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# Management of Intertrochanteric Fractures with External Fixation

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**Abstract**

Objective:This study aimed to examine the efficacy of external fixators in treating intertrochanteric fractures in terms of union, functional outcome, and comorbidities.Background:Internal fixation of intertrochanteric fractures in older patients with anesthesia or surgical concerns or in patients with an open fracture has a high complication risk; thus, external fixation should be examined as a semiconservative method to reduce operating time and complications.Patients and methods:twentypatients with intertrochanteric fracture with a wide range of ages and different physical conditions were treated by Ilizarov external fixator.Results:All patients were clinically and radiologically examined for at least six months. There were 15 patients with excellent and good [satisfactory] outcomes, 2 patients with acceptable results, and 3 patients with bad [unsatisfactory] results. Radiological union and fixator removal occurred between 8 and 20 weeks, with a mean of 13.4 weeks. Illness of the pin tract developed in all patients, with one patient developing a very severe infection. Four individuals had a varus malalignment, and one patient had a valgus deformity. Two individuals experienced temporary knee stiffness.Conclusion:External fixation of intertrochanteric fractures and open fractures in older, high-risk patients has been proved to be a dependable, successful, and safe therapeutic option. It involves little operating risk, minimal blood loss, a brief hospital stay, early mobility, and a low rate of morbidity and death.

**Keywords**: Intertrochanteric; Fractures; External and Fixation.

## 1. Introduction

Trochanteric fractures are one of the leading causes of morbidity and death in the old and are on the rise with osteoporotic elderly. In the near future, trochanteric fractures are projected to become a major public health problem due to increasing life expectancy and an aging population. [1, 2]

Patients with trochanteric fractures and age-related systemic illnesses are more prone to have complications and death. [3, 4]

Approximately one-third of elderly victims who were formerly independent become completely dependent. Overall, hip fractures reduce expected survival by 12 to 20%, with a 5-to-30% death rate during the first year following the fracture. Hip fractures place a substantial financial strain on current medical treatment. [1]

The major treatment target in these patients is to achieve early and lasting union of the fracture, full function of the damaged limb, and speedy rehabilitation [5, 6]. Anatomic reduction of the fracture, stable fixation, decreased mortality, and early mobilization are the primary aims of surgical treatment [7, 8]. However, achieving and maintaining a secure fixation in elderly patients can be extremely difficult due to osteoporotic bone [9]. Intertrochanteric fractures are usually surgically repaired with the dynamic hip screw [DHS], proximal femoral nail, bipolar hemiarthroplasty, and external fixator [10]. However, the treatment of intertrochanteric fractures is a rapidly expanding global problem, and there is no consensus regarding the best efficient approach of treating hip fractures in the elderly [4].

Due to the poor health of patients and the extremely high surgical and anesthetic risks, open reduction and internal fixation are impossible in a number of situations. For such individuals, traction [Hamilton-Russel traction] is an alternative to conservative treatment. Due to extended recumbence, it has exceptionally high risks of complications [12]. In these situations, closed reduction and external fixation may be considered a semiconservative treatment option. In 1943, Anderson et al. utilized external fixators to heal intertrochanteric fractures for the first time [13].

## 2. Patients and Methods

Twenty patients with intertrochanteric fracture with a wide range of ages and different physical conditions were treated by Ilizarov external fixator. From November2020 to June 2022 by Ilizarov fixator. All patients presenting withradiographic diagnosis of trochanteric fracture were included in this study except those who have dementia, previous hipfracture and fractures secondary to a malignant tumor. The fractures were categorized using Evan's categorization system. The study included 10 patients with

stable fracture patterns [5 were type I and 5 were type II] and 10 patients with unstable fracture patterns [5 were type I and 5 were type II] [1 was type III, 2 were type IV, 5 were type V and two were reversed obliquity type].

