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ORIGINAL ARTICLE

Efficacy of Lateral Locked Plate in Treatment of Simple Bicondylar Tibial Plateau Fractures.

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ABSTRACT

Background: Epiphyseal and metaphyseal tibial plateau fractures establish about 1 % of all type fractures and about 8 % of fractures occurring in elderly patients. Correction of bicondylar plateau fractures by surgical management include stabilization with an external ring fixator and internal fixation with lateral and medial plates surgical approaches.

Methods: A prospective clinical trial, simple bicondylartibial plateau fractures were functionally and radiologically evaluated in fourteen patients and treated in Orthopedic Department, Faculty of Medicine, Zagazig University and Ahmed Maher Teaching Hospital. The cases were managed by open reduction and fixation by unilateral locked plate. All patients are followed up clinically and by x-ray immediately, 1, 2, 3 and 6 months postoperatively.

Results: In this study Rasmussen anatomical score was 13.14±1.35 at first month, 13.71±1.32 at 3rd month and 14.3±1.4. Rasmussen anatomical functional was 22.92±3.07 at first month, 26.0±3.63 at 3rd month and 26.7±2.3 at 6th month with significant increase. 28.6% of the studied group was complicated; the highest one was infection (2 cases); compartment syndrome, fixation failure and hardware irritation (1 case for each).

Conclusion: Bicondylar tibial plateua fractures arise from severe trauma, axial loading, varus and valgus applied forces causing articular depression and malalignment which lead to the high risk of post-traumatic osteoarthritis. Single lateral locked plate can be an effective implant in providing fracture stabilization of bicondylar tibial plateau fractures. Using lateral locked plate is better in treatment of simple bicondylar tibial plateau fractures.

Key words: Bicondylar tibial plateau fractures, Lateral locked plate

INTRODUCTION

Epiphyseal and metaphyseal bony parts included as proximal part of tibia are called the tibial level of bone. Incidence of plateau tibial fractures of tibia constitutes about 1 % of all bone fractures and about 8% of all fractures occurring in eldery patients [1].

Type of injury to the tibia differs according to the cause, the intensity of the fracture and the oldness of the patients. It also depends on the average of the condyle structure of the tibia [2].

There are some difficulties when treating bicondylar fractures. The thin skin and delicate tissue make it susceptible to large number of complications when using open reduction and fixation. In addition, the poor bone quality and occurrence of comminuted fractures lead to problems in achieving unbended obsession, as the trabecular and the osteoporotic bone are not ideal to permit weight bearing or to use the joint efficiently [3].

There are two methods in treatment of fractures at bicondylar level that include external ring fixator and internal fixation with the use of lateral and medial plates. Orthopedics have to deal cautiously with these fractures with good care of delicate skin, which allows good joint healing with reestablishing of the good rotation and fill movement freely. Some studies demonstrated the use of circuitous decrease of cracks without danger of harming delicate tissues and without complications in the site of the break. One of these

ideas is the Minimal Invasive Plate Osteosynthesis (MIPO) which gained very good results [4].

The complications of treatment of fractures at tibial level can be briefed as early complications (loss of movement, infection, vein apoplexy) and late complications (nonunion, malunion, knee firmness, joint inflammation).The early consequences are of organic nature while the late ones are connected to the mechanical issue and are equipment related. Joint inflammation and sepsis may occur, despite being uncommon these days [5].

METHODS

In this prospective clinical trial, simple bicondylar tibial plateau fractures were functionally and radiologicaly evaluated in fourteen patients and treated in Orthopedic Department, Faculty of Medicine, Zagazig University and Ahmed Maher Teaching Hospital. Patient selection, preoperative preparation, intraoperative technique, postoperative management, results, and complications were also assessed. The cases were managed by open reduction and fixation by unilateral locked plate.

