

## Simplified technique for passing the wire in a single time for the treatment of multifragmentary patella fractures

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**ABSTRACT.** *Objective:* To compare the efficacy and safety of prescription pattern in treatment of multifragmentary patellar fractures in a trauma reference center. *Material and methods:* We conducted a cross-sectional study of patient's record with multifragmentary patellar fractures from December 2010 to December 2013, comparing treatments that include tension band wire, simple cerclage, double cerclage to bone-tendon junction and conservative treatment. *Results:* With a total of 92 patients, including 60 women (65.21%) and 32 men (34.78%), with an average age of 61 years. In the double cerclage, surgery time was shorter (average 38 minutes), and the range of motion showed improvement since the first month. Minor complications were observed in patients treated conservatively (arthrofibrosis). *Conclusions:* At our institution, the most efficient method was the double cerclage to the bone-tendon junction presenting shorter duration of surgery, less ischemic time and faster recovery with range of motion close to normal since the first month after surgery ( $p = 0.000$ ). The safest method of treatment was conservative treatment, with fewer cases with complications ( $p = 0.184$ ).

**Key words:** Fracture, patella, knee, fixation, treatment.

**RESUMEN.** *Objetivo:* Comparar la eficacia y seguridad del patrón de prescripción en el tratamiento de las fracturas patelares multifragmentarias en un centro de referencia de trauma. *Material y métodos:* Realizamos un estudio seccionado transversalmente de expedientes de pacientes con fracturas patelares multifragmentarias de Diciembre del 2010 a Diciembre del 2013, comparando los tratamientos que incluyen obenque, cerclaje simple, cerclaje doble y tratamiento no quirúrgico. *Resultados:* Se analizaron 92 pacientes, incluyendo 60 mujeres (65.21%) y 32 hombres (34.78%), con edad promedio de 61 años. En el cerclaje doble, el tiempo de la cirugía fue más corto (promedio 38 minutos), y la gama del movimiento demostró mejora desde el primer mes. Las complicaciones de menor importancia fueron observadas en los pacientes tratados no quirúrgicamente (artrofibrosis). *Conclusiones:* En nuestra institución, el método más eficiente fue el cerclaje doble a la unión hueso-tendón que presenta una duración más corta de la cirugía, menos tiempo de isquemia y recuperación más rápida con la gama del movimiento cerca de lo normal desde el primer mes después de la cirugía ( $p = 0.000$ ). El método de tratamiento más seguro fue el tratamiento conservador, con menos casos con complicaciones ( $p = 0.184$ ).

**Palabras clave:** Fractura, rótula, rodilla, fijación, tratamiento.

### Level of evidence: IV

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## Introduction

Globally and in Mexico patellar fractures represents approximately 1% of all fractures of the skeleton. It has been observed that this injury is more common in the third to sixth decade of life, predominantly in males (ratio 1.8:1).<sup>1,2</sup> Most injuries are caused by direct trauma by a fall on the anterior aspect of the knee. Usually the fracture is displaced by the action of the quadriceps muscle.<sup>3</sup>

Currently the classification system most used is the AO/OTA.<sup>4</sup> Surgery is indicated with one or more of the following criteria: displacement of two or more millimeters of the articular surface, more than 3 mm between the fragments, disruption of the extensor mechanism, comminuted fractures or osteochondral fractures, marginal fractures or longitudinal line associated with comminution or displacement, open fracture.<sup>4,5,6</sup> The goals of surgical treatment of fractures of the patella are the following: anatomic reduction of the articular surface, restoration of the extensor apparatus, preserving the patella, maintain stable reduction until consolidation.<sup>7</sup>

## Material and methods

A cross-sectional retrospective study was performed, of the records of patients with multifragmentary patellar fractures in our institution from December 2010 to December 2013. Method: Sample technique of consecutive cases of non-probability was performed. We included 92 patients in this study. This study protocol was reviewed and approved by the ethics committee for research, obtaining institutional record R-2014-3401-8.

Patients who were treated during this period were followed from the day of surgery or non surgical management, following surgical record, the day they were discharged, one month, two months and three months after treatment, to compare differences in the applied techniques, measuring effectiveness according to the ranges of motion, recorded in degrees (extension and flexion); to assess the safety of prescription pattern we evaluated acute complications presented and the severity of these; being, slight, requiring only observation and monitoring; moderate, requiring medical intervention noninvasive; and severe, requiring invasive medical procedure. Later we collected all data, and were analyzed with SPSS v20 software. Prescription patterns for the treatment of multifragmentary patellar fractures were recorded: open reduction with tension band internal fixation, double cerclage to bone-tendon junction, simply cerclage, or nonsurgical management with knee cast.

