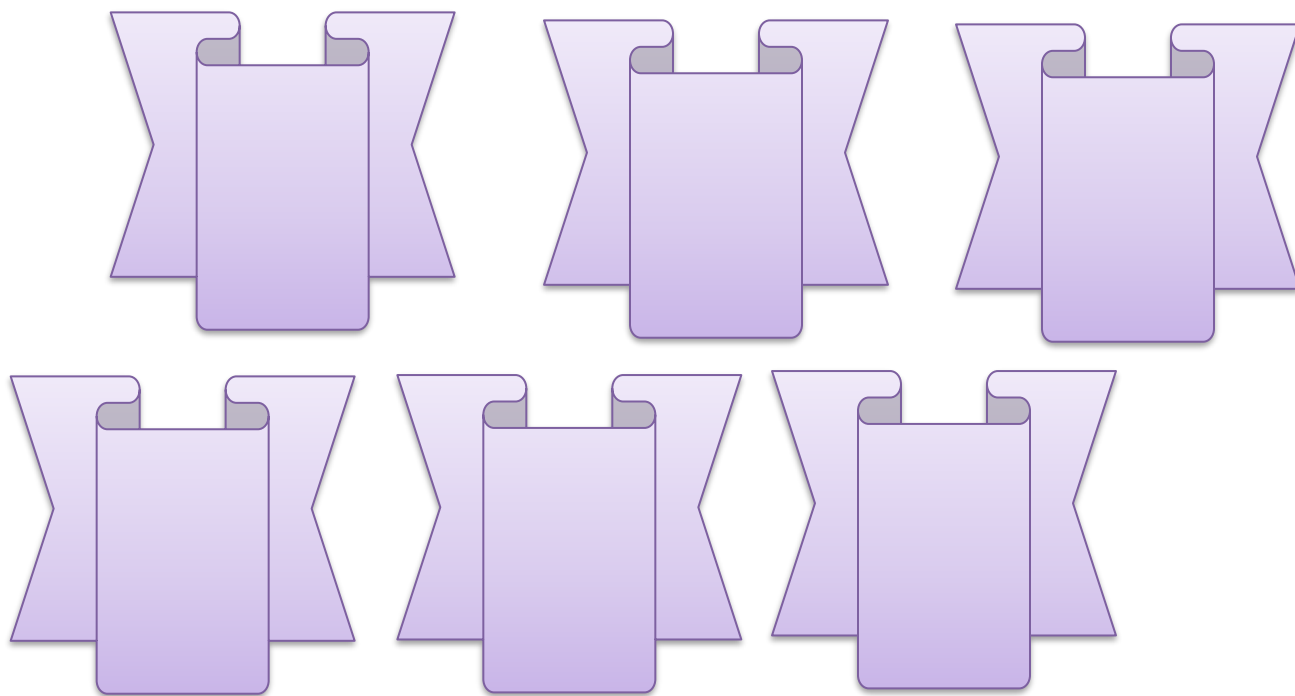


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Original Article

Treatment of Medial Femoral Condyle Fracture in Adult with Lag Screws

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ABSTRACT

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Background: Numerous sites can experience femur fractures. If the fractures are ignored, they might not heal properly, which would be bad for the patient. A medial condyle fracture is an example of these fractures. A fracture of the medial condyle of the femur [AO classification 33-B2] is uncommon.

Aim of the work: The objective of this study is to evaluate the clinical and radiological outcomes of surgically treating a medial femoral condyle fractured using lag screws.

Patients and Methods: Ten patients with medial femoral condyle fracture took part in the current investigation, which was planned as an interventional study. Under spinal anesthesia, all patients underwent open reduction and internal fixation [ORIF]. After surgery, clinical and radiological follow-up for at least six months was done.

Results: The most frequent type of injury was falling during walking [6 patients]. Half of the patients had excellent results (5 patients). Two patients had good outcomes while three patients had fair results. Excellent outcome was significantly associated with lack of associated injuries [0.033] and male gender [P 0.036]. Complications occurred in five patients. The occurrence of complications was significantly associated with left-sided injuries and lack of associated injuries [0.038 for each].

Conclusion: This study suggested that the lag screws may provide a good management method in treating medial femoral condyle fractures. This provides an adequate stability and earlier restoring of knee function.

