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Management of patella fractures with different modalities

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ABSTRACT

Background: Patella fracture is quite a common injury for all ages of patients, constituting approximately 1% of all skeletal injuries. Patella is the largest sesamoid bone in the body. The aim of study was to assess the functional outcome of patella fractures treated with modified tension band wiring using K wires and cannulated cancellous screws with tension band construct.
Methods: This study was a prospective clinical study to be conducted at the Department of Orthopaedic Surgery, Chalameda Anand Rao Institute of Medical Sciences, Karimnagar from October 2016 to November 2018. Total, 20 patients with transverse patellar fractures were studied and divided into 2 groups according to the surgical technique: 10 patients were in the MKTB group and 10 patients in the CSTB group.
Results: Total 20 patella fractures were included in this study. The Bostman's score of ROM, pain, atrophy of quadriceps femoris, and effusion were all higher in the CSTB group than in the MKTB group.
Conclusions: We conclude that compared with the MKTB technique, CSTB fixation is an effective surgical procedure for treatment of displaced transverse patellar fractures.

Keywords: Patella, Cannulated screw tension band, Modified K-wire tension band

INTRODUCTION

Patellar fractures represent 1% of all fractures in the adults. Transverse patellar fractures represent the most common pattern usually affecting patients aged from 20-50 years.[1,2] The technique of tension-band wiring was first described in year 1950 and use of tension band wire technique for patella fractures fixation is a well-established technique.

The principle of the tension-band wiring technique is to convert the tension forces acting on the anterior surface in to compression forces at the articular surface. This technique can substantially improve results because of its reliable fixation and allowance of early joint motion.[3]

The purpose of study was to compare modified tension band wire (MTBW) technique with tension band wiring through cannulated cancellous screws (TBWCCS) in patella fractures in terms of time taken for union, and function.

METHODS

Study design

This study was a prospective clinical study to be conducted at the Department of Orthopaedic Surgery, Chalmeda AnandRao Institute of Medical Sciences, Karimnagar from October 2016 to November 2018. Total 20 patients with patella fractures are included in this study.

Inclusion criteria

Inclusion criteria were age: 20 to 50; isolated open fracture; extensor lag or incompetent extensor mechanism; >2 mm articular incongruity; >3 mm fracture displacement; loose bone or chondral fragment.

Exclusion criteria

Exclusion criteria were age <20 and >50; if any associated fractures, unfit for anaesthesia.

Study procedure

Preoperatively the patient will be evaluated by taking detailed history, general, local and Radiographic evaluations. Patient will be prepared in a conventional way in operation theatre. According to criteria 20 patients were included in the study. The patients were divided into 2 groups according to the surgical technique. 1) MKTB group and 2) CSTB group.

Operative technique

The patient was placed in the supine position, and surgery was performed under lumbar anaesthesia. An anterior longitudinal midline incision over the knee was performed in both groups, and the entire flap was sectioned until the fragments and peripatellar tissue were fully exposed. Any bone chips and hematoma were removed, and the articular cavity was rinsed with sterilized saline.

The distal and posterior fragments were reduced and temporarily fixed with 2 large towel clamps. In the MKTB group, 2 parallel K wires (2.0 mm in diameter) were drilled from the superior to the inferior pole of the patella, with a 2-cm space between the 2 wires and a distance of 10mm from the articular surface.

Steel wire (1.2 mm in diameter, 10 patients) was threaded through the ends of the 2 K-wires to form a longitudinal figure-of-eight tension band at the anterior side of the patella, and then the steel wire was tightened using 2 forceps. The upper end of the K-wire was bent into hooks and buried in the peripatellar tissue. If the reduction of the patellar surface was satisfactory under intraoperative fluoroscopy, the distal tails of the K-wires and any excess steel wire were cut off and also buried in soft tissue.

In the CSTB group, 2 parallel guide pins (1.3 mm in diameter) drilled from the superior pole to the inferior pole of the patella, were used to fix the fragments after reduction of the articular surface. The 2 pins were positioned 2 cm apart and 10 mm from the articular surface.