Description of double cerclage to bone-tendon junction for multifragmentary patellar fractures technique: patient in supine position, under tourniquet ischemia. A knee anterior approach is used (Figure 1), proceed to introduce both wires (1.2 mm) together through the patellar bone-tendon junction from lateral to medial, aided by wire pin,

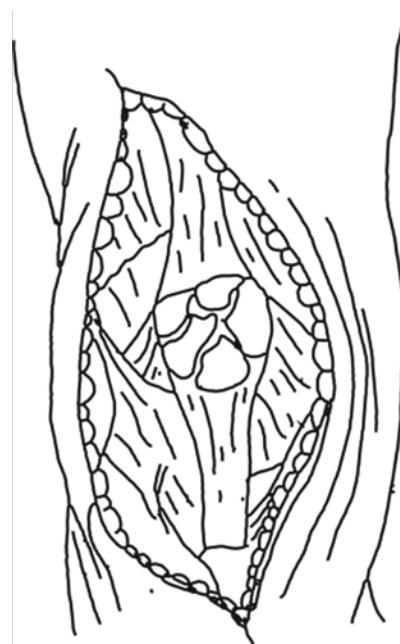


Figure 1:

Anterior incision for the knee is made, continue the incision in layers.

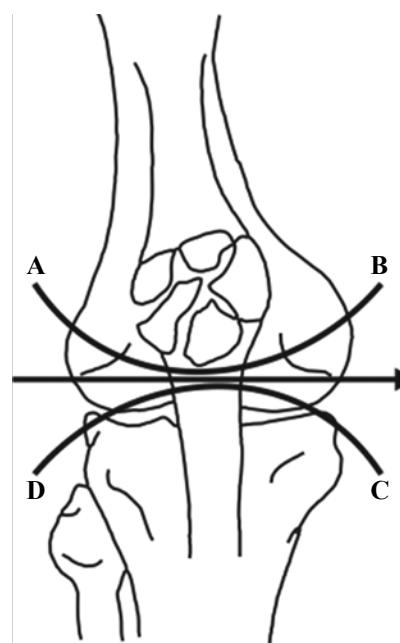


Figure 2:

Proceed to pass the wires together (ASIF 1.2 mm) through the patellar bone-tendon junction from lateral to medial, aided by pass wires, obtaining two lateral and two medial wire ends **A** and **B**, and the other wire ends **C** and **D**.

obtaining two lateral (A and B) and two medial (C and D) wire ends (Figure 2), then the tails B and D are passed in the opposite direction through the quadriceps bone-tendon junction, the D tail is passed above the patella forming an eight figure, and the B tail surround it forming a ring (Figures 3 and 4), it is necessary to adjust both cerclage and tension, flexion-extension maneuvers are performed to produce the compression forces, an absorbable suture is placed to prevent recovery of wire ropes, surpluses are cut and folded so that these do not hurt the soft tissues, stability is confirmed with flexo-extension of the knee, final radiograph is taken.

## Results

Of the 92 patients included in the study, 60 were women (65.21%) and 32 men (34.78%), the age range varied from 32 to 89 years of age, with the highest incidence in the group 51 to 60 years (28.26% of total), with a mean of 61 and standard deviation 13. Sixty-three patients had

comorbidities (68.47%), in order of presentation, type 2 diabetes mellitus in 43 patients (46.73%), hypertension in 40 patients (43.47%) and others in 11 patients (11.95%, these conditions were dyslipidemia, epilepsy, asthma, muscular dystrophy, chronic renal failure, liver failure). Only 29 patients were previously healthy (31.5%). The left patella was observed more frequently injured, in 49 patients (53.26%) and the right in 42 patients (46.73%), the most frequent type of injury, according to the classification of the AO group was type 34C2.1, in 37 cases (40.21%) and least frequent 34C2.2 in 8 patients (8.69%). The most common mechanism of injury was a direct trauma of the knee by a fall in 72.82% of cases (67 patients), followed in frequency by direct trauma or aggression in the 11.95% (11 patients), fall from height and motor vehicle accidents by 7.60% each (7 patients).

