Outcomes of arthroscopic-assisted fixation of intra-articular proximal tibial fractures by circular external fixator

Ahmed Toreih, Mohammed I. Rakha

Orthopaedic Surgery Department, Faculty of Medicine, Suez Canal University, Ismailia, Egypt

Correspondence to Mohammed I. Rakha, Orthopaedic Surgery Department, Faculty of Medicine, Suez Canal University, Ismailia, Egypt
Fax: 0020643135533;
E-mail: MohRakha2005@med.suez.edu.eg

Received: 6 January 2023
Revised: 29 January 2023
Accepted: 15 May 2023
Published: 07 September 2023

The Egyptian Orthopaedic Journal 2023, 58:119–127

Background

Fractures of the tibial plateau usually result from high-energy trauma. Motor vehicle accidents seem to be the predominant cause worldwide. The objective of treating displaced fractures is to restore the articular surface anatomy and repair soft tissue injuries. We aim to improve the functional and radiological results of the arthroscopically assisted fixation of the tibial plateau fractures using Ilizarov fixator.

Methods

The study was carried out on patients attending to Orthopedic Surgery Department at a major metropolitan hospital in Egypt, between March 2019 to September 2020. Forty-five patients with tibial plateau fractures of Schatzker classification type II to type VI were operated on.

Results

The results indicate that the Ilizarov method is a valuable alternative in treating Schatzker II-VI fracture types. The mean time from injury to partial weight bearing (PWB) and full weight bearing (FWB) were 12.75 and 22.73 weeks, respectively. The mean Knee Society Score was 75.42 ± 9.91. Over 70% of self-reported Overall Functional Grades were deemed 'good' (*n*=21, 47.6%) or 'excellent' (*n*=12, 26.7%) at the end of the follow-up period. Pin tract infection was reported in 31(68.9%) cases, and delayed union developed in 7 (15.6%) cases.

Conclusion

Early and definite fixation is achieved with the Ilizarov and arthroscopic technique, allowing intra-articular assessment of the reduction, and management of associated intra-articular soft tissue injuries with immediate PWB. It is believed that this minimally invasive method does not lead to the additional morbidity and the combined advantages of arthroscopy and Ilizarov allows successful fixation and early activity.

Keywords:
arthroscopically, circular external fixator, fractures, tibial plateau

Egypt Orthop J 2023, 58:119–127

1110-1148

Introduction

Tibial plateau fractures usually result from high-energy trauma. Such injuries change knee kinematics, cause joint incongruity, and are often associated with severe soft tissue compromise [1,2]. Hence, while treating these fractures, the surgeon must consider fracture type, soft tissue, and ligamentous injury [1–3]. The objective of treating displaced fractures is to restore the articular surface anatomy and repair soft tissues [4].

The Schatzker classification delineates a tibial plateau fracture into six types, ranging from lateral plateau fracture without depression (type I) to plateau fracture with diaphyseal discontinuity (type VI) [5]. Management of higher-grade fractures must consider the accompanying soft tissue or neurovascular damage. Type 1 fractures can be treated operatively or non-operatively. Higher-grade fractures are treated with operative management [5].

Various surgical modalities for the fixation of tibial plateau fractures include open reduction internal fixation with cannulated screw fixation, condylar plate with or without bone graft, and proximal tibial locking plate [2,6–8]. The Ilizarov circular ring fixator can also be a valuable option for high-energy fractures with gross total intra-articular comminution and severe soft-tissue compromise [9]. External fixation has been associated with fewer complications than internal fixation, possibly due to less extensive soft-tissue dissection [10,11].

Arthroscopic-assisted surgeries have shown promising results and better functional outcomes, possibly due to better visualization of the joint surface. This allows the surgeon to correct the depression, treat injured soft tissues, note ligamentous injuries, or remove any loose fragments inside the joint with less soft tissue compromise compared to open surgical modalities [3].

The study aimed to improve the functional and radiological results of the arthroscopically assisted fixation of the tibial plateau fractures using Ilizarov fixator. Our primary objective was to evaluate the functional and radiological outcomes of arthroscopically assisted fixation of the tibial plateau fractures using Ilizarov fixation. Our secondary goals were to assess the role of arthroscopy in restoring the articular anatomy and congruity, and management of intra-articular associated injuries, determine the radiological outcome of external fixation, and identify intraoperative and postoperative complications of this procedure.

