Illizarov External Fixator for Trochanteric Femoral Fractures in High Risk Patients.
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Abstract
Purpose: To evaluate the effectiveness of illizarov external fixator in management of intertrochanteric fracture of femur in high risk patients.
Methodology: 22 patients of chronic diseases with relative contraindication for closed reduction and internal fixation were managed by illizarov.

There were 17 male patients (77.3%), and 5 females (27.7%), 12 patients had hepatic problems 54.5% , while 6 patients 27.3% had uncontrolled hypertension and cardiac problems , where 2 patients 9.1% had pulmonary diseases , while 2 patients 9.1% had diabetes mellitus.

patients mean age was 65.5 years, range (30-81) years, fracture pattern was stable Evans type 1 in 17 patients 77.3%, while 5 patients 22.7% had unstable Evans type1 .

Results: Follow up was 19 months after fracture healing, there were no mortalities in early or late postoperative period.
In half of the patients , it was 90 days for fracture healing where in the other 50% , 120 days needed for complete union.
Harris hip score used for evaluation of the outcome, the result was excellent in13 patients 59.1%, while good in 4 patients 18.2%, where fair in 4 patients 18.2%, and poor in 1 patient 4.5%.

pin tract infection was in 100% of the patients (superficial type).
Varus deformity in 3 patients 13.6%, while shortening was in 4 patients 18.2%, ranging from 1.2 cm to 1.8cm.

Conclusion: Illizarov could be considered as an alternative treatment modality for high-risk patients with intertrochanteric fracture. Technique is simple, safe and can be performed under regional and even local anesthesia.

Key words: trochanteric fractures, high risk, illizarov.

Introduction
Intertrochanteric femoral fractures are one of the most important fractures of the lower extremity. The prevalence of hip fractures is increasing owing to the increase in life expectancy and the inefficacious treatment of osteoporosis, which still is the basic factor for such fractures [1,2]. Owing to advanced age, the first goal is patient survival. The main objective of the treatment is to minimize the complications related to age and immobilization. This can be achieved using internal or external fixation.
Closed reduction and internal fixation of trochanteric fractures is the routine procedure, but in patients at risk with accompanying pathology, such as ischemic cardiac disease, chronic obstructive pulmonary disease, diabetes mellitus, or severe anemia, there is a high risk of anesthetic or postoperative complications [1,3,4]
The goal of this study is to evaluate the outcome of using of illizarov external fixator in management of intertrochanteric fracture femur in high risk patients. As external fixation technique gives shorter anesthesia time, minimal surgical trauma, and minimal blood loss. This is a very important point to stabilize the general medical condition in such elderly patients and to prevent postoperative complications such as urinary infections, pneumonia, decubitus ulcers, and deep wound infection That increase the mortality rate.

Patient and methods
The clinical data were recorded on a report form. These data were tabulated and analyzed using the
computer program SPSS (Statistical package for social science) version 16 to obtain:

**Descriptive data**

Descriptive statistics were calculated for the data in the form of:

3. Mean and standard deviation for quantitative data.
4. Frequency and distribution for qualitative data.

**Analytical statistics**

In the statistical comparison between the different groups, the significance of difference was tested using Z test (used to compare proportion between two groups of qualitative data).

\[ Z = \frac{X_1 - X_2}{\sigma (X_1 - X_2)} \]

AP value <0.05 was considered statistically significant (S) while >0.05 statistically insignificant P value <0.01 was considered highly significant (HS) in all analyses.

In this study 22 patients of chronic diseases with relative contraindication for closed reduction and internal fixation were managed by application of ilizarov external fixator for stabilization of the fracture till fracture healing occurred. The patients had high surgical and anesthetic risk factors for an open surgical procedure or for extended anesthesia because they had more than one accompanying disease. Between may 2013 and augest 2015, there were 17 male patients (77.3%), and 5 females (27.7%), p value 3.05 (0.001). 12 patients out of 22 had hepatic problems 54.5% (elevated liver enzymes, bleeding tendency, hepatitis B and hepatitis C virus infection, liver cell failure), while 6 patients 27.3% had uncontrolled hypertension and cardiac problems with long period of anticoagulant administration, where 2 patients 9.1% had pulmonary diseases (obstructive lung diseases), while 2 patients 9.1% had diabetes mellitus. table no.1

Table no.1: summary of associated chronic diseases.

