

Research Article

Crossing Screws versus Tension Band Wiring for Treatment of Isolated Non-Comminuted Patella Fractures

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Abstract

Introduction: Patellar fractures represent approximately 1% of all skeletal injuries with a high percentage of them having a transverse fracture pattern. We aim to compare crossing screw fixation to MTBW in treating isolated non-comminuted patella fractures by assessing clinical, radiological, and functional results and assessing complications and secondary procedures. We hypothesized that screws would be associated with more better results. **Patients and Methods:** After approval from the local hospital ethical committee, we started to recruit the patients prospectively from the attendants of the emergency department at Minia University Hospital in the period from Jan 2016 to Jan 2017. **Results:** We studied prospectively 12 patients whom we managed by crossing screws and compared their results to the results obtained retrospectively from the files of 10 patients previously managed at our hospital by MTBW. The demographic data of the participants in this study were presented in table 2. **Discussion:** This study had many limitations. The major limitations were the retrospective nature of the comparative group and the small sample-size. Thus, this study design might be a cause of bias. **Conclusions:** PC or mini-invasive crossing screws is an effective surgical procedure for treatment of displaced transverse patellar fractures. It showed significantly better clinical outcomes than that with the MTBW technique all over the period of follow up as measured with the IOWA score. However, the favorable pain scores and ROM results with crossing screws were more evident at early follow-ups, and comparable between both groups at the final follow-up. The fixation stability and union rates were comparable in both groups with no loosening or migration in the crossing screws group. Further biomechanical and comparative studies on a large scale of patients are recommended. **Keywords:** ROM: Range of motion, MTBW: Modified tension-band wiring

Introduction

Patellar fractures represent approximately 1% of all skeletal injuries with a high percentage of them having a transverse fracture pattern⁽¹⁾. Nonsurgical treatment is advocated for fractures with intact extensor mechanism, minimal (less than 2 mm) articular step off, and minimal (1–4 mm) fracture displacement⁽²⁾. Displaced fractures associated with incompetent extensor mechanism represent an indication for surgical interference.

The cornerstones of surgical treatment include:

1- Anatomical reduction to restore articular

congruity which is crucial to avoid the risk of posttraumatic osteoarthritis predisposed by the high-contact forces in the patello-femoral joint or as a consequence of mal-reduction⁽³⁾

2- Stable fixation that allow early mobilization without fracture displacement to avoid reduction of the knee range of motion (ROM) or union problems.

To achieve this target, several fixation techniques involving combinations of fixation techniques (K-wires, screws and cerclage wiring) have been employed over the years, with no ideal one and different rates of success. Modified tension-band

wiring (MTBW) represents the most accepted and widely used technique for treatment of displaced patella fractures⁽³⁾

Biomechanically, this technique aims to neutralize tension forces, anteriorly applied, to the patella via the extensor mechanism and dynamically convert them into compression forces at the articular surface posteriorly⁽⁴⁾. Because of the reported complications over the years, this technique received many modifications and development of new modes of fixation⁽⁵⁾

Aim of the work

We aim to compare crossing screw fixation to MTBW in treating isolated non-comminuted patella fractures by assessing clinical, radiological, and functional results and assessing complications and secondary procedures. We hypothesized that screws would be associated with more better results.

Patients and Methods

After approval from the local hospital ethical committee, we started to recruit the patients prospectively from the attendants of the emergency department at Minia University Hospital in the period from Jan 2016 to Jan 2017.

The inclusion criteria for this study comprised: isolated non-comminuted patella fractures AO/OTA 34-C1, fractures with a primarily transverse fracture line, AO/OTA 34-C2 transverse fractures with a single additional longitudinal fracture line), either closed or types I & II open as per Gustillo and Anderson classification⁽⁶⁵⁾, in patients aged between 20-60 years, while the exclusion criteria included:

- (1) AO/OTA 34-C3 fractures (comminuted fractures).
- (2) Old fractures
- (3) Type III open fractures

- (4) Ipsilateral femur or tibia fracture
- (5) Previous complicated knee injuries with stiffness
- (6) Pathological fractures

From 30 patients with patella fracture, 18 patients met the inclusion criteria for this study and only 12 patients accepted to participate in the study and signed an informed consent. They were prepared to be managed by closed or mini-invasive reduction and fixation by crossing screws and were assigned as group A.

