



International Journal of Orthopaedics Sciences

ISSN: 2395-1958
IJOS 2018; 4(2): 729-731
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www.orthopaper.com
Received: 14-02-2018
Accepted: 15-03-2018

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Minimally invasive technique of tension band wiring in patella fractures

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DOI: <https://doi.org/10.22271/ortho.2018.v4.i2k.104>

Abstract

Introduction: Patellar fractures constitute 1% of all skeletal fractures. Traditionally they are operated by open technique. In today's world of minimally invasive surgery, doing open technique of wiring seems less justified for this percutaneously palpable bone fracture particularly in transverse fractures. Hence, we developed a technique of percutaneous fixation of transverse displaced patella fracture not described yet using parallel K wires and tension band wiring principle and carried out a study to analyze its results

Methods: Prospective study was carried out at Mimer Medical College. 20 males and 12 females with transverse fractures of the patella were selected for operation with minimally invasive technique of tension band wiring. Patients were evaluated for range of motion, pain, operating time and complications at four months post operation.

Results: 32 patients underwent tension band wiring successfully. Radiological time for union was 10.2+/- 1.8 weeks also had nearly full range of motion. Average operating time was only 40.5 minutes. No patient developed infection and there was no wire breakage and irritation. VAS scores were good and power of quadriceps was also good.

Conclusion: Minimally invasive technique of tension band wiring in patella fractures gives encouraging results.

Keywords: Patella fractures, minimally invasive, percutaneous, wiring

Introduction

The patella is a sesamoid bone embedded in quadriceps tendon. Patellar fractures constitute 1% of all skeletal fractures [1]. Only undisplaced patella fractures or with minimal displacement can be managed non operatively. However for displaced fractures of patella with separation of more than 3mm between the fragments and articular incongruity of 2 mm are considered as indications for surgical management of patellar fractures². Out of all types of patella fractures simple two part transverse patellar fractures are nearly half of all patellar fractures [1,2]. Other types are vertical, marginal, osteochondral etc.

Traditionally they are operated by open technique with parallel 'K' wires and tension band wiring or cancellous screw fixation or encirclage wiring etc. Out of these parallel K wires and tension band wiring is the most popular technique [3, 4]. Surgeons often encounter complications like infection, delayed wound healing, broken wires, irritation, fixation failure, etc. with this technique [2,3]. We thought that complications can be minimized by our technique of percutaneous parallel 'K' wires and tension band wiring technique. In today's world of minimally invasive surgery, doing open technique of wiring seems less justified for this percutaneously palpable bone fracture particularly in transverse fractures. Hence, we developed a technique of percutaneous fixation of transverse displaced patella fracture not described yet using parallel K wires and tension band wiring principle and carried out a study to analyze its results.

Material and Methods

Prospective study was carried out at Mimer Medical College from July 2005 to June 2016. Total 32 patients were included which were operated by percutaneous tension band wiring and parallel K wires. These patients had presented to orthopedic trauma care centre at MIMER

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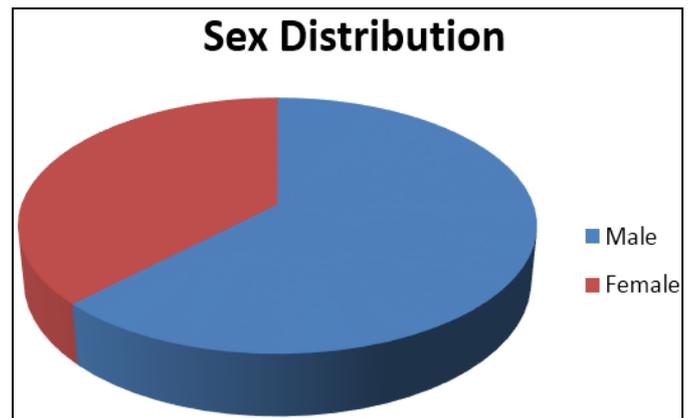
Medical College. We excluded comminuted fractures, open fractures, more than 3 weeks old fractures from our study. We took consent for participation in study. We also got local ethical committee approval. Patients were operated under spinal or epidural anesthesia. Before doing the procedure a tourniquet was tied and inflated. Under C-arm guidance attempt was done to do closed reduction with patella reduction clamps applied through stab incisions at superior border of superior fragment and at inferior border of inferior fragment. If this was possible we went ahead with the procedure. We did percutaneous removal of fracture hematoma through another stab incision lateral to the fracture gap. We inserted 2 mm 'K' wires under quadriceps tendon from laterally to medially percutaneously till it came out of skin medially. Here we took a stab incision (Superomedial stab incision) and passed a cannulated drill bit over this wire from medial to lateral direction. When drill bit came laterally we took a stab incision (Superolateral stab incision) there to allow drill bit to come out through skin. Then we pulled out the K wire over which drill bit was passed and passed stainless steel wire 1.5 mm through cannulated drill bit till it came out medially out of skin. We then reduced the patellar fractures using reduction clamps and checked reduction on the C-arm. We then flexed the knee to forty degrees and passed 2 parallel 'K' wires across the fracture and got them out of inferior fragment. Then we took a stab incision inferolateral to lower fragment of patella (Inferolateral stab incision). Through this stab incision we passed cannulated drill bit towards superomedial; stab incision subcutaneously over patella till it came out of superomedial stab incision. Then we inserted stainless steel wire into this drill bit till it went inside. Then we pulled drill bit out of inferolateral stab incision. Then we took a stab incision inferomedial to lower patellar fragment. We passed cannulated drill bit from inferomedial stab incision towards inferolateral stab incision under patellar tendon till it come out of inferolateral stab incision. We then inserted stainless steel wire into it and pulled it inferomedially along with the drill bit. Then we passed cannulated drill bit from superolateral stab incision towards inferomedial stab incision over patella under skin till it come out of inferomedial stab incision. Then we passed stainless steel wire into cannulated drill bit sufficiently, then we withdrawn