Materials and methods

Study population

This Quasi-Experimental study included 45 adult patients (>18 years old) with tibial plateau fractures of Schatzker classification type II to type VI, operated in Suez Canal University Hospital, Ismailia, Egypt (March 2019–September 2020).

Preoperative clinical assessment

In the emergency department, patients had (1) wound irrigation with saline, sterile dressing, and splinting with above knee slab, (2) antero-posterior (AP) and lateral plain X-rays for the knee and leg to grade fracture according to Schatzker, and CT scans were completed for operative planning, and (3) standard laboratory blood work. Patient received 1 gm of 3rd generation cephalosporin intravenous every 12 h, low molecular weight heparin, analgesic if requested, and anti-edematous medications. The surgeons obtained written informed consent from all patients prior to surgery.

Operative technique

All patients underwent their surgery within the first week from injury under spinal anaesthesia, except one case under general anaesthesia. The Ilizarov frame was preassembled in the operating room. The patient was placed supine on the operating table. A tourniquet was placed on the thigh. The leg was prepared and draped exposing the distal femur and leg.

An anterolateral portal was created for the arthroscope. A conventional antero-medial portal was used for the instruments. Knee irrigation with saline occurred via low pressure pump to prevent extravasation of fluids. After evacuation of the fracture hematoma, a shaver was used to remove the clots and small bone fragments within the joint cavity. Once joint lavage was complete, a comprehensive evaluation was performed to identify the bone and cartilage lesions, as well as any associated injuries of the menisci and ligaments and repair was done as necessary.

Reduction was completed with external reduction by pins or internally by arthroscopic methods. Traction exerted by the capsule and ligaments when the knee was placed in Varus positioning elevated the lateral fragment. Temporary fixation was achieved using one or two K-wires, olive wire or pins. The fixation was maintained under arthroscopic guidance. Fluoroscopy and arthroscopy was used to obtain the best reduction.

Reduction of joint surface was performed following Watson *et al.*[12], followed by the application of the frame. Intra-articular fracture was reduced percutaneously with reduction clamps or Steinman pin as 'joy sticks' and lagged together with or without cannulated screws. The wire was placed just below the joint surface to clear the metaphysis 1 cm below the joint for the tensioned wire pathways. In cases of severe intra-articular depression or failed percutaneous techniques, a limited open reduction (bone window) and elevation of the joint surface was used. Direct medial or lateral para-patellar approaches were used. The medial condyle was reduced by ligamentotaxis. If still depressed, it was elevated with percutaneous elevators or Steinman pins. Subchondral cannulated screws were placed to align the plateau followed by fixation with tensioned wires. The incision was done with sharp dissection and no flaps were elevated.

Distraction of the fracture site was applied to gain ligamentotaxis. A horizontal reference olive wire was placed 1-1.5 cm below the tibial plateau joint surface using the centered lateral view to confirm the position of the wire as parallel to the joint line in AP view. Bolts and nuts were used to assemble the rings and were in the AP plane centered on the tibia. Adequate soft tissue clearance of 2 to 3 cm was observed. The proximal ring was placed on the subchondral wire and tensioned to maintain the reduction. The ankle was grasped, and the second toe aligned with the tibial tubercle to correct rotation. The fracture was distracted manually. The reduction and alignment were checked on fluoroscopy and arthroscopy and a second half pin was placed with a universal Rancho cube on the second ring in the AP plane. The overall alignment was improved.

The posterior angulation was reduced first, allowing the metaphysis to be fixated in an orthogonal position. The tibial shaft was then reduced to the metaphysis. This sequence was used in most reductions. The proximal side of the fracture was aligned orthogonally first, followed by the distal segment of the fracture. The metaphysis was reduced by manual pressure under the gastrocnemius, placing towels between the ring and fracture site, draping a towel under the calf and over the AP rods and pulling up followed by clamping the towel (the towel technique). The mid-ring Rancho cube needed to be loosened to allow the half pin to slide anteriorly through the cube. The shaft fragment was manipulated using either a laminar spreader to axially reduce the shaft on the lateral view or the arch wire technique in which a transverse wire was applied in the proximal part of the distal fragment and attached to the upper ring of the stable base component of the frame.

The fracture was viewed on the AP image and the shaft manipulated medially or laterally. This was done by rotating the Rancho cube for small corrections (5 mm or less), or by using a medial half pin to move the shaft fragment into reduction. Next, additional tensioned wires and half pins was added to the fixator in divergent planes to increase stiffness. The fracture was compressed with the frame to increase stability (Fig. 1).