All male and female patients who were aged 18-60 years having traumatic fractures who had simple bicondylartibial plateau fracture with or without metaphyseal extension; were included in our study. Patients were classified according to Schatzker classification; which divides tibial plateau fractures into six types: lateral tibial plateau fracture without depression (I), lateral tibial plateau fracture with depression (II), compression fracture of the lateral (IIIA) or central (IIIB) tibial plateau, medial tibial plateau fracture (IV), bicondylar tibial plateau fracture (V), and tibial plateau fracture with diaphyseal discontinuity (VI). The first three types (I, II, and III) are typically the result of low-energy injury. The second three types (IV, V, and VI) are typically the result of high-energy injury. However, relatively low-energy trauma to osteoporotic bones may produce fracture patterns similar to those of high-velocity injuries.

Exclusion criteria included all patients who were less than 18 years and more than 60 years, those who have comminuted fractures or pathological fractures, all patients with massive edema till subside; patients with contraindications for surgery, patients with active infections and lack of patient compliance.

Surgical technique: Spinal anesthesia was used in (12) patients and general anesthesia in (2) patients. We used iliac bone graft in (2) patients, as after reduction of the fracture intra operative we found depression and gap; so we used bone graft.

The surgical technique involved supine positioning of the patient under general or spinal anesthesia. Cases with simple bicondylar tibial plateau fractures were operated under traction, good tourniquet high in the thigh; the entire limb and the ipsilateral iliac crest are prepped and draped into the surgical field under complete aseptic technique. A third generation cephalosporin was given intravenously (vial of 1 gm) as a pre-operative antibiotic prophylaxis with the induction of anesthesia in all cases. Patients were subjected to fixation of simple bicondylar tibial plateau fracture by lateral locked plate.

After proper draping, a short oblique antero-lateral incision was made just proximal to the origin of tibialis anterior muscle distally and up to Gerdy's tubercle just distal to the joint then the fascia is released. Exposure of the lateral surface of the proximal tibia is performed with a periosteal elevator. The knee joint was exposed in 3 patients via a minimal dissection and submeniscal athrotomy. As the meniscus is incarcerated in the fracture, it was extracted in 1 patient and stitched in 2 patients.

Reduction of articular portion of lateral plateau was then done by the same manner after elevation of depressed articular surface. There was a large intercondylar imenence fragment, that was reduced and fixed. Iliac bone graft was used in 2 cases for filling defects.

Finally, we confirmed the fixation under fluoroscopic image guidance in both AP and lateral views. The limb was then re-examined for alignment before wound closure. A suction drain was used in all patients. Closure of the subcutaneous and skin layers was finally done. Postoperative plain x ray films (AP and lateral views) were done for documentation and assessment of progress of bone healing later on.

Follow up: all patients were followed up clinically and with x-ray immediately, 1, 2, 3 and 6 months postoperatively as a routine part of monitoring. Clinical and radiographic results were assessed and outcome measures are applied at final follow-up.

Ethical consideration: Institutional Review Board (IRB) of the Faculty of Medicine, Zagazig University approved the study protocol (No.4381). An informed consent was obtained from all participants of this study and they were told about the aim of the study, and were informed that the data would be used for scientific purposes only. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

STATISTICAL ANALYSIS

Data were imported into Statistical Package for the Social Sciences (SPSS version 20.0). The qualitative data were represented as number and

percentage, quantitative continues group were represented as mean ± SD to test differences for significance. Differences between quantitative paired groups were done using paired t-test and association of qualitative variable by Chi square test (X^2). P value were at <0.05 for significant results and <0.001 for high significant result.

