

Treatment of Schatzker Type II and Type III Tibial Plateau Fractures With and Without the Use of Bone Graft

Thesis

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BY*

Islam Mohamed Reda Abd El Aziz

**M.Sc. of Orthopedic Surgery
Faculty of Medicine - Menoufiya University
Under Supervision of**

Prof. Dr. Tarek Mohamed Khalil

Professor of Orthopedic surgery - Faculty of Medicine
Ain Shams University

Dr. Ahmed Hassan Yousry

Assistant Prof. of Orthopedic surgery - Faculty of Medicine
Ain Shams University

Dr. Mohamed Ahmed Mashhour

Assistant Prof. of Orthopedic surgery - Faculty of Medicine
Ain Shams University

**Faculty of Medicine
Ain Shams University
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Contents

Title	Page
• Acknowledgements.....	i
• Contents.....	ii
• List of Abbreviations.....	iii
• List of tables	iv
• List of figures	v
• Introduction	1
• Aim of the work	4
• Hypothesis.....	5
• Review of literature	6
➤ Anatomy.....	6
➤ Classification.....	13
➤ Management.....	30
○ Diagnosis.....	30
○ Treatment.....	40
○ Postoperative rehabilitation	59
➤ Complications	60
➤ Functional outcome.....	66
➤ Bone graft.....	67
• Patients and Methods.....	70
• Results.....	92
• Discussion.....	111
• Summary.....	118
• Conclusion.....	121
• References.....	122
• Case Presentations.....	134
• Arabic Summary.....	

List of Abbreviation

HIV	Human Immunodeficiency Virus
ACL	Anterior Cruciate Ligament
PCL	Posterior Cruciate Ligament
MRI	Magnetic Resonance Imaging
AO	Arbeitsgemeinschaft für Osteosynthesefragen
OTA	Orthopedic Trauma Association
CT	Computed tomography
ASIF	Association for the Study of Internal Fixation
ATLS	Advanced trauma life support
AP	anterior- posterior
3D C.T	3 dimensional
MIPO	Minimally invasive plate osteosynthesis
K-wires	Kirschner wire
ORIF	Open Reduction, Internal Fixation
ARIF	Arthroscopic reduction and internal fixation
post-op	Post-Operative
DBM	Demineralized Bone Matrix
DVT	Deep venous thrombosis
VTE	Venous thrombo-embolism
MFA	Musculoskeletal Function Assessment
RTA	Road traffic accident
t*	<i>Independent t-test</i>
SD	standard deviation
X²	Chi-square test
P-value	probability value
DM	Diabetes mellitus
CBC	Complete blood picture
VAS	Visual analogue score
ROM	Rang of motion
DCP	Dynamic Compression Plate
LCP	Low contact plate

List of tables

Table No.	Title	Page
Table (1)	The AO-OTA Classification of proximal tibial fractures	27
Table (2)	Age distribution	72
Table (3)	Mean and standard deviation of age	73
Table (4)	Gender distribution	74
Table (5)	Side distribution	75
Table (6)	Distribution of mechanism of injury	76
Table (7)	Distribution of Classification of the fractures	77
Table (8)	Rasmussen Score (<i>Criteria of Clinical assessment</i>)	89
Table (9)	Rasmussen Score (<i>Criteria for Radiological Assessment</i>)	90
Table (10)	The mean of measurements of depression	92
Table (11)	The mean of functional score	93
Table (12)	The mean of VAS score at day 1	99
Table (13)	The mean of VAS score at day 2	100
Table (14)	The mean of VAS score at day 14	102
Table (15)	The mean of VAS score after 3 months	104
Table (16)	The mean of radiological score	106
Table (17)	The mean of operative time	108
Table (18)	The mean of amount of blood loss	109
Table (19)	Complications following surgery in both groups	110