Postoperative surveillance

In the post-anesthesia recovery room, the patient's vital signs, neurovascular status and abnormal bleeding were assessed. The patient returned to the floor with their foot elevated, dorsiflexed and strapped to the last ring of the frame. All patients received IV antibiotic (3rd generation Cephalosporin) every 12 h for three days, and continued for 2 more weeks on oral antibiotics. All patients received low molecular weight anticoagulant (Clexane 40IU) and shifted to oral anticoagulant for 2 weeks.

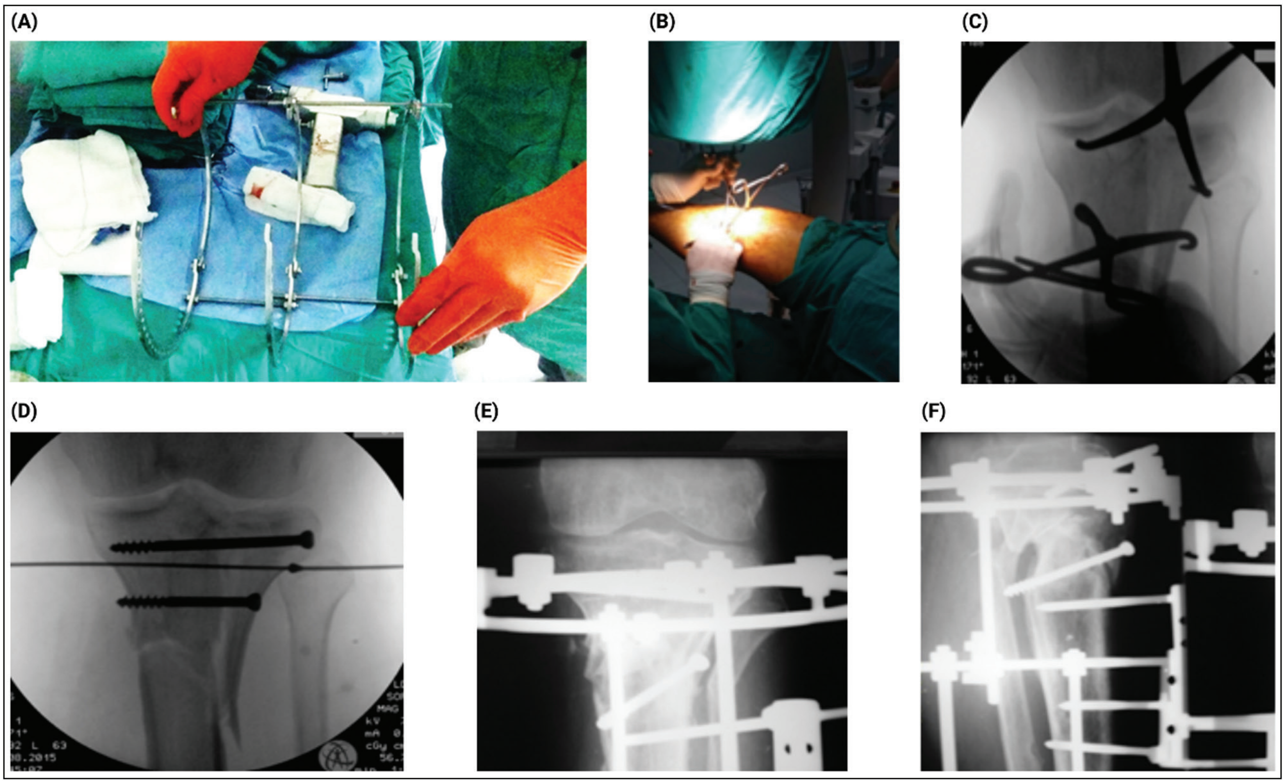
Wounds were dressed postoperative day 2 and pin tract care started immediately via saline and alcohol spray. Mobilization started on the 2nd postoperative day with the patient being non weight-bearing. Active range of motion of the knee, isometric quadriceps exercises, and hip raising exercises were performed. Most of patients was discharged on the 3rd to 5th day post-surgery.

The first postoperative clinical assessment occurred one week after discharge. The limb was reassessed for vascularity, swelling, knee and ankle range of motion, frame stability, and pain. Wound condition and pin-site healing were assessed.

