Outcome of Two Ring Hybrid Ilizarov Fixator in the Management of Proximal Tibial Fractures in Adults.

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ABSTRACT

Objective: To determine the functional and radiological outcome two ring hybrid Ilizarov fixator in the management of proximal tibial fractures in adults.

Methods: This descriptive study was conducted in department of Orthopaedic surgery Nishtar Medical University Multan from 5th May 2018 to 24th June 2020. All adults patients with proximal tibial fractures meeting the inclusion criteria were treated with two ring hybrid Ilizarov fixator. Post operative functional outcome was assessed with knee range of motion and Rasmussen functional knee score and graded as excellent, good, fair and poor. Radiological outcome was assessed with fracture healing on radiographs. Comparative analysis of results were done after stratification of age, gender, type of fracture and time since fracture and P value calculated with Chi square test and student-t test. P value < 0.05 was considered significant.

Results: The total number of patients in our study was 50.The mean age was 40.7 ± 10.16.Male patients were 45(90%) and female 5(10%). Shatzker type VI fractures were present in 30(60%) patients, Shatzker type V fractures in 11(22%), extra articular metaphyseal fractures in 5 (10%) and proximal one third shaft fractures in 4(8%) patients. All the fractures achieved union with mean union time 17.58±3.43 weeks. Functional outcome as per Rasmussen functional knee score was excellent outcome with more than 90° knee flexion in 32(64%) patients, good outcome and up to 90°flexion in 15(30%) and fair outcome with 45°flexion at the knee in 3(6%) patients. Younger patients were able to tolerate early weight bearing than elderly (*P*=0.006) Patients with open fractures had lower Rasmussen score (*P*=0.043), decrease knee flexion (*P*=0.043), and increased pin tract infection (*P*=0.031).

Conclusion: Proximal tibial fractures treated with two-ring hybrid Ilizarov fixator is an effective technique as excellent functional and radiological outcome was achieved in majority of our patients.

Keywords: Fracture, Hybrid, Ilizarov, Schatzker, Tibia, Union.

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INTRODUCTION

The proximal tibia and plateau fractures are high energy and complex injuries and usually difficult to treat.[1,2] Proximal tibial fractures are regarded as severe injuries because they affect the knee joint which is one of the major weight bearing joints of the body.[3] Schatzker divided proximal tibial fractures into two six types depending upon the impact of energy and complexity of fractures.[4] These fractures are a challenge to treat because of associated soft tissue coverage, skin necrosis, infections and extreme comminution.[5] The principles of treatment of the proximal tibial fractures are accurate reduction, rigid fixation and early range of motion.[6] Many treatment options are available. Open reduction and dual plating is widely used but it is associated with

extensive soft tissue dissection and infection.[3]. The use of a hybrid external fixator[7] may provide adequate reduction[8] and stabilization without extensive soft tissue dissection and allows early joint mobilization.[9,10]

The objective of our study was to determine the functional and radiological outcome two ring hybrid Ilizarov fixator in the management of proximal tibial fractures in adults.

METHODS

We conducted this descriptive study in department of Orthpaedic surgery Nishtar Medical University Multan from 5th May 2018 to 24th June 2020. All adults patients of either genders and age with proximal one third tibia fractures presented within three week were included in our study.All Patients with compartment syndrome, vascular injury, pathological fracture, history of previous surgery for the fracture and polytrauma patients requiring surgical intervention by other specialties were excluded. The study was approved by the Ethical committee of our hospital and informed consent was taken.

Patients were admitted in the department of orthopedics via accident and emergency department or outpatient department. In all patients history clinical examination, baseline investigations, AP and lateral x-rays of the tibia with knee joint was done. 3D CT scan was done to assess intra articular extension and stepping. Patients were operated on elective list.

