint.

Murphy et al compared four different treatment methods. They have made biomechanic analyses and the best results were from screw tension band techniques. They had expressed no difference between screw tension band and AO technique. Fyfe et al had study in cadaver and ten cadavers had completed fractures of the ulna oblique, transverse, comminuted. Five different techniques were applied for these fractures. As a result; the most stable methods were obtained from two knot of transvers ulna fracture (2-4).

Weseley et al were treated using as twenty-five cases of fracture of the olecranon process a modification of the Zuelzer hook plate, and uniformly excellent or good results were obtained in all cases in which there were no other associated traumatic lesions about the elbow joint. No failure of the appliance or loss of position occurred in any case despite the fact that active motion was usually instituted in one to two weeks (5).

Hume et al were treated with open reduction internal fixation in a prospective as forty-one adult patients with displaced olecranon fractures, randomized study comparing tension band wiring and plate fixation. Plate fixation required longer operative time, but did not lead to an increased complication rate. Range of elbow motion at six months did not differ significantly between the two groups.

Symptomatic metal prominence was frequently observed after tension band wiring (42 %), although true Kirschner wire (K-wire) migration was seen in only one patient. Postoperative loss of reduction, leading to a significant articular step-off or gap, was more frequent after tension band wiring (53 %) than after Plate fixation (5 %). Tension band wiring resulted in 37 % good clinical and 47 % good roentgenographic results, as compared with Plate fixation, which resulted in 63 % good clinical and 86 % good roentgenographic results. Plate fixation should be carefully considered when planning open reduction and internal fixation of displaced olecranon fractures (6).

According to Nowinski; rigid anatomic fixation with early range of motion is the required treatment for Comminuted fracture-dislocations of the elbow. Because of the local anatomy of the proximal ulna, it is often difficult to achieve a rigid fixation construct. A fixation technique of a dorsally applied AO limited contact-dynamic compression wrist fusion plate contoured to fit the anatomy of the proximal ulna is presented. Advantages of the AO wrist fusion plate in comminuted olecranon fractures include the ease of contouring, a low profile, and the use of variable screw hole sizing to achieve stable fixation. The hybrid design allows for rigid 3.5-mm plate fixation distally while providing low profile 2.7-mm plate fixation over the subcutaneous olecranon. The technical and biomechanical features of this plate make it an ideal alternative for fixation of these complex injuries (7).

In this study, we used classical AO technique and its modification. Kirschner wire (K-wire) migration and skin irritation for treatment with tension band wiring (TBW) is most important complication. K-wires were placed in parallel as intramedullary to solve this problem. So K-wires do not protrude out of anterior cortex and neurovascular damage.

Chi-Chuan and their study was aimed at comparing the superiority between the newly designed modi-

fied AO tension band wiring technique and the traditional modified AO tension band wiring technique in treating an olecranon fracture. Eight pairs of fresh cadaveric ulnae were tested biomechanically. After transverse osteotomy of the olecranon, all left ulnae were fixed by the traditional modified AO technique with two Kirschner wires inserted through the anterior ulnar cortex and all right ulnae by the new technique with two Kirschner wires inserted into the marrow cavity from the olecranon to the ulnar styloid process. All specimens were tested by the Material Testing System machine to evaluate fragment displacement and the maximal failure load. A dual linear variable displacement transducer was used to measure relative minimal displacement. There was no significant difference between the techniques. The maximal failure load by either technique was more than 80 kg. Even at testing failure, no Kirschner wires migrated proximally. The new technique may be applied widely to treat all olecranon fractures, because it is a technically easier and safer technique. Less than 5.5-kg loads could be permitted in daily activity postoperatively. A single tolerable loading weight should not exceed 8 kg. Kirschner wires will not migrate proximally, despite increased joint loading. Clinically, this study may confirm indirectly the hypothesis that proximal migration of Kirschner wires was mainly due to triceps traction. In this study we also compared CAOT and MAOT. There was not a significant difference between two techniques in terms of loss of ROM of elbow, functional results, fracture reduction, loss of reduction, development of arthrosis, kirschner wire migration (8).

In this study, if patients have concomitant injury, loss of ROM were more common. Rommens at all their study in patients with concomitant injury, loss of ROM of elbow were found more frequently. As many patients have complaints related to the implants, they recommend metal removal after fracture healing. Early mobilization after surgery is very important. Between 2-21 days to begin of ROM increases the success of treatment (9,10).

Netz and Strömberg had designed non-sliding wire, according to they are depend on traction force of triceps of K- wires migration and it be buried under the triceps (11).

Technique with tension band are excellent result but it requires a second operation (60 %-80 % percent). Murphy et al 80 %, Wolfgang et al 4 %, encountered up to K-wire migration (12,13). In this study, our clinical results in patients with and without K-wire migration did not observe a significant difference.

Olecranon fractures are observed with loss of movement for over 50 %, especially in the terminal extension and flexion. Study of Eriksson et al had loss of mobility in patients (59 %) of elbow. Karlsson's study had loss of mobility 43 patients in 73 (14,15).

The extension loss examine that factors was significant patients with high energy trauma and additional injuries. In Anneluuk study, extension loss was more frequently injuries associated with elbow dislocation (16).

CONCLUSION

Although there is no difference between MAOT and CAOT in terms of functional result, development of arthrosis and K-wire migration. Very good reduction quality was significantly reduced development of arthrosis and loss of extension.

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