Postoperative long-term follow-up and functional assessment

AP and lateral X-ray were done at 3, 6, and 12 weeks. Any misalignment of the fracture was corrected in

Figure 1



Operative technique for arthroscopically assisted fixation of the tibial plateau fractures by circular external fixator. (A) Preassembled Ilizarov frame. (B) Closed reduction under fluoroscopy. (C) Reduction of large fragments by reduction clamps. (D) Horizontal reference wire adjustment and fixation of large fragments by percutaneous screws and olive wire. (E-F) Callus formation should be seen in at least 3 cortices in AP and lateral views before frame removal. Created by Biorender software.

clinic by adjustment of the threaded rods between the 1st and 2nd rings. Union occurred when healing callus was noticed on 3 cortices around the metaphyseo-dyapheseal part of the fracture in X-rays. Delayed union occurred if there was the failure to reach a stiff periosteal callus after 6 months from fracture. Non union occurred with the failure to show any signs of healing or bridging callus after 9 months of initial injury.

Follow-up was done every week for 1st month for wound care and follow-up, and every two weeks for the 2nd two months until union was achieved, then every month for the 1st year. Patients initiated weight-bearing with toe touch-bearing. This increased gradually after bridging callus was seen in three cortices. When healing was noticed, dynamization between the 1st and 2nd ring was done; if the patient could move without pain the frame was removed under sedation. Physiotherapy was performed as early as possible and continued immediately after removal of Ilizarov. The frame was removed when healing callus was noticed on 3 cortices.

The quality of reduction was assessed using the final intra-operative or initial postoperative radiographs. Serial radiographs were obtained thereafter and evaluated for secondary fracture displacement, loss of fixation, pin-site radiolucency, articular/metaphyseal union, mechanical axis deviation, and development of union, malunion, or non union. Each patient was assessed at the final follow-up period (minimum six months) using the Install Modification of knee society score (KSS) modified by Dr. John Insall [13].

Statistical analysis

Data were analyzed using Statistical Program for Social Science (SPSS) version 27.0. Two-sided Chi-Square, independent Student t, or One-Way ANOVA tests were used for comparison analysis. Pearson's correlation analysis was carried out. Results were considered significant at a P value below 0.05.

Results

Baseline characteristics of the study population

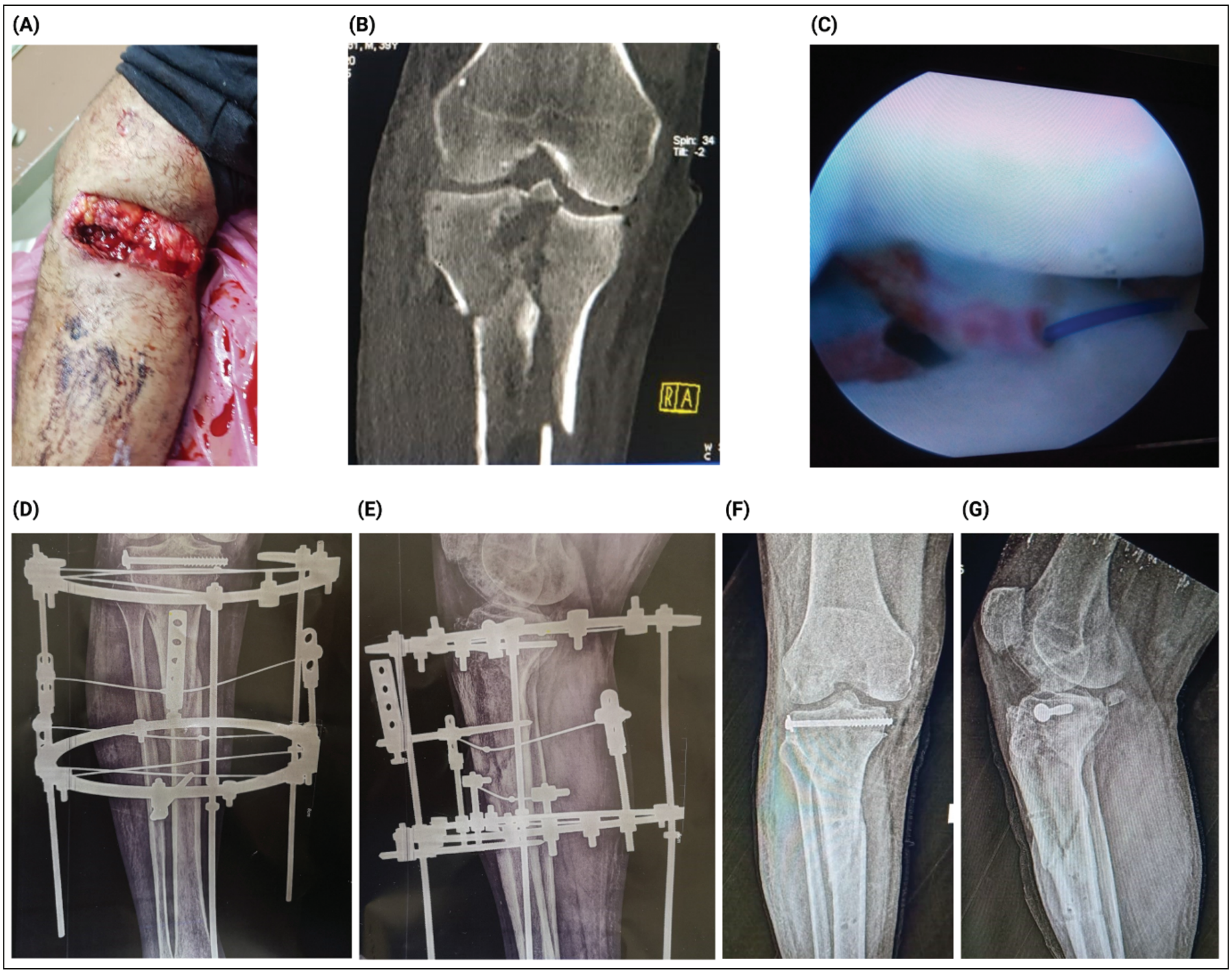
A total of 45 patients were included. Their mean age was 38.60 years±12.18 and 66.7% were males. Nearly half were current smokers, while 31.1% had diabetes and/or hypertension. Almost all patients had road-trauma accident (RTA) (97.8%). The majority of injuries occurred on the right side (64.4%) and were close fractures (66.7%). Soft tissue injuries as bullae and/or compartment syndrome were reported in 62.2%. Meniscal tears were reported in 25 patients, Table 1. An example of a case is demonstrated in (Fig. 2).

