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A study on surgical management of Bicondylar fracture tibia

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Abstract
Background: The knee joint is complex joint and being superficial joint is more exposed to external forces. It is the commonly injured joint now a day because of increased vehicular trauma and sports related injuries. Bicondylar tibial plateau fractures usually occur in a bimodal age distribution. The most important factor in deciding the timing and modality of definitive management is the status of local soft tissue. Adequate fixation and early achievement of post-operative range of motion are important for a good prognosis and adequate postoperative functioning. Surgical fixation of Bicondylar tibial plateau fractures is challenging because of geographic complexity and compromise of the soft tissue envelope. In this small study, our aim is to outline the various principles of surgical management of Bicondylar fracture tibia as practiced in our institution and to evaluate the results while having an insight into contemporary literature related to the topic.
Materials and Methods: A prospective, observational study conducted on 34 patients satisfying the inclusion criteria from June 2016 to June 2018 to study different methods of surgical management of bicondylar fracture tibia.
Result: According to Modified Rasmussen Scoring System, clinically we had 06(17.65%) excellent, 23(67.65%) good, 4(11.76%) fair and 01(2.94%) poor results and radiologically 10(29.41%) excellent, 16(47.06%) good, 08(23.53%) fair and none poor results. We also used Oxford Knee Score in our study where we had 8(23.52%) excellent results, 19(55.88%) good results, 7(20.58%) fair results and 00(00%) poor results.
Conclusion: Pre-op planning is must. CT scan gives exact anatomy of fracture pattern and helps in deciding type of implant and also guides about the surgical approach to be used. To reduce skin related problems and to achieve reasonable alignment, spanning external fixator should be applied at early stage and kept till acute phase is over. Bicondylar tibial plateau fractures having bone defects must be filled with iliac crest autograft / bone substitutes after reduction of articular fragments. Medial side buttress plating is always desirable in bicondylar fracture pattern with unstable medial condyle to prevent delayed medial collapse and undesirable varus deformity. Early mobilization not only gives good knee ROM but also restores patient's confidence resulting in better compliance.

Keywords: Bicondylar fracture, tibial plateau, schatzker, modified Rasmussen score, oxford knee score

Introduction
Tibial plateau fractures represent a wide spectrum that ranges from simple injuries to complex fracture patterns. Tibial plateau fractures involve the articular surface of the proximal tibia. Tibial plateau fractures do not include small rim avulsions that occur in association with knee dislocations and proximal tibia fractures that do not involve the articular surface.
Bicondylar tibial plateau fractures have a bimodal age distribution. In young patients, high-energy trauma results in comminuted fractures and severe soft tissue damage, whereas in older patients, comminution and soft tissue injury arise mainly from poor bone quality and thin skin. Bicondylar fractures of the tibia represent the Schatzker V and VI fractures, and largely part of the AO-OTA "C" type fractures [Arbeitsgemeinschaft für Osteosynthesefragen (German for Association for Study of Internal Fixation) – Orthopaedic Trauma Association].
Non-operative treatment of Bicondylar fractures of tibia, in the era before the use of internal fixation, yielded "acceptable results" as shown by Rasmussen in the early 1970s and in a 20-year follow-up by Lansinger *et al*. [1]

The main complications of non-operative management included stiffness and malunion.

Traditional techniques of open reduction and rigid internal fixation of both condyles through a single anterior incision results in excessive soft tissue stripping, and were associated with wound healing complications when adopted for all Bicondylar fractures. Buttressing of both the medial and lateral compartments with conventional double plating is the gold standard for managing Bicondylar fractures because this provides rigid fixation to prevent medial collapse and subsequent varus deformity. This also allows early ROM (Range of Motion). Minimally Invasive Plate Osteosynthesis (MIPO) with preservation of soft tissue envelope, is the currently popular and acceptable biological plate technique.

Materials and method

This was a prospective, observational study conducted in J.L.N. Hospital & Research Centre, Bhilai (C.G), during the study period of June 2016 to June 2018. All Bicondylar fractures Tibia satisfying the inclusion criteria and willing to take part in the study were included.

Inclusion criteria

- All Patients with Bicondylar fracture tibia except those described under exclusion criteria.
- Patients with age above 18 years

Exclusion criteria

- Patients with Extra articular fracture.
- Patients with Open fracture.
- Patients with Pathological fracture.
- Patients with fractures involving ipsilateral Intra articular distal femur.
- Patients with tibial plateau fractures associated with vascular injury.
- Patients with severe head injury with initial Glasgow coma scale < 8.
- Patients who are medically unfit and not willing for surgery.
- Previously Non ambulatory patients

Methodology

After hospitalization, all patients were assessed as per the ATLS® protocol2, a thorough history elicited and examined thoroughly to assess their general condition, systemic disease and associated injuries. The injured part was examined locally to access soft tissue and bony injuries and distal vascularity was assessed by dorsalis pedis artery and posterior tibial artery pulsations, capillary filling, pallor and paraesthesia over toe tips.