After measuring the depth of the pins and drilling along the guide pin with a cannulated bit (2.5 mm), 2, 3.2-mm titanium cannulated lag screws were threaded along the guide pin. Subsequently the pin was removed and the steel wire (1.2 mm in diameter) was passed through the cannulated screw to form transverse figure-of-eight tension band at the anterior side of the patella, then the excess wire was cut off and buried in soft tissue.

Statistical analysis

Statistical analyses were analyzed using the SPSS statistical software (SPSS Inc, Chicago, IL). Descriptive statistical analysis was carried out. Chi-square test is used to find the significance of study parameters on categorical scale between two or more groups. A $p \leq 0.05$ was considered significant.

RESULTS

Total 20 patients with patella fractures were included in this study. The mean age of MKTB was 35.3±7.43 years and 37±9.01 in CSTB group. There was no difference in both groups.

Table 1 shows clinical demographic data between MKTB and CSTB groups, there was no significant difference in this study.

Table 1: Clinical demographic data between two groups.

Variable		MKTB	CSTB	Chi-square/T score	P value
Age		35.3±7.43	37±9.01	-0.1495	0.882
Gender	Male	8	7	0.2667	0.605
	Female	2	3		
Injury	Fall	5	6	0.424	0.808
	RTA	3	3		
	Indirect	2	1		
Fracture	Right	6	7	0.219	0.639
	Left	4	3		
AO	C1	8	7	0.266	0.605
	C2	2	3		
IFG		15.5±2.63	15.8±2.74	-1.0306	0.3163
O.T		57.1±6.55	58.5±6.04	-0.4965	0.625

Table 2: Clinical results of the two groups.

S. no	Variable	MKTB	CSTB	t-value	P value
1.	ROM	5.1±1.44	5.4±1.26	-0.493	0.627
2.	pain	4.5±2.12	5.1±2.02	-0.325	0.748
3.	work	3.6±0.84	3.8±0.63	-0.652	0.555
4.	Atrophy of quadriceps	3.6±0.84	3.8±0.63	-0.600	0.555
5.	Assistance in walking	3.6±0.84	3.8±0.63	-0.601	0.555
6.	effusion	1.8±0.42	2±0	-1.500	0.150
7.	Giving away	1.8±0.42	1.9±0.31	-0.601	0.555
8.	Stair climbing	1.8±0.42	1.9±0.31	-0.601	0.555

Table 3: Bostman's score.

S. no	Score	MKTB	CSTB	significance
1.	Excellent	5	8	Chi-square=2.025; P=0.363
2.	Good	3	1	
3.	Fair	2	1	

Figure 1: Pre and postoperative radiography of patella with MKTB.

Figure 2: The pre and postoperative radiography of patella with CSTB.

Table 2 shows modified tension band wire group and CSTB group, there was no significant difference in the fracture healing time and knee function score between two groups.

Table 3 shows the post knee pain score, quadriceps atrophy score, and ROM score in the CSTB group were higher than the MKTB group at the follow-up evaluation and a higher total Bostman score and excellent results characterized the CSTB group. But, there were no major complications in the CSTB.

DISCUSSION

Despite biomechanical and clinical studies demonstrating that the MKTB technique provides relatively stable fixation for transverse patellar fractures, deficiencies have been reported with this technique mainly implant loosening, displacement, and irritating pain, which have an impact on limb rehabilitation, and potentially have a deleterious effect on functional outcomes.[3] In order to avoid these problems associated with the MKTB technique, we used a CSTB to treat transverse patellar fractures and compared the clinical results of these 2 surgical techniques.