**Surgical Technique**

An hour before surgery, broad-spectrum antibiotics were delivered intravenously. All patients received spinal anesthesia. Two cases were placed on a radiolucent traction table but the rest of cases were done without traction table. A closed reduction was attempted to achieve the best anatomic reduction possible. This is ensured by two image intensifier views taken in the antero-posterior view and in the lateral view. The ipsilateral upper limb should be brought across the chest and loosely fixed to the operating table to ensure that this upper limb does not interfere with the movement of the c-arm, especially in the lateral view.After making good closed reduction and evaluation of this reduction by C-arm a 5 mm self-tapping self-drilling Schanz pin was introduced percutaneously Fig.[1A4] into the femoral neck below the base of the greater trochanter across the fracture site at an angle of 125°-130° Fig. [1A1] with the femoral shaft in the anteroposterior view fig. 1A2] and central in the lateral view Fig [1A3]. The tip of the Schanz was stopped 0.5-1cm from the articular surface of the head. The position of pin was then checked in A.P and lateral views by C-arm to ensure its good position in head. A neck Rancho cube was applied on the pin and through the next hole in the cube another pin then applied parallel to the first pin Fig [1B]. Two 5 or 6 mm Schanz screws were inserted perpendicular to the proximal femoral diaphysis through Schanz fixation bolts fixed to the upper arch in different planes through the lateral safe zone of the upper shaft femur by1cm snap incisionswhich were done in a longitudinal direction and reached the iliotibial band to prevent transfixing the latter to the femur and thereby causing ipsilateral knee stiffness. After Schanz fixation bolts has been tightened to the upper arch another Rancho cube [or two connected posts] was connected to the first cube that fixed to the neck schanz pins and rotated in an angle to allow its fixation in the upper arch, then tightened in final position Fig [1C1]. The lower arch then was applied and connected to the upper one by three rods or sockets [ fig.1C2] and two to three Schanz pins were inserted in the same way used in the upper arch Fig [1C3]. If the fracture not stable or the bone is osteoporoticanother hyrdoxy-apitate coated Schanz screw was added in nearly a right angle at the base of the greater trochanter Fig [1C4].