Standard radiographs in AP and Lateral views was taken to confirm the diagnosis and also to know the type of fracture. The fracture fragments were analyzed and classified according to the AO Classification. CT scan using 3mm cuts is the investigation of choice for accurate assessment of the fracture. MRI was done in suspected ligamentous and soft tissue injuries.

All the procedure was performed under spinal/epidural/ general anaesthesia. As pre-operative planning, surgical approach3 was decided. A double incision approach4 using a posteromedial incision to stabilize medial condyle fragment and then the lateral condyle fracture is approached through a separate anterolateral incision. Circular fixators such as an Ilizarov frame or a Taylor Spatial Frame allows noninvasive reconstruction and may be more beneficial for comminuted fractures 5.

Post operative X-ray would be taken a day after surgery. Reduction would be judged satisfactory if there is joint depression of less than or equal to four millimeters and/or plateau widening of less than or equal to five millimeters compared with the width of the distal femoral condyles6. The patients would be followed for 3rd week, 6th week, 12th week and then every 6 weeks till 6 months. Range of movements of knee should be assessed, and AP and Lateral X-Ray would be taken to assess implant position and fracture union. We will use Modified Rasmussen score and Oxford knee score7 for our study as this score is simple, easy to use and practically applicable in our scenario.

Results

In our study demographic characteristics of the population was assessed and found that age of the patients were in the range from minimum 23 years to maximum 63 years with mean age of 45yrs. Maximum number of patients belong to the age group between 51-60 years i.e. 11 out of 34(32.35%). In our series 27(79.41%) were male patients and 07(20.59%) patients were females, i.e. highly significant association with male patients with the ratio being M:F=3.85:1. In our study, Right side was involved in 20(58.82%) patients and the left side was involved in 14(41.18%) patients. Road traffic accidents were found as main mode of injury in 27 patients (79.41%) while 7 patients (20.59%) sustained injury during fall from height.

Fractures were classified according to Schatzker's classification system were 22 fractures (64.71%) were of Schatzker type V and 12 fractures (35.29%) were of Schatzker type VI. In our study depending upon preoperative fracture configuration assessment, each case was individually planned and we utilized various treatment modalities like Single Plating + Canulated Cancellous Screw (SP+CCS) in 11 cases (32.35%), Dual Plating (DP) 22 cases (64.71%) and 1 case (2.94%) was treated with Ring Fixator (RF).

In our study, complications were seen in 8 patients, Infection was seen in 2 (5.88%) patients, 1 (2.94%) patient had isolated varus deformity while 1 (2.94%) patient had hardware related complication. Knee stiffness was seen in 4 patients, out of which 1 (2.94%) patient had associated condylar widening, 1 (2.94%) had associated varus deformity and 2 (5.88%) had associated articular depression.

Table 1: Table Showing Methods of Treatment

Modes of Treatment	No. of Cases	Percentage
Single Plate + CCS	11	32.35
Dual plate	22	64.71
Ring Fixator	1	2.94
Total	34	100

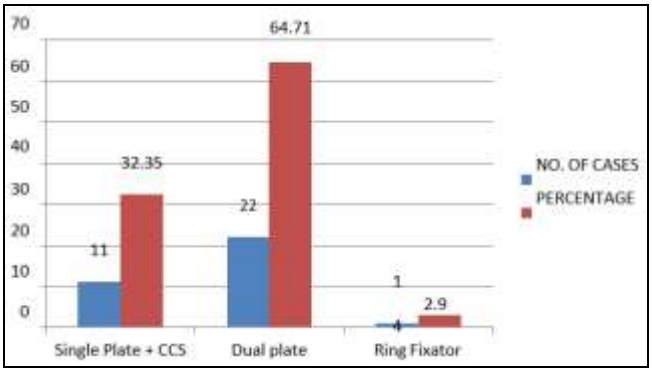

Fig 1: Graph showing Methods of Treatment

Table 2: Table Showing Complications

Complications	No. of Cases	Percentage
Infection	2	5.88
Implant Failure	0	0
Non-Union/Malunion	0	0
Varus Deformity	1	2.94
Varus deformity with knee stiffness	1	2.94
Articular depression with knee stiffness	2	5.88
Condylar Widening with knee stiffness	1	2.94
Hardware related complications	1	2.94

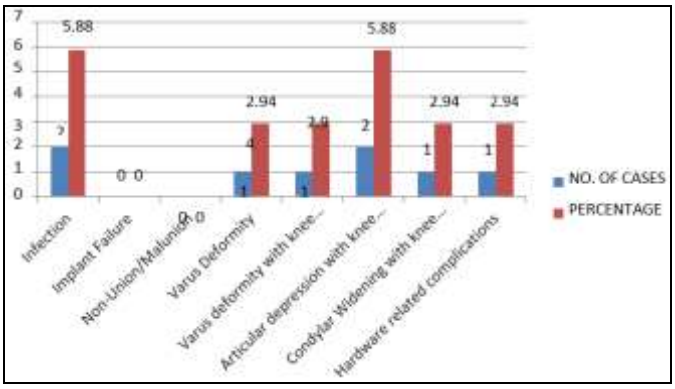

Fig 2: Graph Showing Complications

Discussion

The age incidence in our study shows an average of 45 years which is comparable to that reported by various other studies.