It was observed that patients have on average six days in hospital, being at minimum one day and a maximum of 17 days with a standard deviation of four days, whereas from the day of admission until the day of their discharge. Patients had an average waiting time for treatment from the day of their hospitalization until treatment five days (minimum one and maximum of 12 days, three days standard deviation). Surgical time varied according to the treatment technique applied taking as a minimum of 25 minutes up to 120 minutes with an average duration of 50 minutes, not counting the group of conservative treatment as this was not subjected to surgery. According to the treatment, the lowest average time for surgery was double cerclage bone-tendon junction (38 minutes) and the longest was the tension band treatment (62 minutes) ( $p = 0.000$ ). The ischemic time varied according to the method of treatment having a similar to the surgery time distribution ( $p = 0.001$ ).

The postoperative complications occurred in a total of 11%, with 89% without complications (Figure 5), also expressed according to the method of treatment used (simple cerclage two cases of infection surgical wound, a case of arthrofibrosis and a case of displacement of the fracture line in the double cerclage bone-tendon junction, a case of surgical wound infection is reported, one case of wound dehiscence and minor complications consisting erythema and mild residual pain, for the tension band three cases of intolerance of osteosynthesis material with migration of Kirschner wire, conservative treatment reported two cases of arthrofibrosis showing no statistical significance ( $p = 0.184$ ). Thus same according to the severity of the complications, resulting in uncomplicated patients (75 patients, 81.5%), patients with mild severity of complications (6 patients, 6.52%, three double cerclage for bone-tendon junction 3.2% 2 in the tension band 2.17%, and 1 for the conservative treatment group 1.08%), moderate severity (4 patients, 4.34%, of which the simple cerclage group presented 2 cases, double cerclage and the conservative case each group) and severe severity (7 patients, 7.6%, 3 for simple

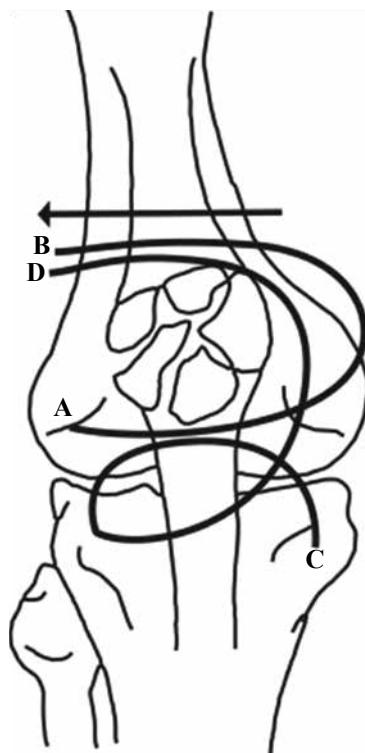


Figure 3:

Tails **B** and **D** are passed in the opposite direction through the quadriceps bone-tendon junction.

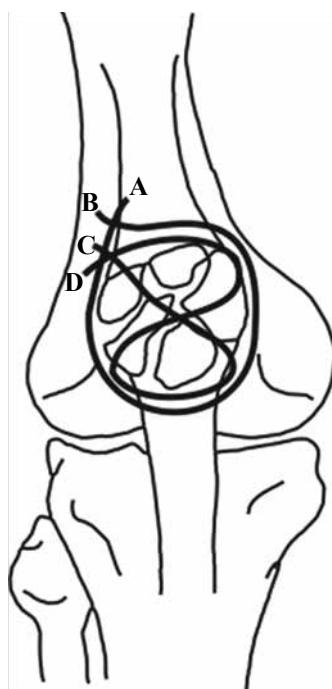
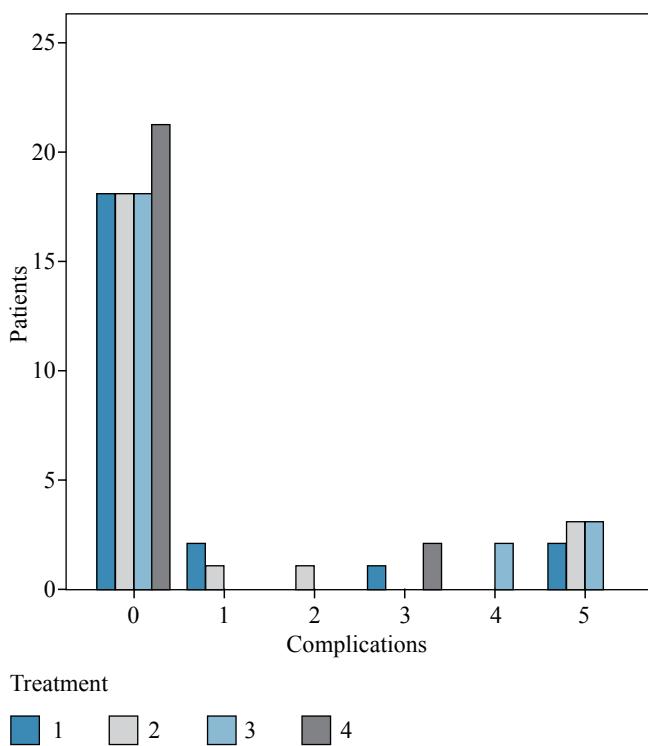


Figure 4:

The **C** tail is passed above the patella forming an eight figure, and the **A** tail surround it forming a ring.