RESULTS

Our results revealed Rasmussen anatomical score was 13.14±1.35 in first month, 13.71±1.32 in 3rd month and 14.3±1.4 in 6th month **(Table 1).** Rasmussen anatomical functional was 22.92±3.07 in first month, 26.0±3.63 in 3rd month and 26.7±2.3 with significant increase in 6th month **(Table 2).** About 28.6% of the studied group were complicated as the follow: infection was 2 cases and Compartment syndrome was one case, fixation failure was one case, hardware irritation was one case **(Table 3).**

A case of 39 year old male was admitted to orthopedic surgery department, Zagazig University hospitals with fracture after motor vehicle accident. The patient was introduced with severe pain, limitation of movement and deformity of the left knee, mild effusion, tenderness over the bony land marks **(Figure 1).** The fracture was type V and diagnosed according to Schatzker classification. Preoperative x-ray and C.T were done. Intra-operative temporary fixation occurred by using k-wires as shown in **Figure 1**. The follow up was assessed at 1st, 3rd and 6th month post operative. In the last visit, the examination revealed that knee R.O.M. was 0°- 135°. Plain X rays were done. No particular depression nor condylar widening were found. MPTA was 85°, PPTA was 10° and condylar widening was 2mm. Rasmussen knee score was assessed and anatomical score was 18 points; which was considered excellent. Functional score was 29, which was considered excellent **(Figure 2**

Table (1): Rasmussen anatomical score distribution in 1st and 3rd months

	Rasmussen anatomical 1month	Rasmussen anatomical 3month	Rasmussen anatomical 6 month
Mean± SD	**13.14±1.35**	**13.71±1.32**	**14.3±1.4**
Median (Range)	**13.5 (10-15)**	**14.0 (10-15)**	**15.1 (12-17)**

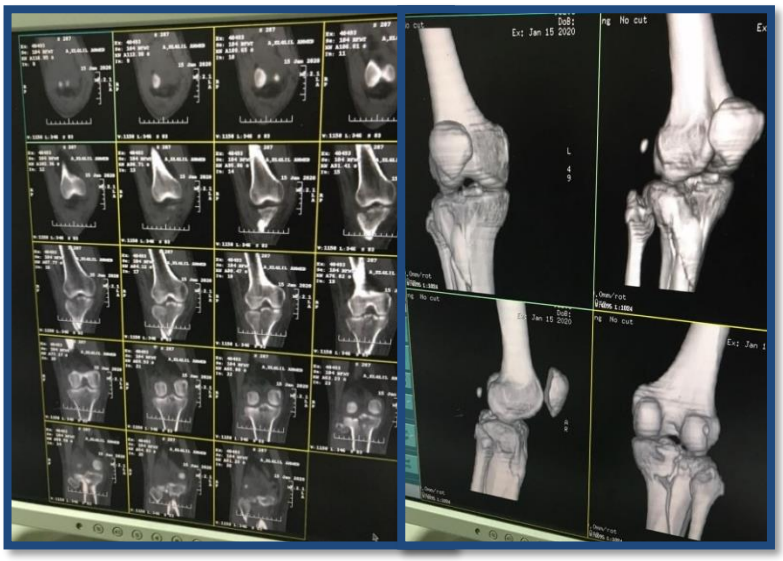
Table (2): Rasmussen functional score distribution in 1st and 3rd months

	Rasmussen functional 1 month	Rasmussen functional 3 month	Rasmussen functional 6 month
Mean± SD	22.92±3.07	26.0±3.63	26.7±2.3
Median (Range)	24.0 (14-26)	27.0 (15-29)	27.9 (17-30)

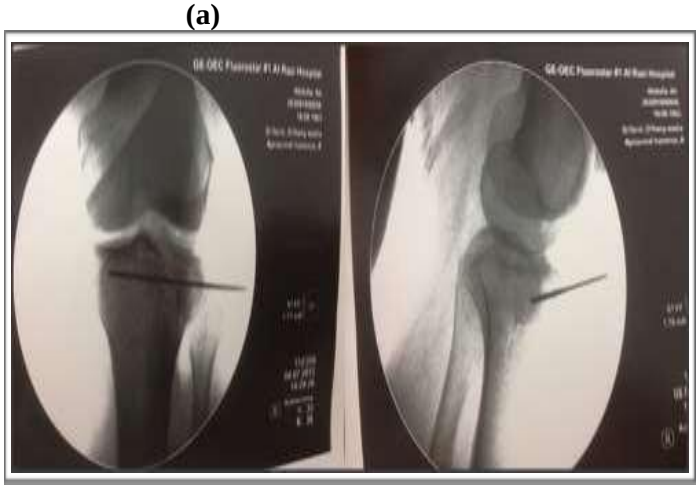
Table (3): Complication distribution among studied group