Keywords: Medial condylar fracture; Lag screws; Fixation; Hoffa fracture.



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INTRODUCTION

There are various places where a femur fracture might occur. If the fractures are not treated, they might not heal properly and cause problems for the patient. A medial condyle fracture is one example of these fractures [1].

Because the center of weight is medial to the knee, it bears more burden, making it greater than the lateral [outside] condyle. The linea aspera, a ridge with medial and lateral lips that extends down the posterior shaft of the femur, develops into the medial and lateral supracondylar ridges, respectively, on the posterior surface of the condyle [2]. This mechanism aids in preventing damage to the knee and femur from traumatic injuries, such as those sustained in pedestrian accidents. A solitary medial condyle femur fracture is uncommon when a person breaks their knee or femur. This makes these fractures more probable to be overlooked [3].

As with any specific damage, anatomical regeneration of the joint's outermost layer is first necessary, subsequently followed by the need for lag screws, buttress plates, and screw fixation in cases of vertical fracture lines. However, no anatomical plates are compatible with the femoral medial condyle [4, 5]. This study's goal was to determine whether surgically repairing a medial femoral condyle fracture using leg screws affected patients.

PATIENTS AND METHODS

An Interventional observational study comprised 10 patients of both genders and age range from 18 to 70 years who were referred to the ER and Orthopedic Surgery Departments of Al-Azhar University Hospital in Damietta and Port Said General Hospitals, with medial femoral condyle fracture in the duration between January 2021 and January 2022 and treated with lag screws. Patients were treated by open reduction and internal fixation [ORIF] using cannulated lag screw. The follow up was radiological and clinical.

Inclusion criteria: Patients aged between 18 and 70 years with medial femoral condyle fracture and with closed fractures.

Exclusion criteria: Unstable cases, patients with previous medial femoral condyle surgery in the same side, infection, osteoporosis and pathological fractures.

Sample size: sample size was calculated using G-power program with α . Error = 0.05 and power 80% and it was equal to 10 patients.

This number of cases was adopted by using Medcalc 19 program. By setting alpha error of 0.05, 95% confidence level and 80% power sample. The sample size for this study was calculated from knee range of motion at 6 months follow up postoperative [0-100 degrees]. Equations were described in Machin *et al.* [6].

Methodology

Preoperative assessment: Personal data [name, age, sex, and occupation], affected side, main complaint [knee pain, deformity, weakness, and inability to use the leg] and onset, course and duration of symptoms. Examination of the soft tissue included looking for the integrity of the skin, swelling, abrasions, skin bullae, contusions, ecchymosis, and any open wounds that need to be attended to depending on their size and extent. Neuro-vascular evaluation evaluated ankle motions, dorsalis pedis pulsation, and feeling in the foot and ankle.

Standard blood tests [complete blood count, blood sugar, prothrombin time, kidney function tests and liver function tests] were analyzed

CT scan [Sagittal, axial, coronal, and 3D CT scans] were sought for the afflicted knee and femur. In the CT scan, we assessed the intra-articular extension of the fracture, the degree of intra-articular depression and plan for reduction of the fracture according to the axial view of the articular surface. Doppler was requested in cases we suspected vascular injury.

Emergency room management: The patient underwent immediate primary care in the ER following assessment and resuscitation. After drainage with saline solution, the lacerated skin was treated. The limb was quickly splinted with a well-padded slab above the knee. All patients admitted with an elevated limb also got low molecular weight heparin as prophylaxis against deep venous thrombosis [DVT]. Strong pain killer for pain and antibiotic for open fractures and control of chronic medical diseases were completed.

All patients underwent the surgical procedure as soon as possible according to general and local condition. Time of operation was from 3 to 15 days after injury. They operated

upon spinal anesthesia and their position was supine position knee flexed 30 degrees.

For all distal femoral fractures, preoperative antibiotics in accordance with regional antibiotic policies and specific patient needs are necessary. First-generation cephalosporins are often given 10 minutes prior to surgery and for up to one day following it.

Operative technique: Under direct vision, clamps are used, followed by provisional fixation and lag screw fixing. Strong axial loading forces and varus/valgus stress in the knee joint have an opportunity to displace fragments, prompting the use of a buttress plate. Additionally, lag screws can be utilized independently or inserted through the plate. The screws are placed at various locations along the femur's mid shaft axis.

