

Assessment Results of Patellar Fracture Treatment after Tension Band Wiring

S. Abdolhossein Mehdiinasab,^{*1} Nasser Sarrafan,¹ Mohammad Fakoor,¹ Saeid Tabatabaei,¹ Sharareh Shalamzari¹

1. Department of Orthopaedic, Musculoskeletal and Rehabilitation Research Center, Ahwaz Jundishapur University of Medical Sciences, Ahwaz, Iran

Article information	Abstract
<p>Article history: Received: 28 May 2011 Accepted: 24 June 2011 Available online: 5 Nov 2012 ZJRMS 2013; 15(4): 60-62</p> <p>Keywords: Patella Surgical treatment Outcome assessment</p> <p>*Corresponding author at: Department of Orthopaedic, Musculoskeletal and rehabilitation research center, Ahwaz Jundishapur University of Medical Sciences, Ahwaz E-mail: hmehdinasab@yahoo.com</p>	<p>Background: To assess the results of patellar fracture treatment by tension band wiring.</p> <p>Materials and Methods: This retrospective study was performed to evaluate clinical and radiological results of patellar fracture during past 6 years.</p> <p>Results: Twenty four patients were participated in follow-up. Union was occurred in the mean time of 2.67 ± 0.61 months. Falling down and direct trauma were the most common cause of fracture. Most common complications were thigh muscle atrophy and pin irritation. Excellent and good results in 87.5% and fair results in 12.5% of the patients were seen.</p> <p>Conclusion: Fixation of patellar fractures with tension band wiring was associated with a high rate of union.</p>

Copyright © 2013 Zahedan University of Medical Sciences. All rights reserved.

Introduction

As the largest sesamoid bone of the body, patella is located in a shallow subcutaneous condition in front of the knee joint and its fractures include about 1% of the entire body fractures [1]. The importance of patella fracture and its appropriate treatment is due to the effects of this bone in knee extensor mechanism and the probability of osteoarthritis occurrence in the patella femoral joint. Therefore, open and anatomical reduction and rigid fixation as well as onset of early knee movements are very important in preventing further complications.

There are several ways to treat patella fractures. If the fracture is not displaced, it will be treated by knee extension casting, but in case of parts displacement of more than 3mm and joint surface difference of more than 2 mm, open fractures and inability to open knee actively, fixation and surgery will be required. The goal of surgery is to bring along the natural extension of joint surface and repair the extensor mechanism [2] that can be performed using pins, wires and cerclage or screws. In cases that severe fractures or breaking occurs in which it is not possible to rebuild and fixate the joint surfaces, partial or total patellectomy may also be required, but given the importance and considerable role of this bone in protecting extension function which is considered the most important knee function, partial or total patella should be at least kept and maintained [3].

One of the treatments used more in recent years is the use of tension band wiring technique. This method is devised by osteosynthes group and its modifying methods is in such a way that by putting two parallel K-Wire of 2

mm in diameter close to the anterior patella surface and fixation with wire around the patella and around pins, the separator or the tension force in the anterior patella surface will turn into compression force in the articular surface by bending knees and the union will be accelerated [5, 4].

Considering that the initial selected treatment in medical centers of Imam Khomeini and Razi Hospitals of Ahwaz during the last years has been the use of tension band wiring and on the other hand, the results of this treatment have not been studied hitherto, this study is conducted to assess the results of treatment of this fracture.

Materials and Methods

This retrospective descriptive analytical study was performed to evaluate the results of patella fracture treatment in Imam Khomeini and Razi medical centers in Ahwaz. First, hospital records of the patients with patella fracture treated with tension band wiring method during the past 6 years were studied and the patients' characteristics and the fracture type were extracted. Then, patients were studied through phone calls and visiting. The patients included in this study were older than 18 years of age at the time of fractures occurrence and had closed fractures and no other fracture in the same limb. The interested variables to evaluate the treatment results included:

1- Motion range of knee joint which was compared with the opposite healthy knee. 2- The union status and its duration were determined based on the initial radiographs

of patients, and if not available, based on the patient history. Probable patellofemoral joint osteoarthritis was evaluated through joint distance decrease and cartilage irregularity as well as formation of marginal osteophytes. For atrophy of the quadriceps femoris muscles, the thigh diameter was measured 10 cm above the patella bone. The Bostrom modified scoring system was used to evaluate the treatment results [6]. The data analysis was performed using SPSS-13 statistical software. The significance level was considered at 0.05 *p*-Value.