In this present study, total of 20 patients were taken into study in which 10 patients treated with MKTB about 2 (20%) are between 21-30, 6 (60%) are between 31-40 and 2 (20%) are between 41-50 with mean age being 35.3 and 10 patients treated with CSTB about 2 (20%) are between 21-30, 4 (40%) are between 31-40, 4 (40%) are between 41-50 with mean age of 37. Tan et al studied patients with age range of 18-54 with mean of 37.12 for MKTB and mean of 35.96 for CSTB. [3]

In this study, 30% of patients in the MKTB group experienced mild to severe pain that affected knee joint function. This pain was caused by the relatively long length of the K-wires or their displacement which could irritate the extensor mechanism during knee flexion.

Painful hardware was most common complication in MKTB group seen in 10% and tension band loosening and migration was the second major complication, seen in 10% of patients.

Shrestha et al study showed that pain at rest was present in 6 patients in MTBW group and in 2 patients in CSTB. Only 3 patients developed superficial wound infection, 2 patients from MTBW and 1 from the 4 patients from MTBW group developed painful hardware and one developed loosening and breakage of hardware even though union was achieved in these patients and hardware were removed after union was achieved. In previous study showed that K-wire prominence and migration are the primary causes of skin irritation associated with this technique.[3]

In our study, the reoperation rate was 0% (0/10) for the CSTB group, which was significantly less than (1/10) in the MKTB group. The main reason is that fixation with K-wires is associated with a high rate of hardware removal compared with screws (Figure 1). Other reports have shown that cannulated screws with a low profile caused less soft-tissue irritation than K-wires.[4,5]

This study showed that the CSTB group had higher scores than the MKTB group for ROM, pain, atrophy of the quadriceps femoris, and joint effusion, which arose from the method of performing the CSTB technique. The rates of removing implant have been reported to range from 37 to 55% for transverse patellar fractures, mainly because fixation with K-wires is associated with irritating pain of the soft tissue caused by the K-wires.[6] Lazaro et al reported a rate of 37% hardware removal due to prominent and symptomatic implants as a result of breakage or continuous soft tissue irritation.[7]

Based on the Bostman scoring system, we compared postoperative knee joint function between the 2 groups. The results of our study showed that the CSTB was associated with significantly better clinical outcomes up to 12 months as measured using the bostman score (Figure 2).

However, while this technique was associated with favourable pain scores, flexion, and ROM at early follow-ups (up to 6 months), there were no differences in these measures at the final 12-month follow-up. Furthermore, there was no difference in the meantime to union between groups. Similarly, studies by Dargel et al 28 patients (70%) had excellent result, 10 (25%) had a good result and 2 (5%) had a fair result, were similar to those from Tian study. Tian et al showed that the Iowa knee score in comparing titanium cable-cannulated screw tension band and modified K-wire and found better scores with the first group. Scores were: excellent in 45 patients; good in four; fair and poor in none for the cannulated screw group, and were excellent in 36 patients; good in nine; fair in four and poor in three for the K-wire group.[9]

According to Baydar et al showed that the cannulated screws are more durable against distraction forces than the modified tension band technique to treat transverse patellar fractures. Similar studies have reported that fractures stabilized with a modified tension band displace significantly more than those fixed with screws alone or screws plus a tension band in simulated knee extensions ($p<0.05$).[10]

Limitations of this study

- The decision to treat patients with either a modified tension band or -cannulated screw tension band was subject to selection bias as this was not a randomized study.
- The degree to which the steel wire was tightened was not standardized. As such, we could not be sure that the tension was equal in any of the patients, which might have had an influence on the interfragmentary pressure and tension band force.
- This was a single center and open-label trial, and the sample size was relatively small. Moreover, one experienced surgeon performed the MKTB technique, and another experienced surgeon performed the CSTB technique.
- Some researchers may feel that the follow-up period of one year is too short to reach an appropriate conclusion.

CONCLUSION

Based on our results and experience we conclude that compared with the MKTB technique, CSTB fixation is an effective surgical procedure for treatment of displaced transverse patellar fractures. Use of the CSTB technique, which did not result in irritating pain, led to a higher rate of excellent clinical results. Although functional limitation arising from hardware pain was commonly associated with MKTB fixation, Knee function significantly improved after removing implant after fracture healing.

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