For medial femoral condyle fractures, the medial parapatellar technique is used. Creating a medial parapatellar incision that crosses vertically and somewhat obliquely from the tibial tubercle to five centimeters over the superior pole of the patella. The joint capsule is opened by cutting the medial patellar retinaculum. To increase the exposure of the distal femur, the incision might be moved farther proximally. To maximize the exposure of the knee joint, the incision might be extended farther distally towards the tibial tubercle. Absorbable sutures to the iliotibial band closure were added. The skin and subcutaneous tissues were closed regularly. Intraarticular hematoma was removed to provide an appropriate reduction, then thoroughly saline solution the joint.

To reduce the fragment, a dental pick or periosteal elevator was used along with a pusher with a ball-spiked tip, then we used a pair of big, pointed reduction forceps to hold the final reduction. K-wire is temporarily inserted after reduction. The buttress plate on the distal femur's medial side was placed. A typical cortical screw just proximal to the fracture line in neutral mode, was inserted, followed by the placement of lag screws, to firmly push the plate to the femur.

Follow-up: Two to three weeks after surgery, the wound's healing was evaluated. Following that, follow-ups at 6 and 12 months are performed. The surgeon evaluated the fracture's healing with the use of periodic x-rays.

Statistical Methods: In order to conduct the statistical analysis, SPSS [version 21, Chicago,

IL, USA] was used. Quantitative parametric data [normally distributed] was given as mean and standard deviation, whereas quantitative non-parametric data [abnormally distributed] was presented as median [minimum, maximum]. Qualitative data was presented as number and percentage. Mann-Whitney test was used for comparing two continuous variables, while Kruskal Wallis test was used for comparing three groups. For numerical variables, Chi square or Fisher's exact tests were applied. P value < 0.05 was set as significant.

Ethical consideration: An informed consent obtained from each patient, after full explanation of the study protocol. The data only be used for study, despite the patient's right to withdraw [Confidentiality was ensured]. The Al-Azhar Faculty of Medicine [New Damietta] local research and ethics committee approved the study protocol.

RESULTS

The patients' average age was 49.6 ± 12.21 years with range of age between 30 to 65 years. Males formed 60% of the patients while females formed 40%. About one half of the patients had chronic illness including hypertension [3 patients], DM [2 patients], ischemic heart disease, bronchial asthma and chronic kidney disease. About 70% of the patients had their right side affected [table 1].

Three patients had associated injuries [distal radial fracture, pneumothorax, and Fracture L1 vertebrae. Half of the patients developed complications, where two patients had wound infection, one patient had implant failure, one patient had knee stiffness and non-union. Moreover, half of the patients had significant intraoperative blood loss [table 2].

Half of the patients had excellent results (5 patients). Two patients had good outcomes while three patients had fair results. Males were found to have significantly more excellent outcomes compared to females [$p=0.036$]. Only 20% of the patients with excellent outcomes had comorbidities and all of them were affected on the right side [table 3].

Patients with excellent outcomes were significantly associated with no associated injuries [$p=0.033$] or complications [$p=0.007$]. Only 20% of the patients with excellent outcomes had intraoperative blood loss [table 4].

Sixty percent of the patients with complications were females and 80% of the patients had associated comorbidities. Complications were found to occur significantly with patients who had their left side injured compared to the right [p=0.038] [table 5].

Sixty percent of the patients with complications had associated injuries [p=0.038]. Moreover, about 80% of the patients with complications had associated intraoperative blood loss [table 6].

Table [1]: Baseline characteristics of patients

Variables		n= 10
Age [years]	Mean ± SD	49.6 ± 12.21
	Median [range]	52.5 [30 – 65]
Gender, n [%]	Males	6 [60]
	Females	4 [40]
Comorbidities	Absent	5 [50]
	Hypertension	3 [30]
	Diabetes mellitus	2 [20]
	Ischemic heart disease	1 [10]
	Bronchial asthma	1 [10]
	Chronic kidney disease	1 [10]
Side	Right	7 [70]
	Left	3 [30]

Table [2]: Clinical characteristics of the studied patients

Variables		n= 10
Complication	Absent	5 [50%]
	Present	5 [50%]
	Failure of implant	1 [10%]
	Wound infection	2 [20%]
	Knee stiffness	1 [10%]
	Non union	1 [10%]
Intraoperative blood loss	Absent	5 [50%]
	Present	5 [50%]