		N	%
Compartmental syndrome	**No**	13	92.9
	Yes	1	7.1
Infection	**No**	12	85.7
	Yes	2	14.3
Fixation failure	**No**	13	92.9
	Yes	1	7.1
Hardware irritation	**No**	13	92.9
	Yes	1	7.1
Over all complication	**Not**	10	71.4
	Complicated	4	28.6
	Total	14	100.0

(a)



(b)



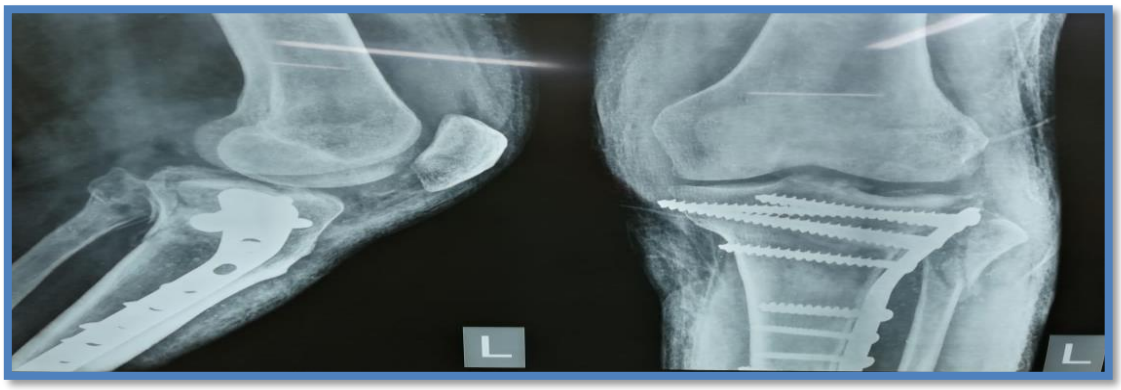
(C)

(d)

Figure (1): A case of 39 year old male was admitted with fracture after motor vehicle accident. The fracture was type V diagnosed according to Schatzker classification. Preoperative x-ray **(a)** and C.T **(b)** was done. Intra-operative temporary fixation was occurred by using k-wires **(c)** and immediate x-ray postoperative was assessed **(d)**.

(a)

(b)



(c)

Figure(2): Ap& lat. X. ray assessment of the same case posteroeratively after one month (a) and after 3 month (b). After 6 month follow up, knee R.O.M. was 0°- 135°. Plain X rays were done. No particular depression norcondylar widening. MPTA was 85°, PPTA was 10°and condylar widening was 2mm. Rasmussen knee score was assessed and anatomical score was 18 points which was considered excellent. Functional score was 29 which considered excellent (C).

DISCUSSION

One proposed clinical advantage of the locking plate is the ability to support the medial plateau and to prevent varus collapse of bicondylar plateau fractures through a single, laterally based implant. This hypothesis was investigated by **Gosling et al.** in a cadaveric study, concluding that the LISS plate and dual plating with traditional plates both provided similar resistance to permanent deformation of the construct under load [6].

Our study was in agreement with **Youssef et al.,** who found mean Rasmussen anatomical score was 16.11 (Range 14-18) 6 months post-operative and 16.67 (Range 14-18) 12 months post-operative. Mean functional Rasmussen knee score was 25.32 (Range 23-28) 6 months post-operative and 28.33 (Range 25-30) 12 months post-operative [7].

According to Oxford knee score, 5 patients were classified as excellent while the remaing 10 patient were good [8]. Also, **Oh et al.** reported 21 patients with excellent or good results and 2 patients with fair results [9].

