DOI: 10.4274/jarem.galenos.2022.35119
J Acad Res Med 2022;12(3):130-6

Results of Our Osteosynthesis Treatment with External Fixator in Risky Patients Aged 70 Years and Older with Intertrochanteric Femur Fracture and ASA III-IV

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Cite this article as: Aybar A, Avkan MC. Results of Our Osteosynthesis Treatment with External Fixator in Risky Patients Aged 70 Years and Older with Intertrochanteric Femur Fracture and ASA III-IV. J Acad Res Med 2022;12(3):130-6

ABSTRACT

Objective: We evaluated our union and functional results of osteosynthesis treatment with external fixator in high-risk patients aged 70 years or older with intertrochanteric femur fracture and American Society of Anesthesiology (ASA) III-IV.

Methods: Fractures were classified according to the Association for Osteosynthesis/Orthopedic Trauma Association (AO/OTA) classification. Preoperative waiting time, time to fracture union, limb length discrepancy, femoral neck-shaft angle, and level of activities of daily living were assessed. The union of the fractures was evaluated according to Foster's radiological evaluation criteria. Functional outcomes were evaluated according to the Barthel index of activities of daily living.

Results: The mean age of 38 patients was 80.35±7.27, 22 (57.9%) were females, 16 (42.1%) were males, and they were followed up for a mean of 15.9±4.1 months. The mean operation time of the patients was found to be 38±6.51 minutes. Thirty-one (81.5%) patients were operated under spinal anesthesia, and 7 (18.5%) patients were under general anesthesia and were discharged 4.3±4.71 days after the operation. Fracture groups according to AO/OTA classification were as follows: A1.1 in 3 (7.89%) patients, A1.2 in 14 (36.85%) patients, A1.3 in 4 (10.53%) patients, A2.1 in 8 (21.05%) patients, A2.2 in 4 (10.53%) patients, and A2.3 in 5 (13.15%) patients. The union of fractures were evaluated according to Foster's radiological scoring, and the mean time to union was found to be 123±11 days. A mean of 1.29±0.99 cm shortness was detected. The mean varus grade was 12.7°± 7.14°. According to Foster's scoring, successful results at the rate of 78.94% were obtained. Barthel index score was found to be 51.31±24.82 in the postoperative 6th month and 54.07±25.54 in the first postoperative year.

Conclusion: Osteosynthesis method with external fixator for intertrochanteric femur fractures of patients with ASA III-IV who were aged 70 years or over and had a high risk of surgery and anesthesia due to medical problems, might be preferred as an alternative treatment method since it was a closed surgery, it could be performed simply and quickly, and it reduced complications related to soft tissue injuries.

Keywords: Intertrochanteric fracture, external fixator, proximal femur, advanced age, ASA III-IV, osteosynthesis

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Received Date/Geliş Tarihi: 23.11.2021 **Accepted Date/Kabul Tarihi:** 17.11.2022

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INTRODUCTION

Intertrochanteric femur fractures, which constitute 8-10% of all adult fractures, are serious injuries with high morbidity and mortality and an increasing incidence in osteoporotic patients. The complication rate of nonoperative treatment is high. Decubitus ulcers, urinary system infections, joint contractures, pneumonia, varus deformity and shortness, and mortality as a result of thromboembolism can be seen in elderly patients (1).

The aim of surgery is anatomical reduction of the fracture, stable fixation and early rehabilitation. Although the technical equipment is very advanced today, many patients with intertrochanteric fractures are considered risky in terms of anesthesia due to cardiological, pulmonary and hematological disorders in the elderly patient population (2). Osteosynthesis with external fixators can be a good alternative treatment as it is a minimally invasive method and can be performed in a short time.

In our study, we retrospectively evaluated the quality of life of the patients with intertrochanteric femur fracture and their fracture union status who had an American Society of Anesthesiologists (ASA) score of III-IV, were at risk in terms of anesthesia and surgery, and were over 70 years old.

METHODS

This retrospective cohort study was approved by the Taksim Training and Research Hospital Clinical Research Ethics Committee (decision no: 128, date: 04.09.2019) and informed consent was obtained from the patients.