List of figures

Fig.No.	Title	Page
Fig.(1-1)	Anterior bony aspect of right knee joint in extension, the patella is excised.	7
Fig. (1-2)	Superior view of bony landmarks of the left tibial plateau	10
Fig. (1-3)	Anastomosis around knee joint	12
Fig. (1-4)	Schatzker classification of tibial plateau fractures	15
Fig. (1-5)	A split fracture (AO/OTA type B-1, Schatzker (1)	16
Fig. (1-6)	A split depression fracture (AO/OTA B-2 and -3, Schatzker (2)	18
Fig. (1-7)	A local compression fracture (AO/OTA B-2, Schatzker (3)	20
Fig. (1-8)	A medial condylar fracture dislocation (AO/OTA type B-3, Schatzker (4)	22
Fig. (1-9)	A bicondylar fracture. The illustration Schatzker (5)	23
Fig. (1-10)	A shaft dissociated fracture (AO/OTA type C-2), Schatzker (6)	24
Fig.(1-11)	AO / OTA classification	26
Fig. (1-12)	Classification of tibial plateau fractures by ten segments in a CT model	28
Fig. (1-13)	Measurement of articular depression	34
Fig. (1-14)	Measurement of condylar widening	35
Fig. (1-15)	CT-scan showing a depressed articular fragment	37
Fig. (1-16)	Value of 3D C.T in tibial plateau fracture	37
Fig. (1-17)	MRI showing displaced comminuted lateral tibial plateau fracture	38
Fig. (1-18)	Anterolateral approach to the tibial plateau	46
Fig.(1-19)	Schatzker (a) type-II and (b) type-V tibial plateau fractures fixed with minimally invasive plate osteosynthesis	47
Fig.(1-20)	Anteroposterior (A) , oblique (B) , and sagittal computed tomographic (C) views of the Schatzker II injury with significant articular impaction. D, E , Postoperative views with a raft periarticular plate	50
Fig. (1-21)	Preoperative CT, anteroposterior (A) and lateral (B) intraoperative fluoroscopy, showing elevation of	51

	centrally depressed, type III lateral plateau fracture through a medial metaphyseal entry site	
Fig. (1-22)	Arthroscopic assessment of a split fracture (A) and the fracture line after it has been reduced (B)	52
Fig. (1-23)	A 35 year old female with a Schatzker II, AO grade 41-B3 fracture. (a) Pre-operative X-rays; (b) Pre-operative CT-scan; (c) Intra-operatively	53
Fig. (1-24)	X-rays follow-up of the previous patient at different steps	54
Fig. (1-25)	True” percutaneous technique of balloon-guided inflation osteoplasty with minimal-invasive incisions	56
Fig. (1-26)	Intraoperative burst balloon with leakage of the radiographic contrast dye into the knee joint	57
Fig. (1-27)	Schatzcker 3 lateral tibial plateau fracture	58
Fig. (1-28)	Postoperative following open reduction and internal fixation using subchondral raft fixation	58
Fig. (1-29)	Photograph of the lateral side of the knee of a patient 9 months after an open reduction with internal fixation	64
Fig. (2-1)	The mean age of both groups	73
Fig. (2-2)	Gender distribution	74
Fig. (2-3)	Preoperative measurement of articular depression in one of the cases	79
Fig. (2-4)	Anterolateral approach was used in all patients	81
Fig. (2-5)	The split component of the fracture was used as a window to reach the depressed fragment.	82
Fig. (2-6)	Periosteal elevator or similar instrument is introduced below level of depressed tibial plateau fragment	83
Fig. (2-7)	Preliminary fixation of the fracture by K-wires.	84
Fig. (2-8)	Definitive fixation of the fracture by buttress plate and screws.	85
Fig. (2-9)	Model of the visual-analogue scale (VAS) used	87
Fig. (3-1)	The mean of pain in both groups	94
Fig. (3-2)	The mean of walking capacity in both groups	94
Fig. (3-3)	The mean of knee extension in both groups	95
Fig. (3-4)	The mean of total range of motion in both groups	96
Fig. (3-5)	The mean of knee stability in both groups	96
Fig. (3-6)	The mean of functional score in both groups	97
Fig. (3-7)	The mean of functional outcome in both groups	98
Fig. (3-8)	The mean score of VAS at day 1	99

