

Fixation of Comminuted Fracture of the Inferior Pole of the Patella Using Suture Anchors with Reinforcement by Ipsilateral Semitendinosus Tendon

Mohammed M. Mansour, MD, Mohamed A. Abdel Salam, MD, Shamel Elgawhary, MD, Ahmed EL Naggar, MD

Mohammed M. Mansour, Mohamed A. Abdel Salam, Shamel Elgawhary, Ahmed EL Naggar, Department of Orthopedic, faculty of medicine, Zagazig, University, Zagazig, Egypt

Conflict-of-interest statement: The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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Correspondence to: Mohammed Mahmoud Mansour, Egypt Zagazig Alqwmia Elkhashab Street No 12 hai Hassan Khedr house, Department of Orthopedic, faculty of medicine, Zagazig, University, Zagazig, Egypt.

Email: mohammedmansour75@yahoo.com

Telephone: +002-055-2333400

Received: May 5, 2018

Revised: May 28, 2018

Accepted: May 31 2018

Published online: June 28, 2018

ABSTRACT

BACKGROUND: Many options have been used for treatment of comminuted fractures of the inferior pole of the patella as the ideal treatment has not yet been identified. The hypothesis was that fixation of these fractures using suture anchors with reinforcement by ipsilateral semitendinosus tendon will be rigid enough to allow early rehabilitation with good functional results with no need for further surgery for hardware removal.

METHODS: Ten patients (7 males and 3 females) with closed comminuted fractures of the inferior pole of patella were included in this study. Of the ten fractures, six resulted from a fall and four

resulted from a car accident. The average age of patients was 31.6 years (range, 19 to 42 years). All patients were operated within 24 hours from the trauma. Fixation of fracture was done using suture anchors with reinforcement by ipsilateral semitendinosus tendon.

RESULTS: All fractures treated with this technique healed. All patients were followed-up for an average of 21 months (range, 13 to 30 months). Patients were evaluated according to the patellofemoral rating system. All patients were available for follow-up. The average patella femoral score was 94.7 points. The score was excellent for nine patients and good for one patient.

CONCLUSION: Fixation of comminuted fractures of the inferior pole of the patella using suture anchors with reinforcement by ipsilateral semitendinosus tendon left attached distally is rigid enough to allow early motion and shows good functional results. The technique is relatively simple and feasible. Harvest of the tendon is easy with low donor site morbidity. No further surgery for hardware removal is necessary.

Key words: Inferior pole of patella; Comminuted fracture; Anchor suture; Fixation

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Mansour MM, Salam, MAA, Elgawhary S, EL Naggar A. Fixation of Comminuted Fracture of the Inferior Pole of the Patella Using Suture Anchors with Reinforcement by Ipsilateral Semitendinosus Tendon. *International Journal of Orthopaedics* 2018; **5(3)**: 932-935 Available from: URL: <http://www.ghrnet.org/index.php/ijo/article/view/2328>

INTRODUCTION

Fractures of the distal pole of the patella are bony avulsions of the patellar tendon that account for 9.3% to 22.4% of all patellar fractures that need surgical treatment. Commonly these injuries are displaced with loss of knee extension due to retinaculum disruption. A lateral x-ray will show patella alta and an increased Insall-Salvati ratio^[1,2].

Displaced comminuted fractures of the inferior pole of the patella are usually difficult to reduce and fix in such a rigid way to permit early mobilization of the knee^[3].

Various methods have been described for fixation of these fractures. But the best method of management is still controversial^[1-4].

The classic treatment of displaced comminuted inferior pole fractures is excision of the comminuted pole with reattachment of the patellar tendon using transosseous sutures. Other surgical options include tension band wiring, cerclage wiring and screw fixation^[1,2].

Few authors used suture anchors for fixation of inferior patellar pole fractures but without any form of enforcement and so they had to delay mobilization for a long time^[5].

Inferior pole resection puts the patella in lower position (patella baja), this shortens the extensor mechanism, which increases compression forces in the patellofemoral joint leading to cartilage damage. All these sequences can be prevented by fixing the inferior patellar pole of patella, with expectation of a better functional outcome^[2].

PATIENTS AND METHODS

Ten patients (7 males and 3 females) with extra-articular comminuted and displaced fractures of the inferior pole of the patella were treated using suture anchors with reinforcement by ipsilateral semitendinosus tendon. Of the ten fractures, six resulted from a fall and four resulted from a car accident. All patients were operated within 24 hours from the trauma. The average age of patients was 31.6 years (range, 19 to 42 years).

Surgical Technique

The procedure was performed under spinal anesthesia. Patients were placed in supine position on the operating table. A well-padded thigh tourniquet was applied. Preoperatively antibiotic (one gram of Ceftriaxone) was given intravenously, after a test dose.

A longitudinal midline incision was made from the upper pole of the patella to the tibial tuberosity. Comminuted fracture of the inferior pole was identified and hematoma was removed and irrigation with saline was done.