Surgical Technique

All the surgeries were done by the same team of surgeons and following a standard uniform technique. The procedure was done under full aseptic measures in supine position under general or spinal anaesthesia. An Ilizarov plain wire was passed in distal femur at condylar level with reference to center of patella and second wire in calcaneus or distal tibia. A distraction/hanging frame was attached with these wires and distraction was given to achieve and maintain reduction at fracture site by ligamentotaxis to reestablish normal length, rotation, and alignment of part of the articular surface. The reduction was assessed under image intensifier. The medial or lateral condyle was reduced if required by a percutaneous wire / Schanz pin or small Bristow by just a stab incision. In some cases percutaneous pointed reduction clamp and pelvic ball tip reduction rod (Matta) was also used to reduce the fracture.After elevation and reduction of the depressed articular surface it was secured by beaded wires. The reduction was checked under image intensifier. The procedure was completed by four or five wires in proximal tibia and one or two wires through second ring in tibia distal to fracture site along with an oblique Schanz pin in distal ring (usually of 5mm thickness).All patients were instructed for pin tract care and early range of motion. Follow-up visits were scheduled weekly for first month and then monthly. Toe touch walking with walker was started at 4-6 weeks, cane was advised at about 12 weeks and full weight bearing at about 28 weeks if clinical and radiological signs of union was noted. Outcome was measured in terms of radiological union, knee range of motion and Rasmussen functional knee score[11] (table 1) at 28th week. Rasmussen score was graded as excellent (score >27),good (score 20-26), fair(score 10-19) and poor(score < 10). Knee flexion more than 90 degrees was considered satisfactory. Frame was removed after complete radiological and clinical union. Usually after 28th week.

All the data was entered in SPSS version 25. Mean and standard deviation was calculated for quantitative variables like age and time since injury. Frequencies and percentages were calculated for qualitative variables like gender, fracture type, union time, presence or absence of pin tract infection. Stratification was done with regards to age, gender, type of fracture, skin condition and time since injury. Chi-square test and independent sample t-test was applied for *P* value. *P* value < 0.05 was taken as statistically significant. Important data was presented in table where necessary.

RESULTS

We treated 50 patients with hybrid Ilizarov for proximal tibia fractures. The mean age was 40.7 ± 10.16. (range 22-60 years).Male patients were 45(90%) and female 5(10%). The mean time of presentation to the hospital was 7.76 ± 2.72(range 3 to 17 days). Majority(78%,n=39) of the fractures were closed while open fractures were present in 11(22%) patients. The aetiology of fracture was road traffic accidents in 33(66%), fall in 10(20%) and gun shot in 7(14%) patients. Shatzker type VI fractures were present in 30(60%) patients, Shatzker type V fractures in 11(22%), extra articular metaphyseal fractures in 5(10%) and proximal shaft fractures in 4(8%) patients. Close reduction was achieved in 48(96%) patients and mini incision was used for reduction in 4(8%) patients. Partial weight bearing was started at 5.50±1.05 weeks (range 4 to 8 weeks).

Table I: Rasmussen functional knee score

			Points	Excellent	Good	Fair	Poor
Subjective complaints	Pain	No pain	6	5	4	2	0
		Occasional ache, bad weather pain	5				
		Stabbing pain in certain positions	4				
		Afternoon pain, intense, constant pain around the knee after activity	2				
		Night pain at rest	0				
	Walking capacity	Normal walking capacity (in relation to age)	6	6	4	2	1
		Walking outdoors at least 1 hr	4				
		Short walks outdoors >15 minutes	2				
		Walking indoors only	1				
		Wheel chair/bed ridden	0				
Clinical signs	Extension	Normal	6	6	4	2	2
		Lack of extension (0-10 degrees)	4				
		Lack of extension > 10 degrees	2				
	Total range of motion	At least 140	6	5	4	2	2
		At least 120	5				
		At least 90	4				
		At least 60	2				
		At least 30	1				
		0	0				
	Stability	Normal stability in extension & 20° flexion	6	5	4	2	1
		Abnormal instability 20° of flexion	5				
		Instability in extension < 10°	4				
		Instability in extension > 10°	2				
Sum (minimum)				27	20	10	6

Table II. Stratification of outcome as per demographic and clinical features of study population.

Demographic/clinical Parameter		n=	Rasmussen score n=			P value	Flexion at knee n=			P value	Partialweight bearing	Union time	Complications n=		P value
			Excellent	Good	Fair		Up to 45°	45 to 90°	> 90°		P value	P value	None	Pin tract infection	
Age	20-40 yrs	22	16	6	0	0.232	0	6	16	0.232	0.006	0.085	22	0	0.037
	41-60 yrs	28	16	9	3		3	9	16				23	5	
Gender	Male	45	28	14	3	0.690	3	14	28	0.690	0.239	0.989	40	5	0.432
	Female	5	4	1	0		0	1	4				5	0	
Fracture type	Schatzker V	11	6	4	1	0.566	1	4	6	0.566	0.419	0.931	10	1	0.710
	Schatzker VI	30	22	7	1		1	7	22				26	4	
	Meta-physeal	5	2	2	1		1	2	2				5	0	
	Proximal shaft	4	2	2	0		0	2	2				4	0	
Skin condition	Close	39	28	10	1	0.043	1	10	28	0.043	0.118	0.147	37	2	0.031
	Open	11	4	5	2		2	5	4				8	3	
Duration since injury	1-7 days	25	17	6	2	0.589	2	6	17	0.589	0.634	0.903	22	3	0.637
	>7 days	25	15	9	1		1	9	15				23	2	
Reduction technique (minimally invasive)	Close	46	30	13	3	0.615	3	13	30	0.615	0.563	0.075	41	5	0.487
	Just stab	4	2	2	0		0	2	2				4	0	

Figure I: Schatzker type VI fracture treated with hybrid Ilizarov ring fixator.

