

## Comparison of displaced patellar fracture treatment by two methods: Cerclage circumferential wiring versus tension band wiring

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### ABSTRACT

**Objective:** There are a variety of methods for operative treatment of patellar fractures. The aim of this study was to compare the outcome of cerclage wiring (CW) versus Tension Band Wiring (TBW) for treatment of displaced fractures of the patella.

**Methodology:** In this retrospective study we reviewed the medical files of the patients who had displaced transverse or comminuted patella fractures treated at two trauma hospitals between 2004 to 2010. Forty four patients were found that had been operated with either of these two methods: TBW=24, CW=20. Outcome was evaluated by Bostman rating score, at a mean follow-up time of 2.3 years.

**Results:** Mean age of all patients was 32.7 years. There was no significant difference regarding the mean age, gender, and mechanism of the fractures in patients treated by two methods of TBW and CW. Atrophy of quadriceps muscle was (1.146 cm  $\pm$  0.9cm) in 19 patients with TBW, and (2.3  $\pm$  0.6cm) in all patients with CW, which shows significant difference. No case of infection or nonunion had occurred. Good to excellent results in TBW and CW were found in 83.4% and 80% of patients respectively that reveals no major difference. Hardware removal due to pin irritation was performed in 66.6% of TBW and 10% of CW group. There was no significant difference between two groups with respect of PF osteoarthritis.

**Conclusion:** Despite less secure fixation with CW, both TBW and CW methods had comparable outcome with a high rate of good to excellent results in the treatment of displaced patella fractures. Individualized treatment plan based on the type and pattern of the fracture is suggested.

**KEY WORDS:** Patella fracture, Open reduction, Internal fixation, Tension band wiring, Cerclage wiring.

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### INTRODUCTION

Patella is the largest sesamoid bone and has an important role in function of the knee extensor mechanism. Patellar fractures account for 1% of all skeletal fractures and results from direct, indirect or combined forces. Because of its subcutaneous location this bone is prone to injury from direct force that usually resulting in comminuted fracture. Indirect injury results from violent contraction of the quadriceps muscle in the flexed knee.<sup>1-3</sup>

Patella fracture occurs more often between 20-50 years age and in men two folds of women. About



Fig.1: Pre operative radiography of a 56 years old patient one third of the patella fractures need operative treatment. Surgery is indicated when displacement and step-off incongruity of articular fragments are more than 2 and 3 mm, and extensor mechanism is disrupted. There are a variety of methods for surgical treatment of patellar fractures such as tension band wiring (TBW), modified TBW, cerclage (circumferential) wiring (CW), screw fixation, basket plate, and partial or total patellectomy. With various techniques of fixation excellent results have been reported in 80% of patients, and overall rate of 25% complications have been reported.<sup>4</sup>

Weber et al concluded that with modified TBW the most secure fixation was obtained.<sup>5</sup> Circumferential wiring (CW) is a simple technique that can be used alone or in combination with other methods for fixation of the patella fractures.<sup>6,7</sup>

Because the patella provides a critical function in the knee extension and its subcutaneous location that makes it vulnerable to direct trauma, we decided to do this study to find out the results of two methods of TBW and CW that has been performed for treatment of this fracture at our hospitals.

### METHODOLOGY

In this retrospective study we reviewed the records and medical files of the patients with patella fractures that had been operatively treated from 2004 to 2010 in Emam Khomeini and Arvand hospitals in Ahvaz city in Iran. Inclusion criteria were closed displaced transverse or comminuted



Fig.3: pre operative radiograph.



Fig.2: Post operative radiograph of the patient showing fixation with TBW.

patella fractures without other ipsilateral fracture in tibia or femur. Forty-four patients who fulfilled these criteria were managed by either of these methods: TBW=24 and CW=20 patients. The study was approved by ethics committee at our university and a consent had been taken at the time of admission before surgery from all the patients.

