ABSTRACT

Objective: To determine the clinical effectiveness and safety of Ilizarov external fixation for the acute treatment of severely comminuted extra-articular and intercondylar fractures of the distal femur.

Methodology: A total of 17 consecutive patients with complex fractures were treated. 16 patients complete their follow up. According to the AO/ASIF system, we had two patients with type A3, three patients had C1, while eight patients presented with type C2, where three patients were type C3 fracture. In addition 3 cases of 16 had fracture tibial plateau. The mean follow-up was 13 months.

Results: Most fractures (14) healed primarily, while the other 2 cases need autogenous iliac graft. The mean range of flexion of the knee at the final follow-up was 54.97, SD 37.13 (0-110) degrees.

Conclusion: We conclude that, in the treatment of comminuted fractures of the supracondylar femur, the Ilizarov fixator is safe and effective in providing stability and allowing early rehabilitation.

Key words: Ilizarov, supracondylar, femur, comminuted.

INTRODUCTION

Articular and extra articular fractures of distal femur can be managed by open reduction and internal fixation using different means of fixation as a 95 degrees blade plate, condylar buttress plate and dynamic condylar screws, while soft tissue dissection is needed. (1)

Retrograde and antegrade intramedullary nails have solve the problem of soft tissue dissection but still unsuitable for specific types of supra and intra articular fractures of distal femur if there was comminution or skin and soft tissue injury in open fractures. (1,2)

Our aim is to determine the effectiveness and safety of Ilizarov external fixation as a definitive treatment of highly comminuted extra-articular and intercondylar fractures of the distal femur.

MATERIAL AND METHODS

Between March 2010 and August 2014, we managed 17 cases of supra condylar fracture femur of various types, 16 patients complete their follow up, one patient lost follow up.

In this case series, 16 supra condylar femoral fractures, 13 males (81.2%) and 3 females (18.8%) admitted in our hospital, all from traffic road accident.

There were 7 cases presented with closed fractures (43.8%) and 9 cases with open fractures (56.2%), 5 of them were Gustillo Andreson grade 2 (55.6%) and 4 (44.4%) were Gustillo Andreson, grade 3.

According to the AO/ASIF system, we had two patients with type A3, three patients had C1, while eight patients presented with type C2, where three patients presented with type C3 fracture, 3 cases of 16 had fracture tibial plateau in addition to the supracondylar fracture femur.

The mean age of the patients was 29.88 years, with SD 11.98, range (13-52 years).

All patients under went complete radiological and laboratory investigations, all patients had plane X rays in the form of antero-posterior and lateral views, in addition all of them had C.T. scan for the supracondylar femoral region.

In the emergency room all patients were examined clinically for vascular and neurological compromise and all of them were free.

Urgent laboratory investigations were done in form of Hb. Concentration, hematocrit value, random blood sugar, blood group and Rh type.

The patients with closed supra condylar fracture femur trial of closed reduction, and above knee slab was done for temporary fixation of fracture.

On the other hand the patients with open fractures were managed in the emergency room by washing of the wound by saline about 6 litres, and above knee slab was done, the patients with open fractures received blood
transfusion when the Hb concentration below 10gm/dl. The patients were prepared for the definitive surgical fixation by illizarov circular external fixator within 6 hours of admission. (Fig 1a,2a, 3a) 

Technique

Under regional anaesthesia the patient lies supine; the affected lower limb is put on traction table 1 with the foot in boot, to facilitate the traction and the image work. The injured lower limb was draped and the relationship of both proximal and distal segment of fracture is determined by image intensifier.

We began the apparatus assembly from proximal to distal down to the knee joint. In all cases we bridging the knee joint for more fixation of the fracture, as the supracondylar region was small to accept more than one level of ring fixation, except in one case we stop the fixation at the level of supracondylar region.

The idea of reduction is that, in closed fractures, we aligned the joint line under image intensifier in case of supra inter fracture femur, we inserted cannulated screws to make the supracondylar segment as one fragment. This fragment is now rotated posterior so; drop wire superior and connected to the fracture ring is used as arch wire technique, to correct the posterior sagging and rotation of the distal fragment.

The fixation of fracture was divided into 4 level of fixation descending from proximal to distal, which consists of level 1; arch, then level 2; complete ring consists of two suitable half ring above the fracture site, then level 3; the fracture ring level at the supracondylar region, then level 4; ring below the knee joint. In addition of associated tibial plateau fractures we increase the level of fixation for another one level.

The assembly of the apparatus begins at the superior part of the femur using 120 degree arch fixed to the bone by 6mm half pins .then complete ring connected to the arch, distal in position, and superior to the fracture site.