<table>
<thead>
<tr>
<th>Associated diseases</th>
<th>Value (22)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiac</td>
<td>6(27.3)</td>
</tr>
<tr>
<td>DM</td>
<td>2(9.1)</td>
</tr>
<tr>
<td>Hepatic</td>
<td>12(54.5)</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>2(9.1)</td>
</tr>
</tbody>
</table>

The mean age of the patients was 65.5 years, SD 13.42 range (30-81) years, the fracture pattern was stable Evans type 1 in 17 patients 77.3%, while 5 patients 22.7% had unstable Evans type 1 intertrochanteric fracture p value 3.05(0.001). The fracture was at the right side in 14 patients 63.6%, while at the left side in 8 patients 36.4%, p value 1.33(0.092). table no.2

Table no.2: summary of methodology and results

<table>
<thead>
<tr>
<th>Value</th>
<th>Z (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age mean ±SD (range)</td>
<td>65.45±13.42 (30-81)</td>
</tr>
<tr>
<td>Sex N&amp;%</td>
<td>3.05(0.001**)</td>
</tr>
<tr>
<td>Male</td>
<td>17(77.3)</td>
</tr>
<tr>
<td>Female</td>
<td>5(22.7)</td>
</tr>
<tr>
<td>Classifications N&amp;%</td>
<td>3.05(0.001**)</td>
</tr>
<tr>
<td>Stable</td>
<td>17(77.3)</td>
</tr>
<tr>
<td>Unstable</td>
<td>5(22.7)</td>
</tr>
<tr>
<td>Side N&amp;%</td>
<td>1.33(0.092)</td>
</tr>
<tr>
<td>Lt</td>
<td>8(36.4)</td>
</tr>
<tr>
<td>Rt</td>
<td>14(63.6)</td>
</tr>
<tr>
<td>Score N&amp;%</td>
<td>1(4.5)</td>
</tr>
<tr>
<td>Excellent</td>
<td>13(59.1)</td>
</tr>
<tr>
<td>Good</td>
<td>4(18.2)</td>
</tr>
<tr>
<td>Fair</td>
<td>4(18.2)</td>
</tr>
<tr>
<td>Poor</td>
<td>1(4.5)</td>
</tr>
<tr>
<td>Time of healing N&amp;%</td>
<td>0.0(0.5)</td>
</tr>
<tr>
<td>90 d</td>
<td>11(50.0)</td>
</tr>
<tr>
<td>120 d</td>
<td>11(50.0)</td>
</tr>
<tr>
<td>Complications N&amp;%</td>
<td>-</td>
</tr>
<tr>
<td>Deformity</td>
<td>3(13.6)</td>
</tr>
<tr>
<td>Shortening</td>
<td>4(18.2)</td>
</tr>
</tbody>
</table>

Operative technique

Various types of regional anesthesia were used in these high risk patients as local infiltration by lidocaine H.C.L 2% injected by spinal needle 20 gauge (1-3 mg/kg) after sterilization of the lateral and posterior part of hip and trochanteric area with alcohol 70%, in the subcutaneous area then intramuscular then proceed to infiltrate the periosteum in the trochanteric region. On the other hand, both femoral and sciatic nerve block were performed.

The patient lie supine after regional anesthesia on traction table with the fractured lower limb in flexion attitude at the knee joint and hold with 6mm steimen pin at the proximal tibia for skeletal traction which was inserted under local anesthesia.

Under guide of image intensifier, Reduction was achieved by moving the limb into 20°-30° abduction and 10°-15° internal rotation on the fractured side, about 135 degrees at neck –
shaft angle in anteroposterior and optimum reduction in lateral view. The limb then draped and under image guide, insertion of the guide wire at angle of 135 degrees from the lateral cortex of the femur to get into the femoral neck at the postero-inferior section. Rancho cube 4 holes was used, as the guide wire occupy the 4th hole of rancho cube, then 6mm cancellous half pin was introduced in the hole number 3 parallel to the guide wire in both anteroposterior and lateral view, while the half pin is proceeding checking of the position was done by the image intensifier, and the half pin insertion stopped at about 1 cm from the femoral head (subchondral). fig.1.A- C.

Then another 5mm cancellous half pin was introduced in the hole number two of rancho cube, to be most proximal half pin and parallel to the guide wire. 90 degrees ilizarov arch was connected to the ranch cube at the hole number 1 at its proximal end, by long bolt, then the guide wire was removed and 6 mm half pin was inserted at the same site of guide wire in the postero inferior area of the femoral neck. Another 120 degrees ilizarov arch was connected to the previous arch in position about 15 to 20 cm distal to the sub trochanteric area. The two arches were connected to each other by uni directional hinges hold by two or three rods. fig.1.B. Fixation of the distal arch to the femoral shaft by 3 half pins 6mm for each in various planes and hold by half pin holders or rancho cubes. The average operative time was about 45 minutes.