Methods of fixation: Surgery was performed under supine position; tourniquet was applied in all cases and approached by anterior midline incision. In TBW, Two 2mm k-wires were inserted parallel from inferior to superior pole, and a stainless steel wire loop was tightened around the patella (Fig. 1 and 2). In CW, A 1.25 mm cerclage stainless steel wire was passed around and close to patella and tightened at medial proximal border of the bone (Fig. 3-6 shows a case of patella fracture treated by CW technique). The knee was protected by a cylinder cast for one week for TBW and 4-6 weeks in CW. Physiotherapy for all patients had been performed. Clinical outcome was assessed using the system of Bostman score.<sup>8</sup> Excellent result was defined as (28-30 points), good (20-27 points) and unsatisfactory (less than 20 points).

Radiography was studied regarding fracture union, position of wire, pins, and patellofemoral

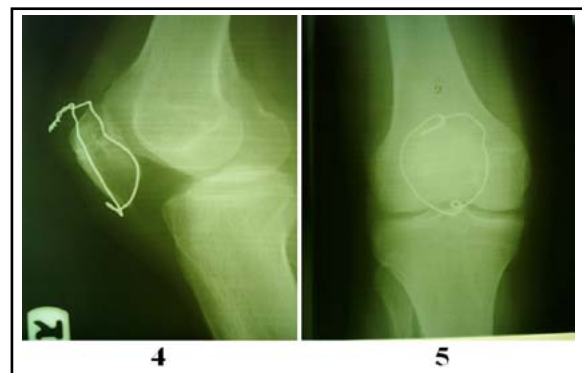


Fig.4 and 5: Radiograph 3 months post operation.



Fig.6: Radiograph taken 22 months after implant removal. joint incongruity. Data was analyzed by t test, chi-square test and a p-value of  $<0.05$  was considered as significant.

## RESULTS

A total of 44 patients were included. There were 31 Male and 13 female with a mean age 39.2 years (Range from 24 to 52 years). The average follow-up time was 29 Months (range from 9 to 53 m). All fractures achieved union at a mean time of 8 weeks. Demographic data are shown in Table-I. There was no significant difference with regard to sex, age and mechanism of the fractures in both groups. There was no different in rate and time to union between two groups. Range of flexion and extension was more in TBW group. The average loss of knee movement was 17 degrees in CW and 9 degree in TBW group. More details of knee function in both groups of patients are shown in Table-II.

Most common complication was atrophy of the quadriceps muscle but in comparison with healthy leg it was not significant. Re operation for removal of the pin/wire was performed in 17 patients with TBW. Breakage of wires was seen in two patients with CW but those were asymptomatic. Mild degrees of patellofemoral arthritis were seen in radiography of four patients with TBW and five

Table-II: Results of knee joint function at final follow-up.

Parameter	TBW N=24	CW N=20	P
Mean quadriceps atrophy (cm)	1.146 0.9	2.3 0.6	0.001
Range of motion (deg):			
Full	9 (37.5%)	9. (45%)	0.746
5 Limitation			
3(12.5%)	2 (10%)		
6-10 Limitation	6 (25%)	5(25%)	
11-15 Limitation	4 (16.7%)	1(5%)	
16-20 Limitation	2 (8.3%)	3(15%)	
Pin/ wire removal	17 (70.8%)	3(15%)	0.002
OA of PF Joint	4 (16.7%)	5 (25%)	0.490

Table-I: Profile of the patients.

Variable	TBW	CW
Mean age at the time of operation (year)	(38 $\pm$ 14)	(41 $\pm$ 11)
Side:		
Right	11(45.8%)	12(%60)
Left	13(54.2%)	8(%40)
Mechanism of fracture:		
Falling down	12(50%)	8(40%)
Car accident	9(37.5%)	12(60%)
Direct trauma	3(12.5%)	0
Gender:		
Male	18(75%)	13(65%)
Female	6(25%)	7(35%)
Total	24	20

patients with CW. None of the patients with PF arthritis in CW group and three patients in TBW group was symptomatic. The results on the knee joint in TBW and CW were excellent in 66.8% and 55% of the patients respectively. (Table-III.)