Studies	Age (In Years)		
	Minimum	Maximum	Mean
Stevens DG *et al*. (2001) [8]	18	77	40
Chang-Wug Oh *et al*. (2009) [9]	36	78	54
Prasad GT *et al*. (2013) [10]	22	61	40
Pun TB *et al*. (2014) [11]	22	61	44
Khatri Kavin *et al*. (2016) [12]	18	60	43
Our Study	23	63	46

Sex distribution in our study have showed male preponderance which shows similarity with other studies

Studies	Male In %	Female In %
Stevens DG *et al*. (2001) [8]	69.56	30.44
Chang-Wug Oh *et al*. (2009) [9]	78.26	21.74
Prasad GT *et al*. (2013) [10]	82.5	17.5
Pun TB *et al*. (2014) [11]	95.23	4.77
Khatri Kavin *et al*. (2016) [12]	96.77	3.23
Our Study	79.41	20.59

In our study Schatzker type V was most common pattern encountered which was the similar observation of two other studies.

Studies	Schatzker Type V	Schatzker Type VI
Prasad GT *et al*. (2013) [10]	50	50
Pun TB *et al*. (2014) [11]	52.38	47.62
Khatri Kavin *et al*. (2016) [12]	40.32	59.68
Our Study	64.71	35.29

In our study infection was seen in 2 (5.88%) patient while Chang-Wug Oh *et al*. (2009) [9] noted 4.3% and Prasad GT *et al*. (2013) [10] 9.52% infection in their series. Articular depression was seen in 2(5.88%) patients in our study while it was 10% in the study of Prasad GT *et al*. (2013) [10] and 19.05% in the study of Pun TB *et al* (2014).11Chang-Wug Oh *et al*. (2009) [9], Prasad GT *et al*. (2013) [10] and Pun TB *et al*. (2014) [11] found no case of nonunion in their series which is comparable to our series. We found condylar widening with knee stiffness in 1(2.94%) of our patient.

Varus deformity was seen in 2(5.88%) patients which was comparable to other studies

Varus Deformity	Percentage
Chang-Wug Oh *et al*. (2009) [9]	8.7
Prasad GT *et al*. (2013) [10]	2.5
Pun TB *et al*. (2014) [11]	4.76
Our Study	5.88

The assessments of results were made using modified Rasmussen scoring system (based on Clinical and Radiological assessment). Clinical Score of the patient in our study was 06(17.64%) excellent results, 23(67.64%) good results, 4(11.76%) fair results and 1(2.94%) poor results.

Studies	Excellent	Good	Fair	Poor
Chang-Wug Oh *et al*. (2009) [9]	15	8	0	0
Our Study	6	23	4	1

Radiological score was 10(29.41%) excellent results, 16(47.05%) good results, 8(23.5%) fair results and 00(00%) poor results.

Studies	Excellent	Good	Fair	Poor
Chang-Wug Oh *et al*. (2009) [9]	18	3	1	0
Our Study	10	16	8	0

Using Oxford Knee Score, we had 8(23.52%) excellent results, 19(55.88%) good results, 7(20.58%) fair results and 00(00%) poor results.

Studies	Excellent	Good	Fair	Poor
Prasad GT *et al*. (2013) [10]	16	16	8	0
Tien Ching Lee *et al*. [13]	9	6	0	0
Our Study	8	19	7	0

Conclusion

Incidence of complex bicondylar fractures of tibia is on rise. This is primarily due to high velocity road traffic accidents involving mostly two wheelers. Male preponderance is seen in tibial condyle fractures which is due to their more involvement in outdoor activities. Before surgical intervention patient should be stabilized and adequately built up. CT scan with three dimensional reconstructions should be done which gives accurate fracture geometry for preoperative planning for osteo-synthesis. In few of the cases with poor skin condition around the fracture site, we used spanning external fixator for temporarily stabilizing the fracture while waiting for the skin condition to improve for definitive procedure. All Patients

were managed surgically mostly by internal fixation and few by Ilizarov circular ring fixator14-15 depending on the fracture configuration. Good reduction, stable fixation and early mobilization not only give good knee ROM but also restore patients confidence resulting in better compliance.

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Conflicts of Interest: There are no conflicts of interest.

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