We found mean Rasmussen anatomical score 13.71 in the 3rd month (Range 10-15) and 14.3 in the 6th months (Range 12-17), mean Rasmussen functional score 26 in the 3rd month (Range 15-29) and 26.7 (Range 17 to 30) in the 6th month post-operative. Final results were 12 patients as excellent , 1 patient as good and 1 patient as fair.

Our results concur Raza et al., who revealed that the outcomes of Rasmussen functional score were excellent in 18 patients, good in 19 patients (90.24% acceptable results), and fair in 4 patients (9.76% unacceptable results) [10].

In our work, 28.6% from studied group were complicated; infection was in 2 cases, compartmental syndrome in 1 case and hardware irritation in 1 case. This results was in the same way with **Youssef et al.,** who reported 16 cases (80%) without complications, 4 cases (20%) with complications, superficial infection in one case (5%) resolved with antibiotics after wound CS, preoperative compartment syndrome in one case (5%) managed with fasciotomy, hardware irritation in one case (5%) possibly due to long implant holes and fixation failure in one case (5%) managed by revision with double plating [7].

Similarly, **Lee et al.** found that 6 patients were complicated, 1 patient had wound dehicence managed by secondary suture, 3 patients had loss of fixation, malreduction in 1 patient and non union in 1 patient [8].

The present study suggested that single lateral locked plate can be an effective implant in providing fracture stabilization of bicondylartibial plateau fractures.

CONCLUSION

Bicondylar tibial plateua fractures occur due to high energy trauma, axial loading, Varus and valgus applied forces leading to articular depression and malalignment leading to increased risk of posttraumatic osteoarthritis. Single lateral locked plate can be an effective implant in providing fracture stabilization of bicondylar tibial plateau fractures. Using lateral locked plate is better in treatment of simple bicondylar tibial plateau fractures.

REFERENCES

[1] Júnior K, Fogagnolo F, Bitar C, Freitas L, Salim R, Jansen A. Tibial Plateau Fractures. *Revis de orto*. 2015; 44(6), 468–74.

[2] Biggi F, Di Fabio S, D'Antimo C, Trevisani S. Tibial plateau fractures: internal fixation with locking plates and the MIPO technique. *Inj*. 2010; 41(11), 1178–82.

[3] Berkson M, Virkus W. High-energy tibial plateau fractures. *JAAOS*. 2006; 14(1), 20–31.

[4] Spagnolo R, Pace F. Management of the Schatzker VI fractures with lateral locked screw plating. *Musculo Surg*. 2009; 96(2):75-80.

[5] Ehlinger M, Rahme M, Moor K, Di Marco A, Brinkert D, Adam P...et al. Reliability of locked plating in tibial plateau fractures with a medial component. *OTSR*. 2012; 98(2), 173–9.

[6] Gösling T, Schandelmaier P, Marti A, Hufner T, Partenheimer A, Krettek C. Less invasive stabilization of complex tibial plateau fractures: a biomechanical evaluation of a unilateral locked screw plate and double plating. *J of orthoc traum*. 2004; 18(8), 546–51.

[7] Youssef E, Nagi A, Senna A, Othman A, Elgamal H. Does single locked plating provide a standard treatment Modality for bicondylartibial plateau fractures? A prospective study. *J Rheumatol Orthop*. 2017; 4:2.

[8] Lee C, Huang T, Lin C, Chen H, Cheng M, Chen C. Bicondylartibial plateau fracture treated by open reduction and fixation with unilateral locked plating. *Kaohsiung J of Med Sci*.2013; 29(10), 568–77.

[9] Oh W, Oh K, Kyung S, Jeon H, Park C, Min K… et al. Double plating of unstable proximal tibial fractures using minimally invasive percutaneous osteosynthesis technique. *Actaorthopaedica*. 2006; 77(3), 524–30.

[10] Raza H, Hashmi P, Abbas K, Hafeez K. Minimally invasive plate osteosynthesis for tibial plateau fractures. *J of orthop surg* (Hong Kong). 2012; 20(1), 42–7.

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