The fracture fragments are manipulated in closed fractures as joy stick using 6mm steimen pin and by aid of reduction clamp, to compress the fragments to each others, then we use cannulated screws to fix the fragments together.

In some cases of high comminution, we use olive wires from both medial and lateral to fix the small fragments.

In open fractures, we fix the fracture fragments by olive and smooth wires only, reduction of fragments could be done by introduction of instruments through the wound.

We use carbon fibre ring as fracture ring to fix the fracture and it connected to the complete ring superior to the fracture ring.

At this stage, we only introduce transverse wire from medial to lateral side or vice versa just superior to the articular surface of the distal femur.

Now the supra condylar fragment is rotated posteriorly , so we introduce another smooth wire superior to the transverse wire and is connected to the fracture ring by two male posts and use it as arch wire . By using of two dynamic tensioners we tensioned the both ends of this wire as arch wire technique to correct the posterior rotation of the supracondylar fragment.

After complete reduction of the fracture fragment we insert smooth wires for more fixations of the fracture fragments at the level of the fracture ring.

We cross the knee joint and we extend the fixation distal to the knee by another ring connected to the fracture site. (Fig 1b,2b, 3b) 

Follow up visits

The patient discharges from the hospital in the 2nd or third day, we teach him the ordinary care of the apparatus and the pin site care as cleaning of the apparatus by gauze socked with alcohol.

We encourage the daily walking after the 2nd day and we prescribe antibiotics against gram positive bacteria for ten days post operative and analgesics and anti oedematous. In some cases, we prescribe anticoagulant drugs to guard against development of D.V.T.

The follow up protocol of our clinic was strict, as the patient came to the clinic every 3 weeks, X rays were done, examination of fixator stability, pin site care, the condition of the scare of open wound, and the capability of patient walking.

If there was a problem, we asked the patient to come every week until the problem was subsided. In some cases, we prescribed inject able antibiotic when pin tract infection flare up.

Physiotherapy was started three or five days after surgery. A vigorous rehabilitation regimen was used and the patients were closely supervised. Non-weight-bearing mobilisation proceeded for two weeks, and thereafter partial weight-bearing continued until there was satisfactory evidence of callus formation, which
usually occurred about three months after surgery.

RESULTS

Sixteen supracondylar femoral fractures were presented in the emergency department of benha university hospital between February 2013 and March 2015, there were 7 closed fractures (43.8%), and 9 open fractures (56.2%).

The open fractures were classified according to gustillo andreson classification into 5 cases (55.6%) of grade 2 and 4 cases (44.4%) of grade 3.

According to the AO/ASIF system, we had two patients with type A3, three patients had C1, while eight patients presented with type C2, where three patients presented with type C3 fracture.

There were flail knee in 3 cases out of 16, who had ipsilateral fractures in both distal femur and proximal tibia.

The mean duration of fixator application was 4.97 months with SD 0.94, range (3-6.5 months).

The fracture was completely united in 100% of cases, From 16 cases the fracture was healed in 14 cases (87.5%) without any additional procedure, where in other 2 cases (12.5%), autogenous iliac graft was done for supracondylar fracture after 3 months of fixation, to enhance the biological and mechanical environment for fracture healing. (Fig 1c,2c)

There were loss of knee range of motion in all cases early after fixator removal, the knee range of motion was improved by physiotherapy, except in 2 cases (12.5%), additional procedure in form of manipulation under general anaesthesia was done to get better knee range of motion, as one of them improved to get 70 degrees of knee flexion and the other case not improved.

The mean knee range of motion was 54.97 degrees with SD 37.13, (0-110 degrees).

Pin tract infection was found in all cases, it was of superficial type, it was subsided in all cases with ordinary pin care hygiene, by cleaning of the pin site by saline, and intake of short course oral antibiotics.

D.V.T was discovered in one female case (6.2%), we suspect development of deep venous thrombosis clinically and it was confirmed by Doppler U.S.

The general surgeon in our hospital suggest of insertion of D.V.T. filter in the right femoral vein.

Pain was present in all cases at the beginning of physiotherapy and by time the pain was decreased and all patients underwent the medications to overcome the pain and oedema in the knee of the injured site.

In follow up period, there were no re fracture, pin sites were healed; all patients were satisfied by the results of the operation.

4 cases out of 16 were annoying of apparatus, they complain of its heavens, bulky construct and pin tract sites, and they asked to remove as early as possible to get out of their bad psychological experience.

<table>
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<td>DVT filter insertion in femoral vein</td>
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Table 2: Comparison of result and methodology.