To compare the results of this new technique versus the most commonly used (standard) technique, we retrospectively evaluated the complete records of patients whom were managed at our hospital by MTBW technique. From 15 cases met the inclusion criteria for this study, 10 cases could be matched to the patients in group A and were assigned group B.

Group A: comprised 12 patients, 9 men and 3 women. Their mean age was 40.55 ± 11.2 years (range 23–56 years), the right side was affected in 7 patients and the left was affected in the other 5 patients. The mechanisms of injury were indirect trauma in 8 patients in slip down and motor vehicle accidents in 4 patients. Seven patients had middle third fractures, 3 patients had their fracture in the distal third, and 2 in the proximal third. Eight patients had AO/OTA 34-C1 fractures, and 4 had AO/OTA 34-C2 fractures.

Results

We studied prospectively 12 patients whom we managed by crossing screws and compared their results to the results obtained retrospectively from the files of 10 patients previously managed at our hospital by MTBW.

Table (1): Variable of IOWA score

Variable	Group A N=12	Group B N=10	P-value
Function	33.8±0.9	31.5±4.01	0.066
Pain	32.9±2.5	30±4.08	0.045*
Gait	9.7±0.4	9.4±0.5	0.106
Deformity	9.08±0.7	9.2±0.7	0.734
ROM	9.75±0.45	9.2±0.6	0.028*
Total	95.3±3.6	91.6±4.8	0.060

Discussion

This study had many limitations. The major limitations were the retrospective nature of the comparative group and the small sample-size. Thus, this study design might be a cause of bias. Although most of the studies about treatment of patellar fractures presented limited number of patients, we believe that high-quality big samples, prospective, randomized study is required to define the effectiveness of crossing screws for patellar fracture fixation.

Despite the several weaknesses in our study, some important findings could be detected. Of which the significantly better clinical outcomes with PC or mini-invasive crossing screws than that with the MTBW technique all over the period of follow up as measured with the IOWA score. However, the favorable pain scores and ROM results with crossing screws were more evident at early follow-ups, and comparable between both groups at the final follow-up. Problems with skin irritation, and implant removal rates were significantly higher with the MTBW. Furthermore, patients' satisfaction with the skin incisions was higher with the crossing screws technique. Finally, comparable fixation stability and union rates in both groups were detected with no loosening or migration with the crossing screws technique.

Most transverse patellar fractures result from excessive tensile forces across the extensor mechanism. Displaced fractures more than 8 mm are likely to be accompanied by disruption of the extensor mechanism. Restoration of extensor

mechanism competence is crucial to ensure an optimal outcome and patient satisfaction.

Displaced fractures more than 8 mm are likely to be accompanied by disruption of the extensor mechanism. So, closed reduction by indirect means may not be difficult, especially with less than 8 mm displacement. The indications for surgery include damage to the extensor mechanism or fractures associated with more than 3-5 mm displacement or 2 mm articular surface step-off incongruity. The main goal of the treatment is providing a regular articular surface with a stable fixation that allow early knee ROM.

Conclusions

PC or mini-invasive crossing screws is an effective surgical procedure for treatment of displaced transverse patellar fractures. It showed significantly better clinical outcomes than that with the MTBW technique all over the period of follow up as measured with the IOWA score. However, the favorable pain scores and ROM results with crossing screws were more evident at early follow-ups, and comparable between both groups at the final follow-up. The fixation stability and union rates were comparable in both groups with no loosening or migration in the crossing screws group. Further biomechanical and comparative studies on a large scale of patients are recommended.

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