Table [3]: Association between baseline characteristics of patients and outcomes

Variables		Outcome			p- value
		Fair [n= 3]	Good [n=2]	Excellent [n=5]	
Age [years]	Mean ± SD	57.6 ± 3.7	42.5 ± 3.5	47.6 ± 15.6	0.364 ^a
	Median [range]	56 [55 – 62]	42.5 [40 – 45]	50 [30 – 65]	
Gender, n [%]	Males	0 [0]	2 [100]	4 [80]	0.036^{*b}
	Females	3 [100]	0 [0]	1 [20]	
Comorbidities	Absent	0 [0]	1 [50]	4 [80]	0.091 ^b
	Present	3 [100]	1 [50]	1 [20]	
Side	Right	1 [33.3]	1 [50]	5 [100]	0.108 ^b
	Left	2 [66.7]	1 [50]	0 [0]	

^a Kruskal Wallis test; ^b Chi square test.

Table [4]: Association between clinical characteristics of patients and outcomes

Variables		Outcome			P-value
		Fair [n= 3]	Good [n=2]	Excellent [n=5]	
Mode of trauma	Direct trauma	0 [0]	0 [0]	1 [20]	0.190
	Falling from height	0 [0]	1 [50]	0 [0]	
	Falling during walking	3 [100]	0 [0]	3 [60]	
	RTA	0 [0]	1 [50]	1 [20]	
Associated injury	Absent	2 [66.7]	0 [0]	5 [100]	0.033*
	Present	1 [33.3]	2 [100]	0 [0]	
Complication	Absent	0 [0]	0 [0]	5 [100]	0.007*
	Present	3 [100]	2 [100]	0 [0]	
Intraoperative blood loss	Absent	0 [0]	1 [50]	4 [80]	0.091
	Present	3 [100]	1 [50]	1 [20]	

*: significant

Table [5]: Association between baseline characteristics of patients and complications

Variables		Complications		p-value
		Absent [n= 5]	Present [n=5]	
Age [years]	Mean ± SD	47.6 ± 15.6	51.6 ± 8.9	0.841 ^a
	Median [range]	50 [30 – 65]	55 [40 – 62]	
Gender	Males	4 [80]	2 [40]	0.524 ^b
	Females	1 [20]	3 [60]	
Comorbidities	Absent	4 [80]	1 [20]	0.058 ^b
	Present	1 [20]	4 [80]	
Side	Right	5 [100]	2 [40]	0.038*b
	Left	0 [0]	3 [60]	

^a Mann-Whitney test; ^b Fisher’s Exact test.

Table [6]: Association between clinical characteristics of patients and complications

Variables		Complications		p-value
		Absent [n= 5]	Present [n=5]	
Mode of trauma				
	Direct trauma	1 [20]	0 [0]	1.000
	Falling from height	0 [0]	1 [20]	
	Falling during walking	3 [60]	3 [60]	
	RTA	1 [20]	1 [20]	
Associated injury, n [%]				
	Absent	5 [100]	2 [40]	0.038*
	Present	0 [0]	3 [60]	
Intraoperative blood loss				
	Absent	4 [80]	1 [20]	0.058
	Present	1 [10]	4 [80]	

A 60 years old male patient presented to the emergency room in Al-Azhar University Hospital in Damietta, complaining of severe knee pain and swelling after direct trauma to the knee. The patient has a previous history of hypertension. X-ray was done and found to have medial femoral condyle fracture. CT was done. The patient prepared for operation and was operated in the second day of admission. The operation was ORIF by cannulated screws and buttress plate. The patient started partial weight bearing after 45 days and full weight bearing after 3 months with no stiffness and full range of motion.



Figure [1]: AP view of knee with fracture medial femoral condyle



Figure [2]: Lateral View of knee joint with fracture medial femoral condyle



Figure [3]: CT. image of fracture medial femoral condyle



Figure [4]: 3D CT. Image of fracture femoral condyle



Figure [5]: Intra-operative image of the operation



Figure [6]: Post-operative [45 days] x ray image



Figure [7]: Patient standing with walking aid

DISCUSSION

The current study reported higher percentage of males than females [60% vs. 40%], which agrees with **Trikha et al.** [7], where medial femoral condyle fracture was common among males [7 patients 63.6%] than females [4 patients 36.4%].