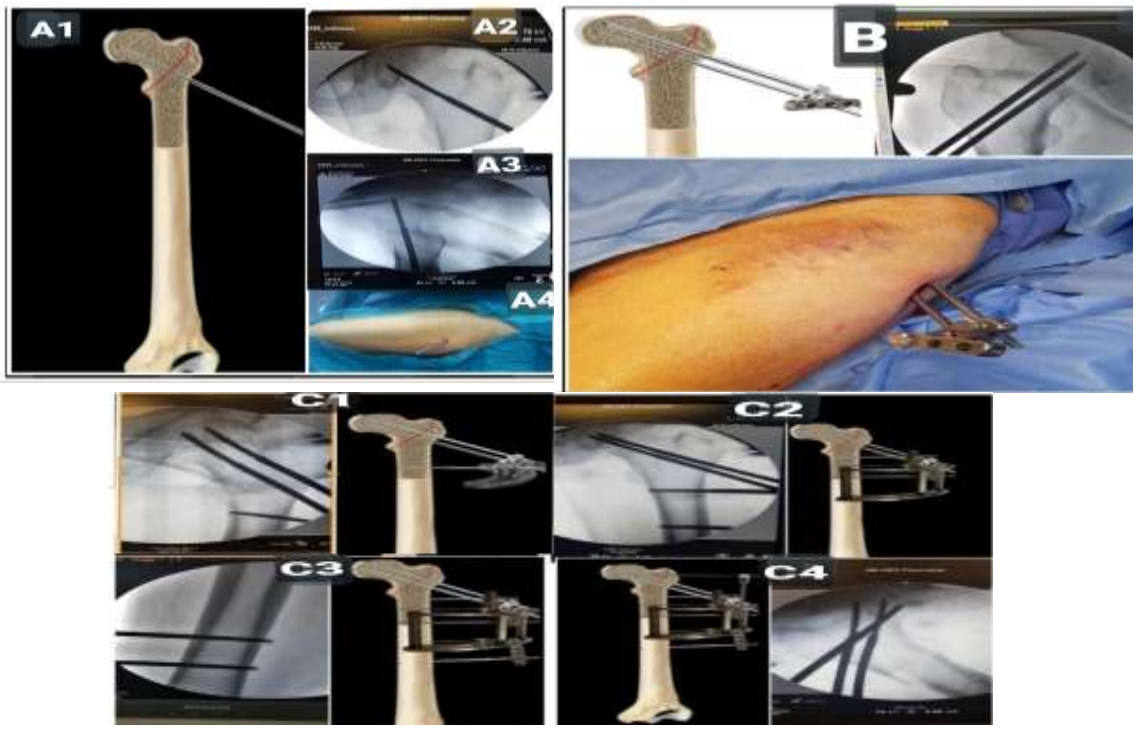


**Fig. (1)** Diagrammatic, intraoperative image and clinical photos showing steps of fixator application.

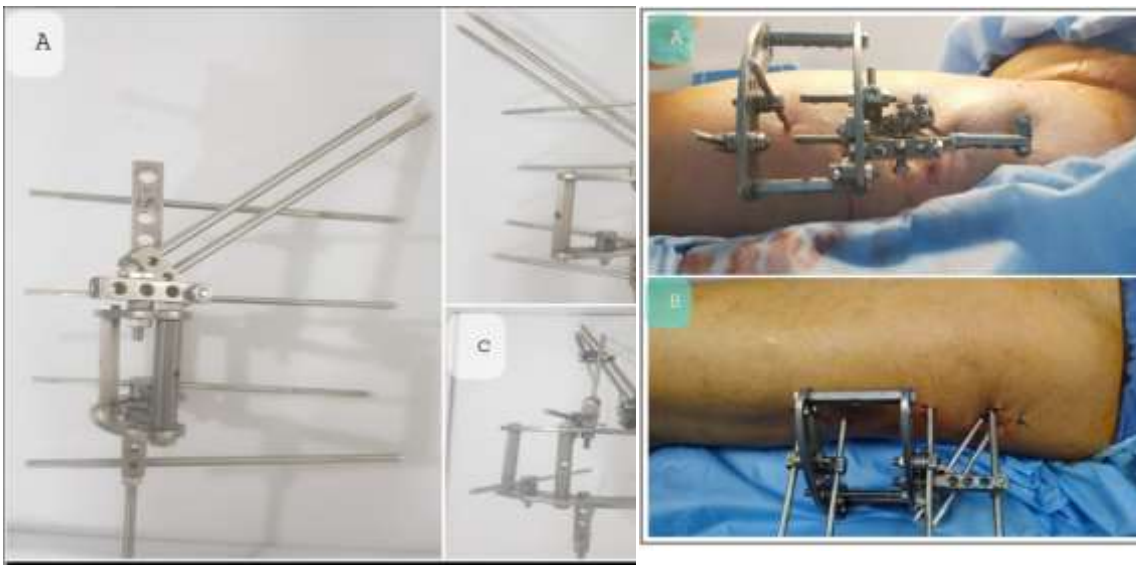


**Fig. (2):** fixator simulation and clinical photos after fixator application.

**Postoperative care**

Antibiotics, analgesics, and anticoagulants were supplied and maintained for three days during the non-weight bearing period. Immediate radiographs were collected. The typical hospital stay following surgery was five days [range 2-10 days]. As part of the treatment for their pin tracks, all patients were directed to apply Betadine solution once per day to their pin tracks. Patients were required to return to the outpatient clinic for clinical and radiological examinations every two weeks for the first month, and then every month thereafter. Stable fractures were instructed to bear weight in the evening of the surgery and to do knee flexion exercises of the affected knee [50 to 100 repetitions throughout the day] during the period the fixator is in place. In unstable fractures Depending on the patient's general health, fracture type, reduction stability, pre-fracture walking capability, and walking pain, partial weight-bearing using a walker [a four-legged frame] is recommended 6 to 16 weeks after surgery. As long as Ilizarov is in place, knee flexion exercises are prescribed. As soon as union was complete, the fixator was removed. The extraction was conducted as an outpatient procedure.

The functional result was evaluated using the Harris grading method for the hip. [26]

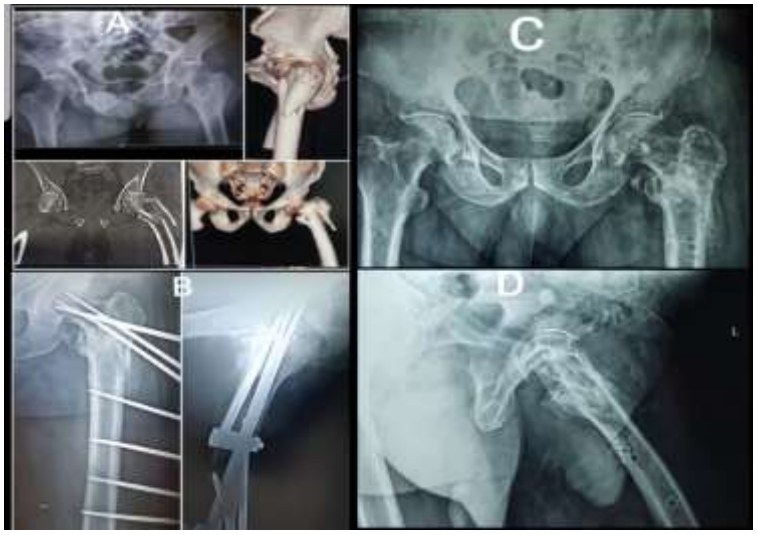


**Fig. (3):** per-operative X ray of unstable trochanteric fracture [A], after fixation by Ilizarov [B] and after complete union and fixator removal [C].