cannulated drill bit, along with it stainless steel wire came out. We then pulled both ends of stainless steel wire and with the help of wire tensioner tensioned the wires and tied knot after ensuring good reduction and tensioning. Then we cut extra wires with the help of wire cutter. All this was achieved without much difficulty but almost always some problem was encountered in bending cut ends of 2 parallel 'K' wires superiorly but with experience it become easy. Thus, the entire surgery was accomplished percutaneously. We did not use wire passers at all and found the cannulated drill bit more useful. Dressings were done.

Physiotherapy was started 24 hours after surgery and patients were discharged after two days. Patients were instructed to continue physiotherapy at home. Sutures were removed at 12-14 days post op. Full weight bearing was allowed after 2 days with a hinged knee brace for support. Patients were evaluated at 6 weeks, 12 weeks, 16 weeks and 6 months. Range of motion was measured using a goniometer. Quadriceps wasting was measured by the girth of the thigh at the point of maximum bulk. Pain was evaluated by VAS score. Extension power of knee was assessed using the medical research council grading.

Results

Male	20
Female	12



Average age of patients	37.4 years
Radiological time for union	10.2 +/- 1.8 weeks
ROM (Average flexion by 24 weeks)	140.2 +/- 4.8 degrees
Pain (VAS Score by 24 weeks)	1.1 +/- 0.2
Extension by 12 weeks	140 degree
Mean thigh wasting	0.7 (range 0.3 cm to 1 cm)
Average operating time	40.5 minutes (30 minutes to 50.5 minutes)

Complications

Infection	None
Wire breakage/irritation	None

Discussion

Two part transverse patellar fractures are best managed by open reduction and internal fixation with 2 parallel K wires and tension band wiring according to literature and it is better than treatment in which screws are used [2, 4, 5]. However easy surgery to perform for an experienced orthopedic surgeon it may has its own complications like delayed wound healing, wire irritation or breakage, delayed union, knee stiffness, infections etc [4, 5]. Patella is an easily palpable percutaneous bone and nowadays for such bones, minimally invasive

surgery is widely advocated [6, 7]. However, most of minimally invasive surgeries revolve around passage of percutaneous screw passage and wiring around these screws which do not give good advantage of tension band principle which has good union rate [6, 7].

Other studies compare open and arthroscopic assisted fixation and quotes good results in minor displaced fractures [7, 8, 9, 10, 11, 12]. We therefore performed closed reduction and percutaneous tension band wiring, over percutaneously passed parallel 'K' wires under C-arm guidance and analyzed the results of our data. We excluded cases of comminuted patella fractures as parallel K wires and tension band wiring is difficult in comminuted fractures [13]. Retinacular repair was not a part of our technique as we got good reduction by closed

methods and retinacular repair can only be done by open techniques [14]. This was not necessary in other percutaneous techniques [6, 7, 8, 9, 10].

In 4 out of 36 patients closed reduction could not be achieved and we went with open reduction. In our study time for union was 10.2+1.8 weeks. Average flexion at 24 weeks (6 months) was 140+4.8 degrees and VAS score was 1.1+0.2 at 6 months. Mean thigh wasting was 0.7 cm (0.3 to 1cm) at 6 months. Full extension was achieved in all patients at 12 weeks onwards. Average operating time was 40.5 minutes (30 to 50.5 minutes). Since we had no control group to control the results with, we compared results with studies in literature.

For open techniques average duration of hospital stay was 16 days according to Hanuman tharaya *et al.* [15]. In our study it was just 7.2 days. In this study at 6 months 25% patients have ROM <120 degrees, quadriceps wasting of 1 cm at 6 months. In our study ROM is > 120 degrees in all cases and quadriceps wasting <0.7 cm in almost all cases. In his study extensor lag at 6 months is 0%. Radiological union was achieved at an average of 3 months in his study. This was observed in our study but there was no extensor lag in our study at 3 months (i.e. much earlier). In his study (3 out of 32 patients) had moderate pain at 6 months but in our study moderate pain (VAS 3-7) was not seen in any patient at 6 months. In other study in which open reduction and parallel K wires and TBW was done by Ozdemir *et al.*, they reported 90% good or excellent results [16].

In study by Burg EE *et al.*, they obtained radiological union at 13 weeks (average) by open technique [17]. Mean operation time was 90 minutes in study by Hanuman Tharaya *et al.* but in our study it was just 40.5 minutes. This is accordance with time lost in opening fracture, doing retinacular repair and closing incision in open technique. In our technique some time was lost in bending the upper ends of parallel K wires but only in initial few cases as it had a learning curve. Thus our procedure takes short operating time, gives good union rate with fewer complications and good functional results at least equal to open procedures. However our study has limitations that we had a small no of patients and was a non-comparative study and we had to compare results with studies in literature which can create bias.

Conclusion

Closed method of tension band wiring for transverse fractures of the patella gives good radiological and functional results with fewer complications and less operative time and has all the advantages of a minimally invasive surgery.

However, it has a learning curve as any new surgical procedure.

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