Table 1 Baseline characteristics and clinical outcomes of the study population

Characteristic	Value
Demographic data	
Age (years)	
Mean±SD (range)	38.60 ± 12.18 (19–58)
Sex	
Male	30 (66.7%)
Occupation	
Worker	10 (22.2%)
Driver	13 (28.9%)
Employer	8 (17.8%)
Officer	10 (22.2%)
Housewife	4 (8.9%)
Smoking	
Positive	23 (51.1%)
Comorbidities	
None	31 (68.9%)
Diabetes	8 (17.8%)
Hypertension	4 (8.9%)
Diabetes and hypertension	2 (4.4%)
Clinical data	
Mechanism of injury	
Road-trauma accident	44 (97.8%)
Direct trauma	1 (2.2%)
Affected side	
Right	29 (64.4%)
Left	16 (35.6%)
Gustillo classification	
Closed	30 (66.7%)
Open G1	10 (22.2%)
Open G2	5 (11.1%)
Soft tissue injury A/O	
Null	17 (37.8%)
Bullae	22 (48.9%)
Bullae & Compartmental syndrome	6 (13.3%)
Associated Injuries	
Medial meniscus	12 (26.7%)
Lateral meniscus	8 (17.8%)
Both menisci	5 (11.1%)
Outcomes	
Time to union (weeks)	
Mean±SD (range)	25.73 ± 8.89 (12–32)
Time of removal Ilizarov (weeks)	
Mean±SD (range)	19.16 ± 3.18 (12–24)
Complications	
None	14 (31.1%)
Pin tract infection	31 (68.9%)
Delayed Union	7 (15.6%)
Time of PWB (weeks)	
Mean±SD (range)	12.75 ± 4.20 (6–26)
Time of FWB (weeks)	
Mean±SD (range)	22.73 ± 6.90 (12–32)
Knee Society Score	
Mean±SD (range)	75.42 ± 9.91 (51–90)
Overall functional grade	
Poor	3 (6.7%)
Fair	9 (20.0%)
Good	21 (46.7%)
Excellent	12 (26.7%)

Data is presented as number (percentage) or mean±standard deviation (SD) and range (minimum and maximum).
PWB and FWB, Partial and full weight bearing.

Figure 2



An example case. (A) 52-year-old male patient in motor car accident with compound fracture tibial plateau, open Gustillo 3 A. The patient was treated with arthroscopic-assisted fixation of the fracture using Ilizarov fixator. (B) CT scan show fracture tibial plateau Schatzker VI. (C) Arthroscopic repair of medial meniscal injury using outside inside technique. (D-E) Antero-posterior and lateral views after 6 weeks with good union. (F-G) Antero-posterior and lateral views after 24 weeks with good union after removal of the circular external fixator. Full range of motion of the knee joint with good functional grade.