**Statistical Analysis**

The Chi-square test and P-value were used to evaluate the data and determine statistical significance, respectively.

**Table. (1) :**Statistical analysis of data.

| Statics parameters | Age | Operative time/ minutes | Bl.Loss | Time tounion/weeks | HHS |
|---|---|---|---|---|---|
| **N** | 20 | 20 | 20 | 20 | 20 |
| **Mean** | 55.55 | 47.50 | 19.00 | 13.40 | 83.50 |
| **Median** | 63.50 | 45.00 | 15.00 | 13.00 | 85.50 |
| **Std.Deviation** | 21.862 | 11.642 | 10.208 | 3.733 | 11.265 |
| **Minimum** | 21 | 30 | 10 | 8 | 60 |
| **Maximum** | 90 | 70 | 40 | 20 | 97 |
| **Pvalue** | 0.014 | 0.153 | 0.001 | 0.224 | 0.101 |

## 3. Results

All patients underwent clinical and radiological evaluation for at least 6 months. Out of the total patients, 15 patients had excellent and satisfactory results, 2 had fair results, and 3 had poor results. The study included 13 male patients [65%] and 7 female patients [35%]. The left side was affected in 13 patients [65%] while the right side was affected in 7 patients [35%]. The age of the patients ranged from 21 to 90 years, with an average age of 55.5 years. The study found a significant correlation between patient age and time needed for fracture complete union [p-value=0.023], indicating that older patients needed more time for union. The series included 7 cases of ASA I, 4 cases of ASA II, 6 cases of ASA III, and 3 cases of ASA IV according to the ASA Physical status classification system. There was no significant correlation between preoperative physical status and postoperative Harris hip score. The Evan's classification showed that 5 cases were type I trochanteric fractures, 5 cases were type II, 1 case was type III, 2 cases were type IV, 5 cases were type V, and 2 cases were R type [reversed obliquity] fractures.

The mechanism of injury involved was 12 cases [60%] fall from a standing height on the affected side, 5 cases gunshots, one case RTA, one case falling downstairs and one case of electric saw injury.There was significant relation between mechanism of injury and fracture stability. High energy trauma caused the unstable fractures, and the low energy trauma caused the stable fracturesp-value=0.04.The mean operative time was 47.5 minutes, ranging from 30 to 70minutes.The average intraoperative blood loss was 19 ml, with a range of 10 to 40 ml. The mean duration for union was 13.4 weeks, with a range of 8 to

20 weeks. All patients experienced pin tract infection to varying degrees, which was treated with antibiotics and daily dressing. All cases were completely resolved, except for one patient who had deep pin tract infection. Following fixator removal and parenteral antibiotics, the infection was controlled with negligible impact on the final outcome. Among the twenty cases, four cases resulted in a neck shaft angle of more than 5 degrees varus, and only one case had more than 5 degrees valgus. Knee stiffness occurred in only two patients and was improved with physiotherapy.

A retained broken tip of schanz pin occurred in a one patient with insignificant effect on the final result. Two patient complained from neuropathic pain which improved by gabapentin and analgesics.

## 4. Discussion

Previous studies have reported that external fixation leads to a short operating time and hospital stay, high rates of bone healing, a reasonable amount of time for the fixator to be applied, and minimal blood loss during surgery [11, 14, 15, 16, 17, 18, 19, 20, 21].

We utilized the Harris Hip Score to evaluate the functional outcome, and the average score was 83.5 points with a range of 60 to 97. In a study by Adanaş and Özkan, the mean Harris Hip Score was 76.3 for the proximal femoral group and 70.5 for the external fixation group. Moroni et al. reported a six-month Harris Hip Score of 62±19 for the DHS group and 63±17 for the external fixator

group. Catagni M et al. found that the average Harris Hip Score for all patients was above 80 at six months, indicating good results, and above 90 at 24 months, indicating excellent results. In Aly et al.'s study, the average Harris Hip Score for the remaining 35 patients at the latest follow-up was 61, with a range of 45-80. In Karn NK et al.'s study, the mean Harris Hip Score at one year was 90.