Among 43 patients who were diagnosed as having intertrochanteric fracture of the femur, aged 70 years or over, had an ASA score of III-IV, and underwent osteosynthesis with external fixator, 38 patients with adequate follow-up were included in the study. The Association for Osteosynthesis (AO)/Orthopedic Trauma Association classification was used for the classification of fractures. Union of the fractures was evaluated according to Foster's radiological scoring. Thirty-eight patients were followed up for a mean of 15.9±4.1 months. The preoperative waiting time after the patients were admitted to the hospital, operation time, type of anesthesia, and mean time to discharge after the operation were examined. The Barthel index of activities of daily living (ADL) was used to measure ADL before the fracture, 6 months postoperatively, and 1 year postoperatively.

Pelvis and hip radiographs and complete blood count of the patients were performed in the controls. Varus deformity was investigated in anteroposterior pelvis radiographs in the control, and the distances between the medial malleolus and the spina iliaca anterior superior were measured clinically, and the length differences of the extremities were recorded. Removal of all external fixators was performed under local anesthesia. One day after the operation, the knee movements of the patients were controlled, and quadriceps exercises were started. On the second day, the patients were mobilized, and they started walking exercises with partial load.

Surgical technique: Closed reduction was performed under spinal or general anesthesia on a traction table, accompanied by fluoroscopy. The reduction was performed by bringing the lower extremity to 20 degrees of adduction and 10-15 degrees of internal rotation after traction. Then, under fluoroscopy control, a 2 mm Kirschner wire was sent to the head in accordance with the collodiaphyseal angle and the anteversion angle. Following the guide wire, at least 2, at most 4 transaxle nails were sent to the femoral head with a low-speed motor through a small incision. In order not to create cracks in the femoral cortex, the schanz screws that would be sent to the shaft were sent after they were drilled with a 3.2 mm drill. The second cortex was passed with the T handle in a controlled manner. All the schanz screws were fixed to the carbon AO type tubular external fixator with clamps (Figures 1, 2).

A first-generation cephalosporin was given to all patients prophylactically at a dose of 1 g parenterally 30-45 minutes (min) before the operation. Low molecular weight heparin (LMWH) was routinely started after the patients were admitted to the ward. There was no patient with additional pathology that prevented our application of LMWH. No blood transfusion was given to the patients during the operation. However, patients with low preoperative hemoglobin (Hgb) levels were provided with a preoperative Hgb value of >10 g/dL.

Statistical Analysis

The conformity of the variables to the normal distribution was examined by using histogram graphics and the Kolmogorov-Smirnov test. Mean, standard deviation and interquartile range values were used while presenting descriptive analyzes. Changes in Barthel index values were examined with Repeated Measures and Paired Samples t-test. The limit of significance was accepted as $p<0.05$. Analyzes were performed using the software program SPSS (IBM SPSS Statistics for Macintosh, Version 28.0, Armonk, NY: IBM Corp, USA).

RESULTS

Of the 43 patients included in the study, 4 (9.3%) died within 1 month, and 1 (2.3%) within 3 months. The mean age of the remaining 38 patients was 80.35±7.27. Twenty-two (57.9%) patients were female and 16 (42.1%) were male.

Six of the male patients (15.79%) had right-sided and 10 (26.31%) had left-sided intertrochanteric femur fractures. Fourteen (36.85%) of the female patients had right-sided, and 8 (21.05%) had left-sided intertrochanteric femur fractures. The characteristics of the patients are summarized in Tables 1a and 1b, and complications are summarized in Table 2.