Postoperative outcomes and complications

As depicted in Table 1, the average time of union was 25.7 weeks. The time of removal of Ilizarov was a mean of 19.16 weeks. The mean time from injury to partial weight bearing (PWB) and full weight bearing (FWB) were 12.75 and 22.73 weeks, respectively. The mean KSS was 75.42 ± 9.91. For postoperative complications, pin tract infection was reported in 31 cases, and delayed union developed in 7 cases.

Knee Society score and demographic and clinical features

A significantly higher KSS was observed in patients without comorbidities ($P<0.001$). In contrast, those who developed complications exhibited lower score compared to without (72.58 ± 10.22 versus 81.71 ± 5.44, $P=0.003$), Table 2. The KSS was negatively correlated with patient's age (r=-0.734, $P<0.001$), time to union (r=-0.614, $P<0.001$), time of removal of Ilizarov (r=-0.633, $P<0.001$), time of PWB (r=-0.673, $P<0.001$), and time of FWB (r=-0.614, $P<0.001$). In contrast, there was no significant correlation with Schatzker classification (r=-0.201, $P=0.18$), time before surgery (r=0.11, $P=0.45$), and operative time in minutes (r=-0.25, $P=0.09$), Fig. 3.

Overall functional grade and associated factors

Overall functional grade (OFG) was better in younger age group ($P<0.001$), with absent comorbidities ($P<0.001$), and closed injuries ($P=0.037$). Better OFG was associated with earlier time to union ($P<0.001$), Ilizarov removal ($P<0.001$), and weight-bearing ($P<0.001$). In contrast, patients who developed complications had poor/fair OFG ($P=0.022$), Table 3.

Table 2 Association between Knee Society Score and demographic and clinical features

Characteristic	Mean±SD	Range	*P* value
Demographic data			
Sex			
Male	76.57 ± 9.48	54–90	0.27
Female	73.13 ± 10.69	51–90	
Occupation			
Worker	72.80 ± 12.05	51–90	0.24
Driver	78.69 ± 9.01	65–90	
Employer	74.13 ± 8.03	60–85	
Officer	72.00 ± 9.58	54–85	
Housewife	82.50 ± 8.66	70–90	
Smoking			
Negative	76.23 ± 8.48	54–90	0.60
Positive	74.65 ± 11.25	51–90	
Comorbidities			
None	80.52 ± 6.18	65–90	**<0.001**
Diabetes	62.75 ± 4.74	54–69	
Hypertension	66.00 ± 10.42	51–75	
Diabetes and hypertension	66.00 ± 8.49	60–72	
Clinical data			
Mechanism of injury			
Road-trauma accident	75.20 ± 9.92	51–90	0.33
Direct trauma	85.00 ± 0.00	85–85	
Affected side			
Right	76.86 ± 10.70	51–90	0.19
Left	72.81 ± 7.95	60–85	
Gustillo classification			
Closed	76.93 ± 10.14	51–90	0.08
Open G1	74.50 ± 9.10	60–85	
Open G2	68.20 ± 8.04	59–75	
Soft tissue injury A/O			
Null	72.71 ± 9.18	59–85	0.34
Bullae	77.41 ± 9.38	54–90	
Bullae & Compartmental syndrome	75.83 ± 13.51	51–90	
Operative data			
Anaesthesia			
Spinal	75.20 ± 9.92	51–90	0.33
General	85.00 ± 0.00	85–85	
Outcomes			
Complications			
None	81.71 ± 5.44	75–90	**0.003**
Pin tract infection	72.58 ± 10.22	51–90	