**Figure 5:** Acute complications: 0. No complications, 1. Infection of the wound, 2. Wound dehiscence, 3. Arthrofibrosis, 4. Intolerance of osteosynthesis material, 5. Other. Treatment: 1. Simple cerclage, 2. Double cerclage to bone-tendon junction, 3. Shroud, 4. Conservative.

banding and tension band and a case for double cerclage group  $p = 0.372$ .

The effectiveness of different prescribing patterns in the treatment of multifragmentary fractures of the patella was assessed with flexion and extension in the first, second and third months of postoperative controls, having no record of conservative management until after retirement of the cast, recording the overall range of motion until the third month. Finding statistical significance only in flexion in the first and second month of evolution, showing a better and faster evolution favorable treaty with the double cerclage bone-tendon junction group ( $p = 0.000$ ) for the third month evolution is similar so it has no statistical significance ( $p = 0.219$ ), to the extension there was no statistical significance at one month ( $p = 0.061$ ) for the second and third months ( $p = 0.250$  and  $p = 0.094$ , respectively).

The consolidation was similar in the four groups showing no statistical significance ( $p = 0.062$ ). A summary analysis of the statistical significance of the variables is presented in *Table 1*.

## Discussion and conclusions

In this study, we sought to compare the efficacy and safety of different prescribing patterns for the treatment of multifragmentary fractures of the patella. Coinciding with the universal literature, where it is mentioned that

**Table 1: Summary of the variables and their statistical significance.**

Variable	Statistical significance	p value
Acute complications	No	0.184
Severity of the complications	No	0.372
Flexion 1st month	Yes	0.000
Flexion 2nd month	Yes	0.000
Flexion 3rd month	No	0.219
Extension 1st month	No	0.061
Extension 2nd month	No	0.250
Extension 3rd month	No	0.094
Surgery time	Yes	0.000
Ischemia time	Yes	0.001

patients achieve a range of full mobility at three months after surgery, likewise, reported complications ranging from 0% to 25% (in our study being reported 17 cases 11% of total). The most common complications include infection, there were reported (3 cases, 3.26%), failure of the implant (2 cases, 2.17%) and mild symptoms associated (such as clamping the skin discomfort and pain).<sup>8</sup> Working out these complications, and treatment monitoring of patients, they all reach complete consolidation of the fracture and acceptable ranges and functional mobility.

Significant difference was found in the outcome variables: flexion in the first and second months and ischemia time. Most likely due to technical double cerclage bone-tendon junction technique is more easily with fewer resources, providing stability to fracture allowing faster patient recovery. Research supported by Curtis *et al.* showed that Pyrford fixing method provides better fixation than the tension band modified especially in the multifragmentary fractures, this method is innovative in Figure of 8 for additional fixation.<sup>9</sup> Ong *et al.* reported an improvement with a 92.5% average on the scale of the activity of daily living, but the numbers of patients reviewed were too few to assert any conclusion.<sup>8</sup>

We conclude based on observed and recorded in patients treated for multifragmentary patellar fracture at our institution, the most efficient method is the double cerclage to bone-tendon junction with less time, on average, in surgery with less ischemic time, greater technical ease, resources, as well as a faster recovery with range of motion close to normal since the first month after surgery.

The safest method of treatment according to the results was the conservative treatment, with fewer cases with complications and minor complications were presented without requiring invasive care. We found no significant difference in fracture healing and that 100% of these injuries consolidated, mobility levels are very similar for the second

and third postoperative month coinciding with the literature that patients recover arches acceptable and functional mobility, not you can say that complete, since most of the patients have a certain condition of the knee joint by the age of onset of these injuries.

The hospital stay is increased in this report for the lack of operating time due the high demand of patients in our hospital, also affected the waiting time for treatment for the same reasons. We consider and recommend the use of the technique of double cerclage to bone-tendon junction to improve outcomes in patient care by reducing the surgical and ischemic time, ease and accessibility of technical, cost reduction and improvement observed since the first month of treatment, improving early patient mobility.

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The authors of this study have no conflict of interest.

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