Results

The number of patients who were treated and followed up was 24 patients with mean age of 14±38 years, 18 of whom were male and 6 were female. The most common cause of fracture was direct stroke to knee and falling down in 12 patients (50%). Car accident in 9 patients (37.5%) and a direct blow to knee in 3 patients (12.5%) were another cause of fracture. There were no significant differences between left and right side. Nine patients had normal knee motion range. Patellofemoral joint osteoarthritis symptoms were observed in 5 patients, in 3 of whom were symptomatic associated with patella pain. Union was observed in all patients and no case of infection had been occurred.

Statistically, the most common symptom was weakness and atrophy in the quadriceps femoris muscles which was observed in comparison with healthy muscles (*p* =0.018), but it had no clinical symptoms; while, the irritation caused by pins location was observed in 17 patients (70.8%), which led to referral and taking out the pins (*p*=0.01) (Table 1), and Bursitis and localized swelling were developed in one patient at the distal end of the pins. According to Bostrom scoring system, 87.5% of the cases had excellent results and the fair results were seen in 12.5% of patients.

Table 1. Treatment results

Variable		N(%)
Knee motions	Without restrictions	9(37.5)
	≥5 degrees	3(12.5)
	6-10 degrees	6(25)
	11-15 degrees	4(16.7)
	16-20 degrees	2(8.3)
Patello- femoral joint arthritis	Mild	2(8.3)
	With osteophytes	1(4.1)
	No arthritis	19(79.2)
Quadriceps femoris muscles weakness	46.1±0.6	24(100)
Union (months) (Mean±SD)	167.2±0.61	24(100)
Removing pin or wire		17(70.8)
Remaining of pin or wire		7(29.2)

Discussion

The results of this study suggest that patella fracture is associated with a high rate of mending. Fracture led to mending in all patients which indicates that the tension band technique creates enough strength in fracture location. In our study, pin irritation and their taking out was also the most common marked symptom which was

observed in 17 patients. This problem is actually inevitable. This side effect may be decreased or removed through shortening the location of cutting pin end or using Canulated screws. The Patella bone has an important role in straightening knee joint and this bone, as a focal point of lever and mechanical properties, improves tendon of quadriceps femoris muscles as well as patella and facilitates knee straightening [2, 3]. At the time of fracture, in addition to maintaining the above function, this bone can be effective in preventing osteoarthritis and joint pain in future [7].

Several methods have been used to fixate this fracture, such as circular cerclage wire around bone, removal of part or the entire patella, cortical or cancellous screws as well as tension band wiring technique using pin and wide wire which accelerates the union by converting tension force on the anterior surface into the compression at articular surfaces when bending knee in addition to allowing early motion to knee [8].

Several studies have been so far reported in regard to knee function following the above procedure in the treatment of fractures of this bone. For example, in 20 cases of surgical treatment of patella transverse or comminuted fractures through tension band wiring surgery and in 24-month follow-up results, Ozdemir et al. reported good results in 55%, moderate in 35% and poor results in 10% of cases. In 45 patients with patellar fractures, Gumula et al. [9] treated 20 patients with tension band wiring, 14 cases with partial patellectomy and 11 patients with total patellectomy; and in a follow-up process during 2-6 years, most of good and excellent results were reported in tension band wiring patients. According to these authors, the worst results were observed in patients who had patellectomy [10].

Mehdi et al. reported the results of treatment of 203 patella fractures in 200 patients with tension band wiring technique in a multi-center study. The mean age and follow-up age of patients were respectively 36 and 6 years. The excellent and good results were observed in 83% and the fair and poor results in 17% of patients. The common side effects in this study were nonunion in 4%, losing pins in 10% and osteoarthritis in 5.8% [11].

In 26 cases of patella fracture during 1989-1992, Ndiaye et al. treated 18 cases with modified tension band wiring technique, 5 cases with tension band and 3 cases with circular wire. According to them, the first approach has been associated with better results for transverse fractures or crushing the middle part of patella [12].

Other separate studies conducted by Bostman and Chen to treat patella fractures, have reported the results from good to excellent in 50 to 80 percent with anterior tension band method [13, 14].

In a study, Benjamin et al. compared the biomechanical properties of four different types of fixation in transverse patella fractures and according to them, the modified tension band wiring technique had stronger fixation than the other methods [14]. In a research study, Burvant et al. have compared the strength level of patella fracture fixation in three methods of wire, circular wire around the bone and tension band wiring and found that the tension

band wiring causes stronger fixation and greater stability [15].