These results summarized that the most frequent type of injury was falling during walking [6 patients]. Two patients were injured during Road Traffic Accident [RTA]. Only one patient was injured due to a direct trauma and the other due to falling from height. Similar results obtained from **Gao et al.** [8]; Hoffa fractures are usually caused by motor vehicular accidents. This goes in line with **Dhillon et al.** [9], as they reported that mechanism of injury of medial femoral fracture was road traffic accidents where

the patients were rider or passenger on a motor bicycle in 4 out of 6 cases. Also, **Trikha et al.** [7] reported the mechanism of injury among 32 patients with medial femoral condyle fracture, as road traffic accident [81.25%] was the most common mode of injury followed by fall from height [18.75%]. **Lewis et al.** [10] concluded that direct impaction leading to axial loading force to the femoral condyle with the knee in 90 or more of flexion possibly with an element of abduction results in typical Hoffas fracture.

This study found that three patients had associated injuries as distal radial fracture, pneumothorax, and fracture L1 vertebrae. Similarly, **Dhillon et al.** [9] reported two cases out of six had associated injuries as lateral condyle femur fracture and supra condylar intercondylar fracture femur. Also, **Viskontas et al.** [11] found that patients with medial unicondylar medial

Hoffa fracture had associated injuries. One fracture [1/5] was open and had an associated medial traumatic skin wound. One knee [1/5] had concomitant lateral and posterolateral ligament injuries.

This study demonstrated that there were postoperative complications where two patients had wound infection, one patient had implant failure, and one patient had knee stiffness and un-union. Similar to our results, **Gavaskar et al.** [12] treated 18 isolated Hoffa fractures with internal fixation by screws. The complications include stiffness and pain in one patient, collateral laxity in two patients and progression of arthritis in one patient.

In disagreement with this study, **Gao et al.** [8] reported that there was no infection, un-union, secondary displacement, or bone resorption. This may be explained by the different methodology and study design. Another study by **Pires et al.** [13] aimed to present a novel classification system and a rationale for treatment of medial femoral condyle fractures. They described no complications such as infection, fixation failure, or medial femoral condyle osteonecrosis.

Also, **Viskontas et al.** [11] reported no post-operative complications among five patients with unicondylar medial femoral condyle fracture after treatment with reduction and internal fixation.

In the current study, 90% of the participants had bone union after treatment and only 10% had non-union. This non-union may be due to the relatively small size and the lack of soft tissue attachment. Also, worse blood supply bone union may participate in this non-union. Similar to our results, **Gao et al.** [8] who found that the bone union occurred among 10 patients [77%] were seen at 3 months, bone union of 2 patients [15%] were seen at 5 months, and 1 patient [8%] got bone union at 6 months. At the end of 24-month follow-up, all the fractures were united after treatment with plate and screw.

In accordance with these results, **Holmes et al.** [14] reported that series of five Hoffa fractures treated at a Level 1 trauma center by one surgeon employing a protocol of open reduction and internal fixation with lag screws and one patient reported non-union.

This study concluded that the outcomes of surgical treatment of medial femoral condyle

fracture with lag screws. Half of the patients had excellent results [5 patients]. Two patients had good outcomes while three patients had fair results. In a case study by **Kodama et al.** [5] about an 80-year-old woman with medial femoral fracture after falling from height and treated with plate and lag screw. This case showed improvement in the function of the knee with range of motion of 0° to 120° without any pain.

The same results were obtained by **Gavaskar et al.** [12], the treatment of Hoffa fracture with screw gives good results as functional outcome measures showed a continuous significant improvement in function over the 1-year follow up period. Upon using lag screw in treatment of Hoffa fracture in a study by **Zhao et al.** [15], 10 patients out of 17 got excellent results, 4 out of 17 good results, 3 out of 17 fair results.

This study had limitations as the lack of controls to compare the clinical and functional outcomes. Also, the limited number of patients was due to that the medial femoral condyle fracture is rare type of fracture.

Conclusion: This study suggests that the lag screws may provide a good management method in treating medial femoral condyle fractures. This provides an adequate stability and earlier restoring of knee function.

Conflict of Interest and Financial Disclosure: None.

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