Operative time with **Moroni et al**. [11] in DHS group [20 patients] the mean was 64 minutes but in external fixator group[20 patients] the mean was 34 minutes, with **Vossinakis et al.** [14] in DHS group [50 patients] the mean was 38.8 minutes but in external fixator group[50 patients] the mean was 21.2 minute, in **Kazakos K et al**.[25] study was on 56 patients the mean operative time was 45 minutes, with **Aly M et al**.[23] study was on 38 patients and the mean was 25 minutes and with **Catagni M et al**. study was on 23 patients, the mean was 20 minutes [22]. Christodoulou et al. compared the outcomes of patients treated with external fixation against internal fixation. In the external fixator group, the mean operating time was 35 minutes, whereas in the internal fixation group, the mean operative time was 75 minutes [27]

In our study the mean blood loss was 19 ml, so blood transfusion wasn't needed.The mean operative blood loss with **Vossinakis et al**. in DHS group was 568 ml but in external fixator group the mean was 0ml [14]. In **Karn NK et al.** studywas on50 patientsthe mean was 33.33 ml [24].In**Adanaş** and **Özkan** study the mean blood loss in proximal femoral group [38patient] was152ml and blood loss was 25ml in external fixation group [34patient] but blood transfusion wasn't needed in both groups [4].

In our study 6 patients were ambulatory at the time of discharge and the average time to union was 13.4 weeks[94days] ranged from 56 days to 140 days. **Dvgan et al.** [17] reported an average time to union of 106 days. 90 patients [out of 108 surviving] were ambulatory at the time of discharge. This increased to 98 [out of 106 surviving] at 4 month follow up. Aly et al. [23] reported that the mean time to union was 9.5 weeks [range: 8-14 weeks], while Ahrengart et al. reported that 88% of 179 patients who underwent treatment with a dynamic hip screw achieved fracture union at six months [28].

Our complications included mild pin track infection which despite patient education in pin care occurred universally in all cases and which completely resolved after fixator removal. There was only one case of deep infection which completely resolved with parenteral antibiotics and fixator removal. In Adanaş and Özkan study in proximal femoral group only one case of 38patient had superficial infection without any reported cases of deep infection and in external fixation group 9 cases of 34 had superficial infection and one case of deep infection had detected [4]. **Moroni et al.** [11] didn't report any infection in both DHS and external fixator group**,** with **Vossinakis et al.** [14] in DHS group 3 patients had superficial infection, but in external fixator group 15 patients had superficial infection and deep infection is reported in only one case of DHS group, **Karn NK et al.** had observed Grade I pin-track infection in 30 patients [60%], but all resolved on removal of the pins. The infections were successfully treated with oral antibiotics and daily cleaning with antiseptic solutions, which healed by 2 weeks [24]. In **Catagni M et al.** superficial pin tract infection was observed around 10 pins [15%] ,this usually involved the proximal pins. Infections were successfully treated with oral antibiotics and daily cleansing with antiseptic solutions, but no deep infections had detected [22]. In **Aly et al.** studysuperficial skin reaction at pin sites had noted in 30% of patients without any cases of deep infection [23]. **Kazakos et al**. mentioned 22 patients [39.3%] who developed superficial skin reactions around the screw and the pins without any case of deep infection [25].

## 5. Conclusion

The fixation of trochanteric fractures with the Ilizarov is a safe, reliable and easy to learn treatment option especially for the elderly high risk patients and also for the young patient who are coming with high energy trauma and associated with other limb or internal organ injury or have open fractures.

The use of external fixation provides several benefits such as reduced surgical trauma, preservation of fracture hematoma, minimal blood loss, short operative time, minimal anesthesia complications, possibility of local anesthesia application, ability to adjust the frame, short hospital stay, and easy removal of the construct as an outpatient procedure. Our implant is both reusable and easily removable, and it demonstrates comparable results and complication rates to the standard DHS or PFN techniques.

However, our series is too small in patient numbers and too short in follow up period to challenge the internal fixation technique which stood the test of time. Larger series and long term follow up are surely necessary to allow for direct comparisons with the well-established internal fixation techniques.

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