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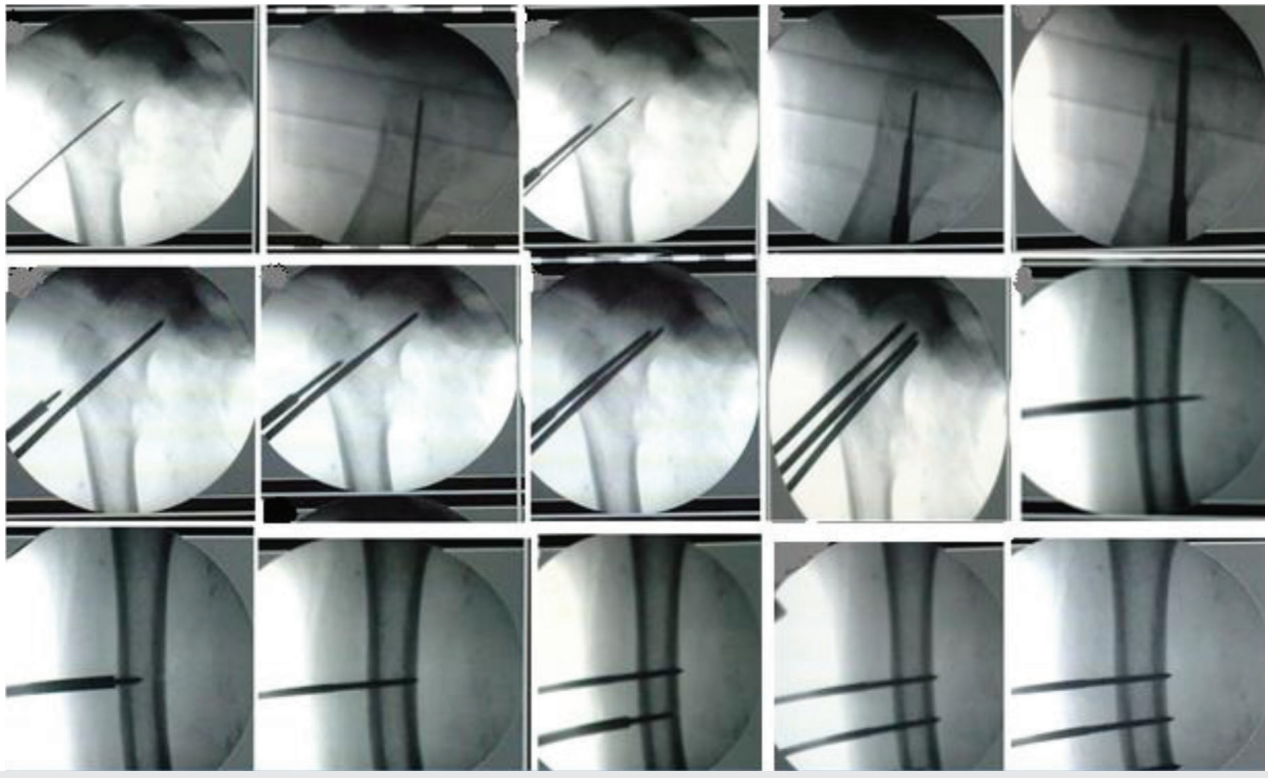

Figure 1. Surgical technique-scopy images

Figure 2. X-rays of our patient's in the preoperative period, postoperative period, control and after external fixator removal

The patients were followed for an average of 15.9±4.1 months. The patients were operated on an average of 6.8±4.16 days after admission to the hospital, and the mean hospital stay was 11.1±6.3 days. The mean operation time was 38±6.51 min. Thirty-one (81.5%) patients were operated under spinal anesthesia and 7 (18.5%) patients under general anesthesia. The patients were discharged after an average of 4.3 to 4.71 days after surgery. Transfusion was not needed due to intraoperative and postoperative blood loss.

According to Foster's radiological evaluation scoring, 8 patients were evaluated as Grade 1 (21.06%), 12 patients Grade 2 (31.57%), 6 patients Grade 3 (15.80%), and 12 patients Grade 4 (31.57%) (Table 3). Mean union time was 123±11 days, and shortness was detected at an average of 1.29±0.99 cm. The mean varus degree was measured as 12.7°±7.14°. According to Foster's radiological evaluation scoring, successful results were obtained at a rate of 78.94%. The Barthel index scores were found to be 58.68±28.53 preoperatively, 51.31±24.82 in the postoperative 6 months, and 54.07±25.54 in the 1st postoperative year (Table 4). As a result of the pairwise comparison, there was a significant decrease in the 6th month and 1st year values of Barthel index score compared to the pre-fracture value ($p<0.001$). There was a significant increase in Barthel index score in the 1st year compared to 6th month ($p=0.002$) (Table 5, Figure 3).