**Post-operative care:**
The patient encourage for walking from the 2nd day post-operative on crutches, pin site care were told to the patients as daily cleaning of the pin sites by normal saline, and dressing around the half pins. Hot shower was encouraged and cleaning of the crusts around the half pins were done then dry dressing was done around the half pins. Antibiotics were prescribed to the patients 1 hour preoperative as a prophylactic dose, 1st generation cephalosporins was given to the patients, then antibiotic injection was continued for 3 days post-operative then the patient continue on oral antibiotic for 10 days.

In hepatic patients antibiotics, cephalosporins in the form of half dose of normal person was given to the patient in association with metronidazole solution in the 1st 3 days post-operative then continue on oral antibiotics for another 10 days. Injectable anticoagulants was given to the patients in the 1st 15 days post-operative then continue upon antiplatelet drugs as low dose aspirin which began 10 days postoperative and continue till fracture was united. Analgesics in the form of pethidine to the cardiac and patients with chest problems, but patients complain of liver cell failure in the 1st two days post-operative. Acetaminophen at a dose less than 2 gm/day is a reasonably safe option, tramadol 25 mg every 8 hours can be used. The patients were discharged from the hospital 5th to 7th day post operative after controlling the general medical status. The patient came every two weeks to check the apparatus stability and to tighten the nuts and rods and follow up x ray was done to check the fracture position and the union.fig.2, A-D, fig.3, A-C.

Removal of the ilizarov apparatus was done in outpatient clinic, the patients received strong analgesics as pethidine then the external fixator was removed. The site of pin tract covered with sterile dressing and daily cleaning till the tracts were healed.
Fig. 2-A: Preoperative X-ray of intertrochanteric fracture of left femur. B: early post operative X-rays. C: clinical photo of illizarov external fixator application. D: follow up X-rays after fracture union.

Fig. 3-A: Preoperative X-ray of intertrochanteric fracture of femur. B: early post operative X-rays. C: follow up X-rays after fracture union.
Results

Follow up of the patients extended up to 19 months after complete fracture healing, there were no mortalities in early or late postoperative period of follow up.

In half of the patients 50%, it was 90 days for complete fracture healing where in the other half 50% of the patients 120 days needed for complete fracture union.

Harris hip score system was used for evaluation of the patients outcome and satisfaction, the result was excellent in 13 patients 59.1%, while it was good in 4 patients 18.2%, where in 4 patients 18.2% it was fair, while the result was poor in 1 patient 4.5%.

The reported complications were pin tract infection in 100% of the patients and all of superficial type and was improved with oral antibiotics and local cleaning of the pin sites.

Varus deformity in 3 patients 13.6%, between 12-15 degrees deviated from normal neck-shaft angle, Shortening of the affected limb was recorded in 4 patients 18.2%, ranging from 1.2 cm to 1.8cm.

Discussion

Intertrochanteric fractures generally occur as a result of low-energy trauma (such as simple falls) in advanced age, whereas they are caused by high energy trauma in young individuals [5]. Increased longevity, together with osteoporosis and senile muscular insufficiency, may explain the increasing number of patients with intertrochanteric fractures [3]. The main aims of the treatment of intertrochanteric fractures are to mobilize the patient in a short period of time and to ensure union in the appropriate position [1]

Intertrochanteric fractures mostly occur in patients with poor general condition who cannot undergo general anesthesia or who are not fit for an invasive intervention owing to diabetes, atherosclerotic heart disease or chronic obstructive pulmonary disease. Treatment of such patients by long-term immobilization following internal fixation is not possible owing to the risk of decubitus ulcers, pneumonia, urinary tract infections, deep venous thrombosis and cardiopulmonary complications [1,3,4,6,7].