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<th>Comparison</th>
<th>Current study</th>
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<tr>
<td>patients</td>
<td>16 patients</td>
<td>20 patients</td>
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<td>Fracture classification</td>
<td>7 closed fractures, 9 open fractures:</td>
<td>Guistallo grade 11B.</td>
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<td>5 patients guistallo, Grade 11, 4 patients guistallo grade 111.</td>
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<td>Time for fracture healing</td>
<td>4.97 months, about 20 weeks.</td>
<td>30 to 39 weeks.</td>
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<td>Mean Knee range of motion</td>
<td>54.97 degrees (0-110).</td>
<td>92 to 110 degrees in C2 fractures.</td>
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<td>37 to 73 degrees in C3 fractures.</td>
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<td>complications</td>
<td>Pin tract infection superfacial type In 100%. D.V.T. in one cases</td>
<td>Pin tract infection in 21%.</td>
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Legend of figures

Fig.1 a: preoperative x rays. B: early post operative x rays and clinical photos. C: X-rays after fixator removal.

Fig.2 a: preoperative x rays. B: Early post operative x rays. C: X-rays after fixator removal.

Fig.3 a: preoperative x rays and clinical photo. B: Early post operative x rays and clinical photos
DISCUSSION

Ilizarov external fixator has many advantages: minimal surgical exposure and soft tissue dissection, decrease loss of blood, keeping of fracture haematoma which allows of rapid fracture healing as well as mechanical stability rather than monoplanar external fixator. (2-5)

Presence of divergent olive wires in ilizarov system allow great stability as well as the ability to compress the fracture fragments at the femoral condyle. (6)

In 2006, Pankaj kumer had managed twenty patients with Ilizarov external fixation for a Gustilo grade IIIB supra-condylar fracture of the femur were functionally assessed 12 to 52 months after treatment. Fourteen fractures were type C3 and 6 were type C2 according to the AO classification. Fractures were united at an average of 39 ± 9 weeks. There was a final knee extension deficit of 5° to 10° (12.2° ± 3.5°) and flexion reached 110° ± 10° in type C2 and 73° ± 36° in C3 supracondylar fractures. (6)

In this series we managed sixteen supracondylar femoral fractures between February 2013 and March 2015, there were 7 closed fractures (43.8%) and 9 open fractures (56.2%), in addition 3 out of 16 patients had flail knee. The open fractures were classified according to gustillo andreson classification into 5 cases (55.6%) of grade 2 and 4 cases (44.4%) of grade 3.

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Kumer reported that Pin-track infection occurred in 21%. Half of the C3 fracture cases had problems with pain on walking, needed support and had pain at rest, where- as no patients had difficulty in getting out of a chair, going up and down stairs. However, all C2 type fractures had problems with all types of function. (6)

This current study shows that Pin tract infection was found in all cases, it was of superficial type, it was subsided in all cases with ordinary pin care hygiene, by cleaning of the pin site by saline, and intake of short course oral antibiotics. Table. No. 2

Arazi et al. and in other reported studies, concluded that the most disabling complication was loss of knee movement . The anatomical type of the fracture and the severity of the associated soft tissue damage are primarily causing this complication. the wires and half pins used for fixation act as a stopper that prevent the movement of quadriceps muscle and iliotibial band as long as the fixator is applied.(1,7,8)

In this series there were loss of knee range of motion in all cases early after fixator removal, the knee range of motion was improved by physiotherapy, except in 2 cases (12.5%), and additional procedure in form of manipulation under general anaesthesia was done to get better knee range of motion.

The mean knee range of motion was 54.97 degrees with SD 37.13, (0-110 degrees).

D.V.T was discovered in one female case (6.2%), we suspect development of deep venous thrombosis clinically and it was confirmed by Doppler U.S.

The general surgeon in our hospital suggest of insertion of D.V.T. filter in the right femoral vein.

Pain was present in all cases at the beginning of physiotherapy and by time the pain was decreased and all patients underwent the medications to overcome the pain and oedema in the knee of the injured site.

The mean duration of follow up was13 months where no re fractures were reported, pin sites were healed, all patients were satisfied by the results of the operation.

Kumar et. al, concluded that early aggressive debridement of non-viable tissues, stabilisation with an Ilizarov external fixator, and either primary or delayed primary skin closure followed by early mobilisation and weight bearing is a sound alternative treatment method for com mitted Gustilo Grade IIIB supracondylar and intercondylar fractures of the distal femur. (6)

In this series we agree that aggressive debridement and washing of the wound by saline and wide skin sutures is the golden step in decreasing the development of infection.

CONCLUSION

In our experience, the use of an Ilizarov external ring fixator in the treatment of supra- condylar fractures offers several distinct advantages, although the indications for its use are very...
specific, we suggest adopting this method for functional limb salvage after compound high-energy injuries. This fixator is safe and versatile, is effective in providing stability and allowing early rehabilitation, in spite of the motion of the knee was uniformly limited in our series.

REFERENCES