Fig. (3-9)	The mean of severity of pain at day 1	100
Fig. (3-10)	The mean score of VAS at day 2	101
Fig. (3-11)	The mean of severity of pain at day 2	101
Fig. (3-12)	The mean score of VAS after 2 weeks	103
Fig. (3-13)	The mean of severity of pain after 2 weeks	103
Fig. (3-14)	The mean score of VAS after 3 months	104
Fig. (3-15)	The mean of severity of pain after 3 months	105
Fig. (3-16)	The mean of radiological score	106
Fig. (3-17)	The radiological outcome	107
Fig. (3-18)	The mean of operative time	108
Fig. (3-19)	The mean of amount of blood loss/ mm	109
Fig. (4-1)	Preoperative X-ray of case no.5	135
Fig. (4-2)	Preoperative CT of case no.5	135
Fig. (4-3)	Intraoperative image taken by C arm of case no.5	136
Fig. (4-4)	Postoperative X-ray of case no.5	138
Fig. (4-5)	Postoperative CT of case no.5	138
Fig. (4-6)	Postoperative X-ray of case no.5 after 6 months	140
Fig. (4-7)	Postoperative X-ray of case no.5 after 1 year	141
Fig. (4-8)	Preoperative X-ray of case no. 28	142
Fig. (4-9)	Preoperative CT of case no. 28	143
Fig. (4-10)	Intraoperative image taken by C arm of case no. 28	144
Fig. (4-11)	Postoperative X-ray of case no.28	145
Fig. (4-12)	Postoperative CT of case no.28	146
Fig. (4-13)	Postoperative X-ray of case no.28 after 6 months	148
Fig. (4-14)	Postoperative X-ray of case no. 28 after 1 year	148
Fig. (4-15)	clinical outcome of case no. 28	149
Fig. (4-16)	Preoperative X-ray of case no.35	150
Fig. (4-17)	Preoperative X-ray of case no.35	151
Fig. (4-18)	Intraoperative photo taken for the wound of case no.35	152
Fig. (4-19)	Postoperative X-ray of case no.35	153
Fig. (4-20)	Postoperative CT of case no.35	154
Fig. (4-21)	Postoperative X-ray of case no.35 after 6 months	156
Fig. (4-22)	Postoperative X-ray of case no.35 after 1 year	157
Fig. (4-23)	clinical outcome of case no.35	157

Introduction

Tibial plateau fractures involve a major weight-bearing joint. They occur due to a combination of axial loading and varus/valgus applied forces leading to articular depression, malalignment and an increased risk of post-traumatic osteoarthritis^{1,2}.

Schatzker has defined lateral tibial plateau fractures type II as cleavage combined with depression: a lateral wedge is split in addition varying portions of the remaining lateral tibial plateau and articular surface are comminuted and depressed downwards into the metaphysis, while type III as pure central depression: the articular surface of the lateral plateau is depressed and driven into the lateral tibial condyle. There is no lateral wedge and the lateral cortex is intact³.

Depressed tibial plateau fractures remain technically demanding for orthopaedic trauma surgeons^{1,2,4}. The main challenges consist of achieving anatomic joint reduction in conjunction with stable fracture fixation, to allow early range of motion of the knee, with the aim of achieving good functional outcomes⁵. Further limitations include the risk of a residual intra-articular step-off after insufficient articular reduction⁶ and the adequacy of bone grafting options to fill the metaphyseal void after fracture reduction with conventional bone tamps⁷⁻¹⁰.

Anatomical reconstruction of tibial plateau fractures is necessary to prevent pain, axial malalignment, knee joint instability and posttraumatic arthritis¹¹. Considering the articular reduction of tibial plateau fractures, much variability remains as to the accepted amount of residual step-off, with

some authors recommending 3-4mm¹²⁻¹³. This is most likely the result of imperfect reduction tools, as anatomic reduction is always preferred. Though posttraumatic arthritis at the knee is correlated more with overall joint alignment and stability, restoring the native anatomy is always the goal¹⁴.

In the surgical treatment of depression fractures (Schatzker II-III) of the lateral tibial plateau¹⁴ (which constitute more than 50% of all tibial plateau fractures) the goal is reduction of the articular surface and stable fixation. Access to the subchondral bone is gained through a cortical window or other fenestration in the metaphyseal bone. A tamp or elevator is then inserted and used to elevate the depression en bloc¹³. The subchondral defect in the metaphysis is usually grafted with bone from the iliac crest to support the elevated articular surface. Disadvantages are pain symptoms¹⁵ and other donor site complications¹⁶, as well as resorption of the graft with subsequent loss of reduction.