DISCUSSION

Of intertrochanteric femur fractures 90% occur in patients over 65 years of age, and the mortality rate in these fractures is 7-27% in the first 3 months after surgery (3) and around 20% in the first year (4). It has been associated with significant preoperative medical

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problems and postoperative complications (5). The time between admission to hospital and surgery is a factor affecting mortality in patients with intertrochanteric femoral fractures. It is known that elderly patients are at risk in terms of anesthesia due to significant preoperative medical problems. However, the prolongation of the preoperative preparation period for them to reach the optimum anesthetic state required for surgery paves the way for additional pathologies that increase mortality (6,7). In general, the consensus in the literature is that the comorbidities of patients with hip fracture should be evaluated rapidly within 12-24 hours before surgery and the operation should be performed within 2 days. When the literature was reviewed, the time to surgery was found as 7.7 days by Aksoy et al. (7) and as 5.76 days by Ozdemir et al. (8). The time from the date of admission to the operation in our patients was 6.8±4.16 days.

Table 1a. Patient characteristics

			n (%)
Gender	Female		22 (57.89)
	Male		16 (42.11)
Side	Right	Female	14 (36.8)
		Male	6 (15.8)
	Left	Female	8 (21.0)
		Male	10 (26.4)
ASA	ASA-III		23 (60.5)
	ASA-IV		15 (39.5)
Form of anesthesia	Spinal anesthesia		31 (81.5)
	General anesthesia		7 (18.5)
AO/OTA classification	A1.1		3 (7.89)
	A1.2		14 (36.85)
	A1.3		4 (10.53)
	A2.1		8 (21.05)
	A2.2		4 (10.53)
	A2.3		5 (13.15)

Table 1b. Patient characteristics

	$\bar{X} \pm s$
Age (years)	80.35±7.27
Length of hospital stay (days)	11.1± 6.3
Operation time (minutes)	38± 6.51
Follow-up time (months)	15.9±4.1
Waiting time before surgery (days)	6.8±4.16
Shortness (cm)	1.29±0.99
Varus degree	12.7±7.14
Healing time (days)	123±11
Barthel index score before fracture	58.68±24.57
Barthel index score-6th month	51.2±24.82
Barthel index score-1st year	54.08±24.1
Hemoglobin level-hospitalization (g/dL)	9.52±1.72
Hemoglobin level-1st month (g/dL)	10.09±1.33
Hemoglobin level-6th month (g/dL)	10.26±1.75
Hemoglobin level-1st year (g/dL)	11.24±1.07

Table 2. Complications in our patients

Complications	n (%)
Superficial pin site infection (DAHL 2)	7 (54)
Deep pin site infection (DAHL 4)	2 (15)
Deep vein thrombosis	1 (8)
Schanz screw migration	3 (23)
Total	13 (100)

Table 3. Clinical evaluation of the patients

Clinical evaluation of the patients		n (%)
Foster's radiological scoring	Grade 1	8 (21.06)
	Grade 2	12 (31.57)
	Grade 3	6 (15.80)
	Grade 4	12 (31.57)

Table 4. Barthel index score

Barthel index score	Before fracture	6th month after surgery	1st year after surgery
Mean ± SD	58.68±24.57	51.32±24.82	54.08±24.21
Median (IQR)	62.5 (45-75)	55 (30-65)	55 (40-70)

IQR: interquartile range, SD: standard deviation

Table 5. Comparison of Barthel index scores

Barthel index score	p-value
Before fracture-6th month-1st year	<0.001[1]
Before fracture-6th month	<0.001[2]
Before fracture-1st year	<0.001[2]
6th month-1st year	0.002[2]

[1]Repeated Measures, [2]Paired Samples t-test

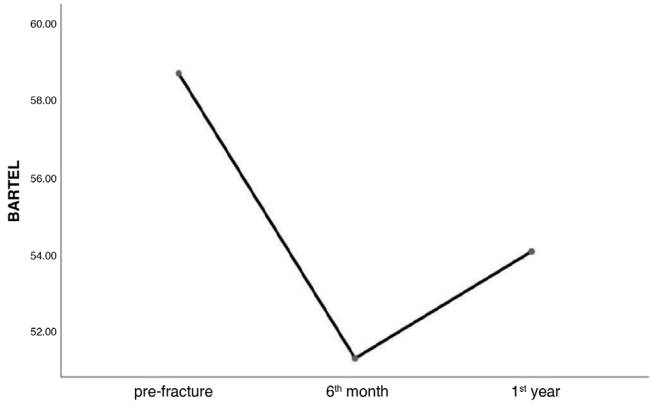

Figure 3. Change in the Barthel index score

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Figure 4. Clinical photographs of our patient

The operation time in external fixator surgeries is less than in other intertrochanteric fracture surgeries such as dynamic hip screw (DHS) and proximal femoral nail. In the study by Vossinakis and Badras (9), it was 21.2 min in the external fixator group, and it was 38.8 min in the DHS group, and in the study of Moroni et al. (10) it was 64±6 min in the DHS and it was 34±5 min in the external fixator group. Our average time of surgery with external fixator was 38±6.51 min.