## DISCUSSION

The aim of surgical treatment in patella fracture is anatomic reduction to restore articular congruity, preservation of patellar bone stock and repair of extensor mechanism. Among the various methods for fixation of patellar fractures, currently the modified TBW is most widely used. In this technique the tension or distracting forces tending to separate the fragments at anterior aspect of patella converted into compression at articular surface that enhance the fracture union and allows early motion and exercise of the knee joint.<sup>8,9</sup> Ozdemir et al in their study on 20 patellar fractures with TBW reported good and fair results in 55% and 35% of the patients respectively.<sup>10</sup> Mehdi et al in a multicenter study found 83% excellent and good results in 203 patellar fractures treated by TBW.<sup>11</sup> Gumala et al reported more satisfactory results in patients treated by modified TBW.<sup>12</sup> Li Yang et al found that titanium cerclage wiring was associated with a high rates of excellent results in comminuted patellar fractures.<sup>13</sup> CW is a simple method that is more applicable in comminuted fractures. The main disadvantage of this modality is the need for knee immobilization for about 4-6 weeks. Although this technique gives

Table-III: Results in both groups of patients.

Bostman score(point)	TBW	CW	Results	P
28-30	16(66.8%)	11(55%)	Excellent	0.712
21-27	4(16.6%)	5(25%)	Good	
$\leq 20$	4(16.6%)	4(20%)	Unsatisfactory	
Total	24	20		

less secure fixation, but the pin site problems & need for re-operation in our study was less than TBW.

This study represents that all patellar fractures achieved union at a mean time of 8.2 weeks that are comparable to those reported elsewhere. There were no significant differences with regard to the time and rate of union in both groups of patients.

Although Bostman et al reported better results with TBW compared with three methods of CW, screws fixation and patellectomy, our results with CW was comparable with TBW. Rates of hardware removal have varied from 10% to 60% with TBW technique.<sup>8,14</sup> we observed more significant hardware problems in our patients treated by TBW which may be a technical error. Decreased motion of the knee joint was more in flexion which may be due to intra articular fibrous adhesion. Good to excellent results with CW has been reported in 70% of the patients.

We found good to excellent results in TBW and CW in 83.4% and 80% of the patients that shows no major difference. Difference between these two modalities of fixation was not significant despite the fact that biomechanical construct of fixation and post operative immobilization differ in these two methods. Atrophy of quadriceps muscle was seen in all patients. The average muscle wasting was 1.146 cm in TBW and 2.3 cm in CW group. Although it shows significant difference (p 0.001), but clinically it was not significant.

The most common complication in TBW group was pin irritation and need for removal of the pins, while in CW group it was quadriceps atrophy and some degrees in muscle power reduction that may be due to longer immobilization time in the CW patients.

In spite of a mean 5.2 weeks knee immobilization in our series with CW, the rates of knee range of motion had no significant difference from those patients treated with TBW. With a protocol of rehabilitation program most of these patients can achieve full or near a full knee motion despite 5 weeks of knee casting.

Currently a modified TBW Technique with two cannulated screws and a 0.8 mm wire passed through them are used to treat patella fracture. We believe that in spite of different biomechanical properties with a various modalities of patella fixation, most of these patients can regain a good to excellent function of knee joint should the articular surface reconstruction could be achieved.

Our study has few limitations. This is a retrospective study and we were not able to see all initial radiography of the patients. So, in large proportion

of them, we had only the medical records with regards to fracture pattern and displacement. Also the post operative immobilization was different in both groups of study. This can affect the rate and amount of muscle atrophy which could leads to prolonged rehabilitation time in CW patients.

## CONCLUSION

Both cerclage wiring and tension band wiring were associated with high rates of good to excellent outcome for treatment of transverse and comminuted fractures of the patella. Pin or wire related problems were more common with TBW technique. We suggest that modified TBW technique using steel wire through two cannulated screw can eliminate this complication.

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