Several matters are noteworthy in this study including full union in all patients to whom fracture is expected due to cancellous nature of bone and rigid fixation. Mild atrophy was the most common complication. Although this complication had no clinical symptoms, it is preventable and treatable from the day after surgery with an emphasis on performing physiotherapy and isometric exercise by the patient.

The results indicate that the tension band wiring is associated with acceptable results and the patients who have undergone surgery had no complaint with specific restrictions in regular activities. The main problem was related to pin irritation, particularly at the top and bottom ends of the bone with bent edge, and had caused localized bursitis in a patient.

However, by removing the pins, patients' complaints were completely eliminated and they were satisfied with the results of operation in long-term follow-up (about 6 years). Patella fracture treatment with open reduction and fixation with tension band technique is associated with a high rate of union and good results. The most common

marked complication is local irritation caused by the pins ends removing which after the union the symptoms will be resolved. Cannulated screws can be used instead of pins. In this case, while eliminating the above side effect, typically there will be no need for repeated surgery and removing the devices.

Acknowledgements

Hereby, the esteemed Research Deputy of Ahwaz Jundishapur University of Medical Sciences, which supported this proposal, is highly appreciated. This article is the result of a research project (No. U88054) of Research Council.

Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

Funding/Support

Ahwaz Jundishapur University of Medical Sciences.

References

- Whittle PA. Fractures of the lower extremity. In: Cohoon Campbell W, Canale ST, Beaty JH. Campbell's operative orthopaedics. 11th ed. Las Vegas: Mosby/Elsevier; 2008: 3161-65.
- Catalano JB, Iannacone WM, Marczyk S, et al. Open fractures of the patella: Long-term functional outcome. J Trauma 1995; 39(3):439-44.
- Bedi A, Karunakar MA. Patellar fracture and extensor mechanism injuries. In: Bucholz RW. Rockwood and green's fractures in adults. 7th ed. Philadelphia: Lippincott; 2010: 1756-1767.
- Weber MJ, Jfaneki CJ, Mcleord P, et al. Efficacy of various forms of fixation of transverse fractures of patella. J Bone Joint Surg Am 1980; 62(2): 215-20.
- Carpenter JE, Kasman R, Matthews LS. Fractures of the patella. Instr Course Lect 1994; 43: 97-108.
- Bostman O, Kiviluoto O, Nirhamo J. Comminuted displaced fractures of the patella. Injury 1981; 13(3): 196-202.
- Berg EE. Open reduction internal fixation of displaced transverse patella fractures with figure-eight wiring through parallel cannulated compression screws. J Orthop Trauma 1997; 11(8): 573-6.
- Baran O, Manisali M, Cecen B. Anatomical and biomechanical evaluation of the tension band technique in patellar fractures. Int Orthop 2009; 33(4): 1113-7.
- Ozdemir H, Ozenci M, Dabak K and Aydin AT. [Outcome of surgical treatment for patellar fractures] Turkish [Abstract]. Ulustravma Derg 2001; 7(1): 56-9.
- Gumula J, Wisniewski P, Kusiak A. [Evaluation of clinical and radiological results of operative treatment of patellar fractures] Polish [Abstract]. Chir Narzadow Ruchu Ortop Pol 2001; 66(5): 463-8.
- Mehdi M, Husson JL, Polard JL, et al. [Treatment results of fractures of the patella using pre-patellar tension wiring. Analysis of a series of 203 cases] French [Abstract]. Acta Orthop Belg 1999; 65(2): 188-96.
- Ndiaye A, Sy MH, Dansokho AV, et al. [Early evaluation of surgical treatment for patella fractures] French [Abstract]. Dakar Med 1996; 41(2): 119-23.
- Hung LK, Chan KM, Chow YN and Leung PC. Fractured patella: Operative treatment using the tension band principle. Injury 1985; 16(5): 343-347.
- Benjamin J, Bried J, Dohm M and McMurtry M. Biomechanical evaluation of various forms of fixation of transverse patellar fractures. J Orthop Trauma 1987; 1(3): 219-22.
- Burviant JG, Thomas KA, Alexander R and Harris MB. Evaluation of methods of internal fixation of transverse patella fractures: A biomechanical study. J Orthop trauma 1994; 8(2): 147-153.

Please cite this article as: MehdiNASAB SA, Sarrafan N, Fakoor M, Tabatabaei S, Shalamzari S. Assessment results of patellar fracture treatment by method of tension band wiring. Zahedan J Res Med Sci (ZJRMS) 2013; 15(4): 60-62.