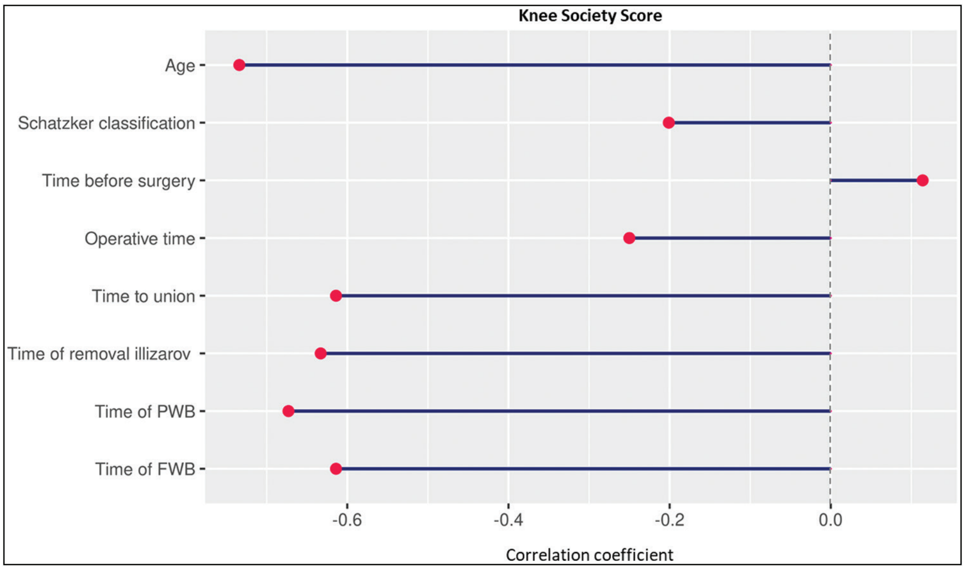
Data is presented as number (percentage) or mean±standard deviation (SD) and range (minimum and maximum). Independent Student t and One-Way ANOVA tests were used.

Discussion

The aim of this study was to improve the functional and radiological results of the arthroscopically assisted fixation of tibial plateau fractures using Ilizarov fixator. The most important finding was that, in both unicondylar (Schatzker II-IV) and bicondylar fractures (Schatzker V-VI), Ilizarov fixation allowed early weight-bearing without jeopardizing fracture stability and healing. Most treatment methods do not allow FWB in intra-articular proximal tibial fractures [7,14]. In the present study, all the patients were allowed unrestricted weight-bearing without the compromised reduction.

Conventional treatment of tibial plateau fractures is difficult [8,15]. *De Coster et al.* [15], demonstrated that traction and after bracing was unsuccessful. *Young and Barrack* [8] emphasized that internal fixation caused additional soft tissue damage and increased infection. In our series, 73% of patients reported good (*n*=21, 47.6%) or excellent (*n*=12, 26.7%) OFGs when undergoing arthroscopic and circular external fixator

Figure 3



Correlation of postoperative knee society score with patient data and outcomes. Pearson's correlation analysis was performed, and correlation coefficient is shown.

(CEF) treatment, possibly due to minimizing soft tissue trauma compared to conventional methods [14].

Additionally, the operating time in the present study compares favorably with that of *Lee et al.* [16] who operated on thirty-six tibial plateau fractures using the less invasive stabilization system (LISS); their mean operation time was 150 min, whereas the mean time in our study was 60.5 min Shorter operative times not only enhances hospital efficiency, but also reduces risk of wound contamination and infection [17].

Furthermore, CEF uses beam loading through the entire span of the fixator, resulting in symmetrical loading of the fracture site [18,19] that uni or biplane fixators lack. *Geller et al.* [20] suggested that CEF had more advantages than alternative fixators in a cadaveric study. Here, they demonstrated that greater reduction and compression of bone fragments are provided by the olive wires specifically seen in CEF [9].

Despite these benefits, our findings indicated that CEF systems resulted in pin-site infection in 68.9% of patients. The wires of the Ilizaroy model can be applied 2 mm below the joint surface, allowing more precise surface arrangement. Contrastingly, in uni or bi-planed external fixators, the wire-joint surface distance is longer [12,21]. Shorter distances between pins may explain the high rates of pin-site infections seen in our study. However, the majority of observed infections were treatable superficial pin-site infections. Using the Ilizarov technique, *Catagni et al.* [22] did not observe any deep infections in a series of 59 patients with Schatzker V-VI fractures. This aligns with our findings, as no deep tissue infections were noted.

In recent years, arthroscopic reduction of the intra-articular structure has become increasingly popular due to better intra-articular visualization of concomitant knee pathology compared to open procedures [23,24]. In this series, CEF applications under arthroscopy were rather successful in the treatment of tibia plateau fractures, and management of intra-acular associated injuries with mean KSS being above 75%. The Ilizarov technique assisted with arthroscopy is a safe and effective method with a relatively low complication rate to treat tibial plateau fractures.

Conclusion

Early and definite fixation is achieved with the Ilizarov and arthroscopic technique, allowing immediate FWB. It is believed that this minimally invasive method does not lead to additional morbidity and the combined advantages of arthroscopy and CEF allows successful fixation and early activity.