The mean hospital stay times was found to be 8±4 days in the study by Aksoy et al. (7), 10.3±4 days in the study by Ozdemir et al. (8), 7±5 days in the study by Ozkaya et al. (11), 6±3 days in the study by Kazakos et al. (12), and it was found 7.3±1.1 days in the DHS group and 6.8±1.4 days in the external fixator group by Moroni et al. (13). In our study, we found the mean hospital stay of the patients to be 11.1±6.3 days. Patients were discharged on average 4.3±4.71 days after surgery.

An advantage of external fixators is that they can be removed without the need for a second operation. Performing a second surgical treatment in patients whose general condition is poor due to comorbidities carries a high risk in terms of anesthesia complications. The external fixators of all our patients were removed with local anesthesia. With closed surgery, periosteum and fracture hematoma are preserved, so union and healing are facilitated (14,15).

In our study, open reduction was not required in any of our patients. Approximately 1200 cc of bleeding can occur after hip fractures. This may cause dehydration and hemoconcentration in elderly patients. Vossinakis and Badras (16) emphasized in their study on patients treated with an external fixator that blood loss during surgery was negligible. Our patients did not need transfusion due to blood loss during or after the surgery.

Another problem in patients with external fixation may be stiffness of the knee joint and limitation of movement. It may be caused by the fixation of the vastus lateralis muscle and facia lata with the schanz screws, and this problem can be eliminated by placing the distal schanz screws as close to the proximal part of the femur as possible (16,17). In our study, we detected knee joint stiffness in one of our patients (Figure 4). We determined that the patient was hemiparetic and did not exercise. We did not encounter knee contracture in other patients in whom we started early mobilization.

Pin site infection is a common complication in external fixators and has been reported with a rate of 7-44% (16,18). However, these infections are superficial and rarely cause osteomyelitis. This rate increases in osteoporotic bones. Green (18) stated that two main factors led to pin site infection. One of them was nail base soft tissue necrosis and the other was excessive movement of nails and nail base soft tissues. Vossinakis and Badras (16) determined that mechanical and thermal damage predisposed to infection. He recommends paying attention to the soft tissues while applying the schanz screws, using a low-speed motor or hand perforator to avoid bone thermal necrosis, and supporting the circumference of the schanz screws with dressing materials to reduce skin movements. Moroni et al. (13) reported that there was no pin site infection with hydroxyapatite (HA) coated external fixator pins. Pizà et al. (19) was reported that there was no difference in terms of infection between HA coated and non-HA-coated pins, but HA coated pins adhered better to the bone and had less pin loosening.

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Seven (16%) of our patients had 2nd degree pin site infection and 2 (4.6%) had deep pin site infection. In these patients, infection was treated with antibiotics, and there was no need for washing or debridement.

External fixators can cause psychological problems due to their rough structure. Patients have to modify their clothes and lifestyle. Yildiz et al. (20) stated in their study that this situation mostly occured in the use of circular external fixator. In our patient population, the most common complaint was the limitation of lying position. Over time, we found that they easily adapted to this situation.

Thromboembolic diseases are one of the most common and dangerous complications after skeletal trauma. Fatal pulmonary embolism occurs in 7-10% of patients who develop deep venous thrombosis (DVT) (21). In our general practice, we start LMWH immediately after patients are admitted to the hospital. LMWH administration is usually discontinued 24 hours before surgery, and we continue to administer it 12 hours after surgery. We start early mobilization after the surgery and use elastic stockings. We continue to administer LMWH for 15 days after the patients are discharged. No clinically evident deep vein thrombosis was detected in our study.