There is no consensus as to the weight-bearing regime that should be followed after fixation of fractures of the tibial plateau. Recommendations vary from non-weight-bearing for 12 to 16 weeks, non-weight bearing for six to eight weeks, non-weight bearing prescribed on an individual basis or immediate partial weight-bearing for all patients¹⁷

Autogenous bone-graft harvesting is associated with significant morbidity with reported major complication rate of 8.6% including massive blood loss, avulsion of anterior superior iliac spine, lumbar hernia and neuropathies and minor complication rate of 20.6% including cutaneous nerve damage, persistent discomfort, local wound complications and there is a limited availability for larger defects. Autologous cancellous bone grafts from the iliac crest have a rather high morbidity, such as postoperative pain

up to 2 years, difficulty ambulating, haematoma and infection of the donor site, e.g. iliac crest abcess^{18,19}.

Allografts are associated with transmission of diseases like HIV and Hepatitis; they showed an incidence of disease transmission as high as 3.6%. Screening of allograft is an expensive process and bone banks are not commonly available. Other synthetic bone graft substitute such as the injectable calcium phosphate cement was used as well with promising result but still work in progress and has yet to establish itself as a beneficial tool in the treatment of depressed tibial plateau fracture¹⁹.

Complications after tibial plateau fracture surgery are many and are avoided by strict adherence to the principles and techniques of gentle tissue handling and limited incisions. The complications can be divided into early (loss of reduction, deep vein thrombosis, infection), or late (nonunion, implant breakage, post-traumatic arthritis). Most early complications can be viewed as biological failures, while late failures are often associated with mechanical problems¹.

S. Langhi, et al.¹⁹ suggested the use of the subchondral raft plate fixation technique using small fragment screws without bone grafting for the treatment of split depressed fractures of tibial plateau. Therefore, avoiding morbidity associated with bone grafting without compromising the fracture stability.

Aim of the work

The purpose of this study is to evaluate the clinical, radiographic and functional results in a cohort of patients who sustained open reduction and internal fixation without bone graft for Schatzker type II and type III lateral tibial plateau fracture in a controlled study.

Hypothesis

There is no difference in the clinical, radiological and functional outcomes in patients with lateral tibial plateau fractures type II and III treated without bone graft to the controlled group who was treated with bone graft when the depression is less than 2 cm.

Clinical Anatomy

The proximal surface of the tibia contains the medial and the lateral tibial plateaus, which are separated by the intercondylar tibial eminences (Fig.1-1). The articular cartilage on the lateral plateau is slightly thicker than that on the medial side.²⁰

In the frontal plane, the tibial articular surface forms an angle of approximately 3 degrees of varus with the long axis of the tibia. This varus, as well as the slight difference in cartilaginous thickness between the medial and lateral plateaus as the lateral meniscus is larger than the medial meniscus and covers a larger percentage of the lateral plateau, result in the lateral plateau being slightly higher than the medial plateau.¹ This difference is further exacerbated by the convexity of the lateral side and the concavity of the medial side. Such knowledge is extremely important during placement of screws from the lateral to the medial side of the proximal end of the tibia because if surgeon did not recognize this anatomy well, he can easily place a subchondral lateral screw through the articular cartilage of the lower medial side.²⁰



Fig. (1-1): Anterior bony aspect of right knee joint in extension, the patella is excised.²¹

The medial tibial plateau has a slightly concave shape in both the sagittal and coronal planes and is larger in both length and width than the lateral condyle, which has an articular surface slightly convex in shape in the sagittal plane and nearly flat to slightly convex in the coronal plane. The lateral tibial plateau lies approximately 2 to 3 mm superior (proximal) to the medial plateau. There is a slight varus alignment of the proximal tibia. It is also important to recognize that the proximal end of the tibia has a posterior slope of approximately 9°.^{20,22}

In a normal knee, load is predominantly born on the medial side. Consequently, the trabecular bone on the medial tibial condyle is stronger and more sclerotic than that on the lateral side, perhaps the reason why lateral-sided fractures are far more common, except in higher-energy injuries.²⁰