Acknowledgements

Nil.

Compliance with Ethical Standards:

The authors declare that they have no relevant financial or non-financial interests to report. This research did not receive any specific funding. This study received ethical approval from the Ethics committee of Suez Canal University Hospital under the protocol number IRB#4056.

Table 3 Univariate analysis for the factors associated with overall functional grade

Characteristic	Poor (*N*=3)	Fair (*N*=9)	Good (*N*=21)	Excellent (*N*=12)	*P* value
Demographic data					
Age, years					
Mean±SD	55.0±2.65	51.33±6.48	35.19±9.79	30.92±9.71	<0.001
Sex					
Male	2 (66.7%)	4 (44.4%)	15 (71.4%)	9 (75.0%)	0.45
Female	1 (33.3%)	5 (55.6%)	6 (28.6%)	3 (25.0%)	
Occupation					
Worker	2 (66.7%)	2 (22.2%)	3 (14.3%)	3 (25.0%)	0.76
Driver	0 (0.0%)	3 (33.3%)	6 (28.6%)	4 (33.3%)	
Employer	0 (0.0%)	2 (22.2%)	5 (23.8%)	1 (8.3%)	
Officer	1 (33.3%)	2 (22.2%)	5 (23.8%)	2 (16.7%)	
Housewife	0 (0.0%)	0 (0.0%)	2 (9.5%)	2 (16.7%)	
Smoking					
Negative	1 (33.3%)	3 (33.3%)	12 (57.1%)	6 (50.0%)	0.62
Positive	2 (66.7%)	6 (66.7%)	9 (42.9%)	6 (50.0%)	
Comorbidities					
None	0 (0.0%)	1 (11.1%)	18 (85.7%)	12 (100.0%)	<0.001
Diabetes	2 (66.7%)	6 (66.7%)	0 (0.0%)	0 (0.0%)	
Hypertension	1 (33.3%)	1 (11.1%)	2 (9.5%)	0 (0.0%)	
Diabetes and hypertension	0 (0.0%)	1 (11.1%)	1 (4.8%)	0 (0.0%)	
Clinical data					
Mechanism of injury					
RTA	3 (100%)	9 (100%)	21 (100%)	11 (91.7%)	0.42
Direct trauma	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	
Affected side					
Right	3 (100%)	5 (55.6%)	11 (52.4%)	10 (83.3%)	0.16
Left	0 (0.0%)	4 (44.4%)	10 (47.6%)	2 (16.7%)	
Open G1	0 (0.0%)	3 (33.3%)	4 (19.0%)	3 (25.0%)	
Open G2	1 (33.3%)	2 (22.2%)	2 (9.5%)	0 (0.0%)	
Soft tissue injury A/O					
Null	1 (33.3%)	6 (66.7%)	6 (28.6%)	4 (33.3%)	0.46
Bullae	1 (33.3%)	3 (33.3%)	12 (57.1%)	6 (50.0%)	
Bullae and Compartmental syndrome	1 (33.3%)	0 (0.0%)	3 (14.3%)	2 (16.7%)	
Operation					
Anaesthesia					
Spinal	3 (100%)	9 (100%)	21 (100%)	11 (91.7%)	0.42
General	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (8.3%)	
Operative time (minutes)					
Mean±SD	67.67±19.3	68.44±20.9	58.24±17.7	56.75±14.2	0.37
Outcomes					
Time to union (weeks)					
Mean±SD	34.33±6.43	28.56±7.54	22.76±3.32	19.67±3.60	<0.001
Time of removal Ilizarov (weeks)					
Mean±SD	23.33±1.15	22.44±1.67	18.86±2.35	16.17±2.17	<0.001
Complications					
Pin tract infection	3 (100%)	9 (100%)	14 (66.7%)	5 (41.7%)	0.022
Time of PWB (weeks)					
Mean±SD	25.67±7.57	18.56±6.15	11.90±2.32	9.67±2.39	<0.001
Time of FWB (weeks)					
Mean±SD	47.33±6.43	33.56±7.54	22.76±3.32	19.67±3.60	**<0.001**

Data is presented as number (percentage) or mean±standard deviation (SD).
Two-sided Chi-Square and One-Way ANOVA tests were used.
PWB and FWB, Partial and full weight bearing; RTA, road trauma accident.

Financial support and sponsorship

Nil.

Conflicts of interest

Authors have no conflict of interest to declare. Coauthor has seen and agree with the content of the manuscript and there was no financial interest to report.

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