Michel et al. (22) stated that ASA scoring could be used as a marker of mortality in the long term. Hamlet et al. (23) determined the three-year mortality rate as 23% in patients with ASA I and II, and 39% in patients with ASA III and IV, and stated that ASA classification was a good indicator of mortality. Richmond et al. (24) evaluated the mortality of hip fractures with ASA scoring in a series of 836 patients (patient group aged 64-84 years and patient group aged over 85 years). As a result, they found that mortality in hip fractures was not associated with ASA scoring in patients aged 85 years or over, but there was a relationship with ASA in the group aged 64-84 years. Especially in the younger patient group (64-84 years), they found a strong correlation between ASA III-IV and 2-year mortality (as ASA score increased, mortality increased). It is obvious that generalization cannot be made between ASA scoring and mortality in a very small series, but ASA scoring can provide a preliminary view on the mortality of patients with hip fracture, their postoperative state and returning to pre-fracture state.

The Barthel index was found to be 58.68±28.53 preoperatively, 51.31±24.82 in the postoperative 6th month, and 54.07±25.54 in the postoperative 1st year (Table 4). Compared to preoperative value, a decrease of 12.54% was detected in the Barthel index score in the postoperative 6th month and a decrease of 7.86% in the postoperative 1st year. As a result of the paired comparison, there was a significant decrease in the postoperative 6th month and 1st year values of the Barthel index compared to the preoperative value ($p<0.001$). There was a significant increase in the Barthel index score in the postoperative 1st year compared to the postoperative 6th month ($p=0.002$) (Table 5, Figure 3).

The fractures healed in 123±11 days in our study. 12.7°±7.14° varus and 1.29±0.99 shortness was detected. (Table 1b). Ozkaya et al. (11) found the mean time to union to be 4.1 months in all patients, the mean femoral neck-diaphyseal angle measured in the early postoperative period as 133°, and 132° at the final controls. Ozdemir et al. (8) found the mean time to union to be 12.3 weeks. They found varus (3°, 5°, 9°) in 3 patients (12%) and mean shortness of 1.33 cm in 3 patients (12%). Tomak et al. (25) removed the external fixator in an average of 12 weeks. They found varus in 2 (4.7%) patients and less than 2 cm shortness in 10 (23.8%) patients. They did not find implant loss, fracture, knee and hip joint stiffness.

Dhal et al. (17) achieved union in an average of 16 weeks in closed intertrochanteric femur fractures and in 28 weeks in open fractures in a series of 154 patients. They found a shortness of less than 2 cm in 74 (48%) of the patients and more than 2 cm in 9 (5.84%) patients. They reported that these shortnesses were caused by osteosynthesis in the varus during the first surgery or due to full weight bearing. Vossinakis and Badras (16) achieved union in an average of 11 weeks. They did not detect migration of the screw into the acetabulum by piercing the femoral head or screw slipping or screw breaking. They found an average of 1.8 cm shortness in 12 patients (27.27%).

Study Limitations

The limitations of our study were the absence of a control group, the relatively short follow-up period, and non-homogeneity of the additional pathologies of the patients (atrial fibrillation, diabetes mellitus, Alzheimer's disease, hypertension, chronic ischemic heart disease, chronic renal failure, myocardial infarction, chronic obstructive pulmonary disease, cerebrovascular disease, tuberculosis, Parkinson's disease). As the strong sides of our study, the patients were treated by the same surgical team and a single type of osteosynthesis technique was applied to all patients.

CONCLUSION

In patients with intertrochanteric femoral fractures who have additional medical problems and who are at high risk for surgery and anesthesia due to these problems; external fixator is an alternative treatment in the surgical treatment of intertrochanteric femur fractures because the operation time is very short, blood loss is less, the fracture hematoma is not evacuated due to close operation, the fracture heals in a short time, the postoperative hospital stay is short, patients regain mobility early, pressure ulcers and pulmonary complications are less, the rate of fixator-related complications is low, and removal of the fixator after union or re-arrangement of the fixator in case of mechanical failure does not require anesthesia.

Ethics Committee Approval: This retrospective cohort study was approved by the Taksim Training and Research Hospital Clinical Research Ethics Committee (decision no: 128, date: 04.09.2019).

Informed Consent: Informed consent was obtained from the patients.

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Peer-review: Externally and internally peer-reviewed.

Author Contributions: Surgical and Medical Practices - A.A., M.C.A.; Concept - A.A., M.C.A.; Design - M.C.A.; Data Collection and/or Processing - A.A.; Analysis and/or Interpretation - A.A., M.C.A.; Literature Search - A.A.; Writing - A.A.

Conflict of Interest: The authors have no conflict of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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