Then ipsilateral semitendinosus tendon was harvested while the leg was externally rotated and the knee joint was flexed to 60° through an oblique 4cm incision starting 2 cm medial to, and just distal to, the tibial tubercle (Figure 1). The subcutaneous tissue and fat were sharply dissected to expose the Sartorius fascia. Once identified, the aponeurosis was opened in line with its distal fibers.

The gracilis and semitendinosus were identified by palpation as they separate and pass over the posteromedial border of the tibia. The gracilis is round and palpable deep to the Sartorius whereas the semitendinosus is flatter and inferior to the more palpable gracilis. Once the 2 tendons have been identified, the semitendinosus was freed using a curved clamp, it is critical to remove all tissues attached to the tendon as far back as possible because these strands of tissue can misguide the tendon stripper and cut the tendon. The tendon was left attached to the tibia. An open stripper must be used. By slow oscillating back and forth motion the stripper was advanced beneath the semimembranosus sling to avoid premature cutting. The tendon is left attached distally and the free end sutured by Ethibond 5 suture.

Two horizontal mediolateral tunnels were drilled. The first tunnel was drilled through the upper half of the patella not in the lower half to allow space for fixation of the suture anchors in the center of the proximal fragment of the patella. Drilling of the tunnel was done over a pin which is used to pull suture at the free end of the graft from medial to lateral. The second tunnel was drilled in the upper tibia at the level of the tibial tuberosity over a pin which is used to pull suture at the free end of the graft from lateral to medial.

Two suture anchors of size 3.5 mm each loaded with 2 ultra braid

sutures (*Smith-Nephew, Ma, USA*) were fixed in the proximal fragment of the fractured patella where the sutures will be passed in the proximal part of the patellar tendon to do reduction of the fragments.

At that time graft should be passed through the patellar tunnel from medial to lateral then through the tibial tunnel from lateral to medial. The graft was used to help to pull down the patella by pulling the tendon. Now reduction of the inferior pole was done using the sutures. When good reduction is by confirmed by intra-operative X-ray (C-Arm) knots should be tied.

After measuring the length of the patella and the patellar tendon on the lateral x-ray considering the Insall-Salvati ratio (normal length of the patellar tendon is approximately equal to the length of the patella). Then the tendon graft can be tensioned which is usually done at 90° knee flexion. The free end of the semitendinosus tendon is sutured to itself on the upper medial aspect of the tibia (Figure. M&N) using Ethibond 2 suture.

Wounds were irrigated and closed in the standard technique.

Patients were placed in immobilizer in full extension for four weeks to allow for healing of the retinaculum and to allow for some healing of the inferior pole to the proximal part of the patella. Patients were encouraged to do isometric quadriceps exercises, straight leg exercises, ankle pumps and to do weight bearing as tolerated with the help of crutches on the knee immobilizer immediately postoperative.

Patients were discharged on the second postoperative day.

After four weeks the immobilizer was discontinued range of motion started.

RESULTS

The average age of patients was 31.6 years (range, 19 to 42 years). All fractures treated with this technique healed. All patients were followed-up for an average of 21 months (range, 13 to 30 months). Patients were evaluated according to the patellofemoral rating system. All patients were available for follow-up. The average patellofemoral score was 94.7 points (Table 1). The score was excellent for nine patients and good for one.

Eight patients were free of pain. Two patients had occasional pain after prolonged work or recreational activity. None of our patients had to change his or her job because of knee problems. When the active range of motion of the involved knee was compared with that of the uninvolved knee, nine patients showed full flexion and one lacked 15° of full flexion. The patellar height was assessed radiographically with use of the method of Blackburne and Peel. Normal patellar height was found in all patients. We had no complications in our patients.

DISCUSSION

Extra articular fracture of the inferior pole of patella represents less than 10% of all patellar fractures. They are frequently comminuted, displaced and difficult to reduce and fix firmly enough to allow early mobilization of knee joint^[6].

The patella is an essential part of the extensor mechanism. Loss of patella reduces quadriceps muscle power, tone and volume^[7].

Up to a 30% increase in the quadriceps force is required to achieve full extension in cases treated with patellectomy^[8].

Inferior pole resection (partial patellectomy) results in shortening of Patellar tendon which leads to shortening of the extensor mechanism and increased compression forces in the patellofemoral joint resulting in cartilage damage and poor functional outcome. So preservation of the inferior patellar pole improves functional results^[4].

Excision of the inferior patellar pole (partial Patellectomy) and repair of Patellar tendon to the proximal fragment of the Patella was the standard treatment of comminuted fracture. However this leads to reduction of Patellar height and loss of efficiency of extensor mechanism. So this should not be advocated as the treatment of choice^[9].

Fracture fixation is an alternative to excision for treatment of comminuted inferior pole fractures to obtain an accurate reduction, rigid fixation and to restore the knee extension mechanism which allows early range of motion. However this is usually difficult to achieve due to the high degree of comminution of these fractures^[10].