All the fractures achieved union with mean union time 17.58±3.43 weeks(range 12 to 25 weeks). Functional outcome as per Rasmussen functional knee score was excellent outcome and more than 90° knee flexion in 32(64%) patients, good outcome and up to 90° flexion in 15(30%) and fair outcome score with 45° flexion at the knee in 3(6%) patients. Stratification of outcome as per demographic and clinical features of study population is shown in table II.

Younger patients were able to tolerate early weight bearing than elderly(*P*=0.006) Patients with open fractures had lower Rasmussen score (*P*=0.043), decrease knee flexion (*P*=0.043), and increased pin tract infection (*P*=0.031). Pin tract infection was documented in 5(10%) patients. No major complication was noted.

DISCUSSION

Treatment of proximal tibia fractures is always a challenge due to skin and soft tissue problems, fracture comminution and resulting knee joint stiffness.[12] The Ilizarov fixator although used primarily for non-unions and deformity correction,[13] is a valid choice for complex proximal tibia fractures as well and adding a Schanz screw (half pin) increases the stability of frame[14] and hence improves the outcome of treatment.[14] Kumar and Paige differentiated conventional Ilizarov fixator from hybrid Ilizarov fixator by the addition of a Schanz screw into the frame.[15]

In our study in-hospital physiotherapy was advised to all patients under the supervision of a qualified physiotherapist and partial weight bearing

(toe touch walking with walker) was started at 5.50 ± 1.05 weeks(range 4 to 8 weeks) after surgery. Iliopoulos and colleague[16] studied the role of physiotherapy after fixation of proximal tibial fractures and found early range of motion and weight bearing beneficial and helpful.

In our study excellent score and more than 90° knee flexion was achieved in in 32(64%) patients as per Rasmussen knee scoring(Fig. I). Prabhakar and Mohan[17] treated 21 proximal tibia fractures with hybrid Illizrov and achieved 42.85% good and 33.33% excellent results using Neer rating system. Ariffin and Mahdi[3] treated Schatzker type V and VI fractures with modified hybrid fixator and reported excellent outcome in 15(48%), good in 13(42%) and fair in 3(10%) patients as per Rasmussen knee score. The average flexion at knee was 120° (range 90° - 140°) in their series. Wu and colleagues,[15] however reported similar short term functional outcome in proximal tibial fractures treated with external fixation and internal fixation.

In our study the average union time was 17.58±3.43 weeks(range 12 to 25 weeks). Variable union times have been reported in literature. Siddalingamurthy[18] reported union time of 23.47±2.72 weeks, Ariffin and Mahdi[3] 14 weeks (range 8 to 20 weeks), Krupp[19] 7.4 months (range 3 to 15 months) and Conserva[20]15.9 months (range 7.5 to 32 months).

Sarad[21] treated 30 proximal tibia fractures with hybrid Ilizarov and reported excellent bone results in 21 (70%), good in 6 (20%), fair in 2(6.6%) and poor in 1(3.3%) as per ASAMI scoring system. The functional outcome was excellent in 17(56.6%), good in 9(30%) and fair in 4(13.3%). Sarad concluded that hybrid Ilizarov was better than conventional Ilizarov in all aspects. In one local study by Nawaz and Afghan[22] 90 proximal tibial fractures were treated with hybrid Ilizarov and union was reported in 84(93.3%) patients. Excellent functional outcome was noted in 18(20%), good in 49(54.4%) and fair in 23(25.5%) patients.

The descriptive design of our study and small sample size were the two probable limitations of our study. Further studies are recommended to confirm our results.

CONCLUSION

Proximal tibial fractures treated with two ring hybrid Ilizarov fixator is an effective technique as excellent functional and radiological outcome was achieved in majority of our patients. We therefore recommend this technique as first line treatment in selected patients with proximal tibia fractures.

Conflict of Interest: None
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