In current study 22 patients of chronic diseases, 12 patients out of 22 had hepatic problems 54.5% (elevated liver enzymes, bleeding tendency, hepatitis B and hepatitis C virus infection, liver cell failure), while 6 patients 27.3% had uncontrolled hypertension and cardiac problems with long period of anticoagulant administration, where 2 patients 9.1% had pulmonary diseases (obstructive lung diseases), while 2 patients 9.1% had diabetes mellitus. (Chart)

Most studies comparing the external fixator devices to sliding hip screws have found no differences with respect to surgical time, duration of hospital stay, infection rate or wound complications, implant failure, screw cut out, or screw sliding. Patients treated with an intramedullary hip screw, however, are at increased risk for femoral shaft fracture at the nail tip and the insertion sites of the distal locking bolts[8,9].

It may be a reasonable alternative for patients who are of advanced age, have a poor general condition and cannot tolerate long operations [4]. With external fixation, the average operative time was 30 minutes including reduction and percutaneous application compared with 72 to 100 minutes for closed reduction and internal fixation procedures [3,6]. External fixation technique gives shorter anesthesia time, minimal surgical trauma, and minimal blood loss.

M. Subasi et al. Managed Thirty-three patients, 19 males and 14 females, with intertrochanteric fracture of the femur by external fixation between 1994 and 1999. Fifteen patients had right and 18 had left intertrochanteric fractures. The mean age of the patients was 65.9 (47 to 90) years. Eight fractures were the result of traffic accidents and 25 of falls. The patients had high surgical and anesthetic risk factors for an open surgical procedure or for extended anesthesia because they had more than one accompanying disease. Seventeen patients had ischemic cardiac disease, 18 pulmonary disease, 10 diabetes mellitus, 14 hypertension, 5 heart failure, and 9 had cerebral dysfunction. The average time of hospitalization was 2.8 days (0 to 21 days). External fixation was used in patients with Evans stable type 1 intertrochanteric fractures and unstable type 1 fractures which could be reduced to anatomical or nearly anatomical position by closed methods under fluoroscopic control[10].
In comparison to our study, there were 17 male patients (77.3%), and 5 females (27.7%), p value 3.05(0.001). The mean age of the patients was 65.5 years, SD 13.42 range (30-81) years, the fracture pattern was stable Evans type 1 in 17 patients 77.3%, while 5 patients 22.7% had unstable Evans type 1 intertrochanteric fracture p value 3.05(0.001).

The average operative time was 45 minutes for reduction of fracture under image intensifier and application of illizarov external fixator.

M Subasi advocated that, the mean follow-up period was 24 months. Mortality in three months following surgery was 15%. The six-month mortality was 39%. There was no mortality in the early postoperative period; Malunion was detected in 3 patients (15%). Shortening greater than 2 cm was noted in these patients at the latest follow-up as a result of varus.[10]

Akm Zahiruddin, et.al in their evaluation of the trochanteric fracture of the femur treated by uniaxial external fixator in risk elderly patients, 14 patients were selected for this study. Out of these one patient died before discharge, one patient died within 3 weeks and also one patient was subsequently lost from follow up. Hence this study comprises 11 patients, all this 11 patients were followed up for 6 months to 12 months.[11]

Christodoulou et al. have compared the results in patients who were treated by external fixation or internal fixation. According to their study, in the external fixation group, operating time was 35 minutes, hospital stay was 6 days, varus deformity was detected in 3 patients. Three of them were corrected by fixator. They have reported operating time as 75 minutes, hospital stay 16 days, varus deformity in three patients in the internal fixation group [3]. The average hospital stay in our cases was 8 days.

In this case series no mortalities in both early and late postoperative follow up period which extended up to 19 months after complete fracture healing, Varus deformity in 3 patients 13.6%, between 12-15 degrees deviated from normal neck-shaft angle, and Shortening of the affected limb was recorded in 4 patients 18.2%, ranging from 1.2 cm to 1.8cm, the patients hospital stay was 5 to 7 days after surgery.

External fixation preserves the fracture hematoma, which is of importance for union.[10]

Possible complications of treatment of intertrochanteric fractures using external fixation are pin-tract infection, varus deformity and shortening. However, the literature review shows that such complications occur with a low rate. The advantage of external fixation in unstable intertrochanteric fractures is that it is possible to correct these deformities, especially in the first postoperative days, without open surgical intervention [3]. The rate of infection varies between 2 and 25% [6, 12, 13], while in this current study it was 100% of superficial pin tract infection and it was completely controlled by administration of oral antibiotics.

**Conclusion**

Illizarov external fixator could be considered to be an alternative treatment modality for high-risk geriatric patients with selected intertrochanteric fracture of femur. This technique is simple, safe and can be performed under regional and even local anesthesia together with narcotic analgesic support when required.

**References**


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