Figure of eight wiring of the patella and tibia to protect the repair of Patellar tendon is an option but this carries the risk of breakage of the wire loop. Also the wire loop may cause anterior knee joint pain because of the tenting during knee movement^[10].

Separate vertical wiring for the fixation of the comminuted fracture of the inferior pole of Patella through vertical oblique tunnel in the proximal fragment was reported to have excellent functional outcome^[11].

The basket plate is used for osteosynthesis of the comminuted fractures. It has the shape of the inferior pole of the patella which allows it to hold the pole fragments in position leading to preservation of normal height of patella. Basket plate allows rigid fixation which permits immediate mobilization and early weight bearing. However the technique is difficult and usually needs second surgery for removal^[2].

An option for fixation of extra articular fracture of inferior pole of Patella is by an on needle stainless steel suture^[11].

Kumar et al^[5] Used suture anchors for repair of comminuted inferior pole fractures of patella in five patients. To protect the repair from the powerful forces generated by the quadriceps mechanism they used figure of eight, load sharing wire or cable or used prolonged immobilization. The cable transmits loads directly from the Quadriceps tendon or proximal pole of the patella to the tibial tubercle but this creates additional stress risers in the Patella and the Tibial Tubercle. The cable or wire requires removal one to two years after surgery.

In our study of ten patients, we fixed the comminuted fractures of the inferior pole of the patella using suture anchors with reinforcement by ipsilateral semitendinosus tendon left attached distally which gave excellent functional outcome. We achieved Preservation of low-

er patellar pole, ensured normal Patellar height and hence retained efficient extensor mechanism. The technique is relatively easy and the best part is, as there is very little hardware, it does not irritate the tissues around the knee with no need for second procedure. Our study group is of small size due to the fact that these fractures are rare.

CONCLUSION

The use of ipsilateral semitendinosus tendon augmentation with

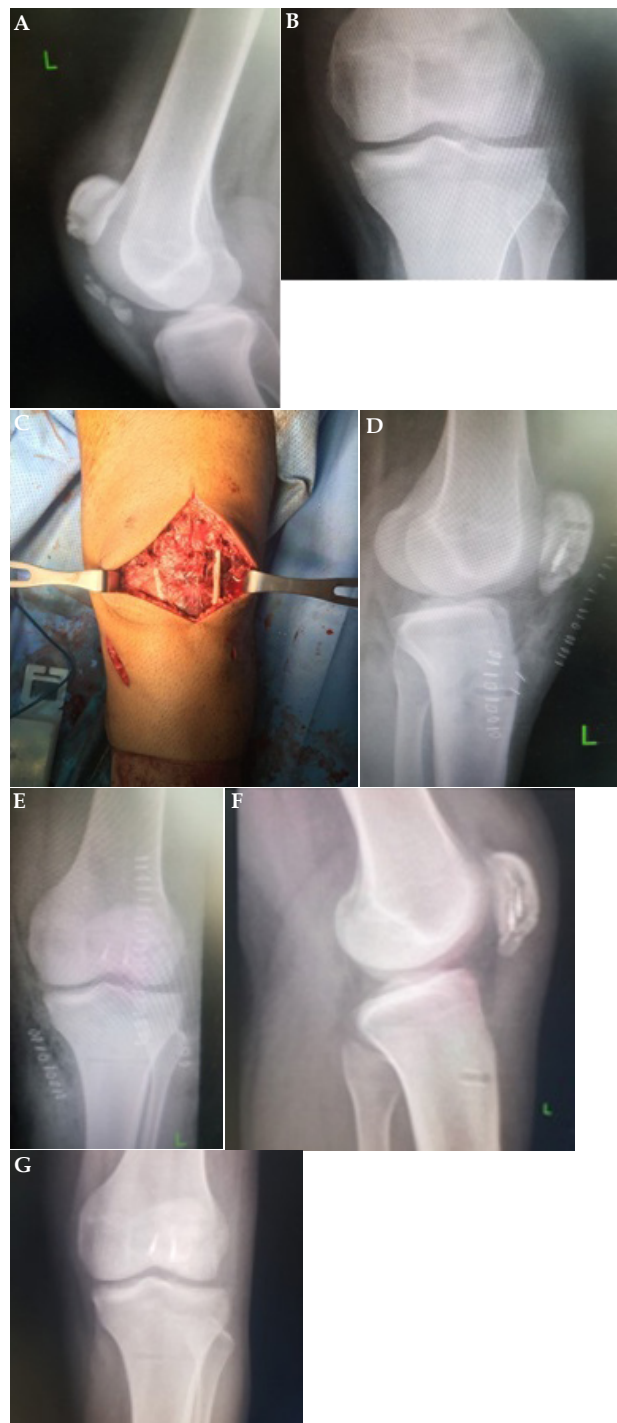


Figure 1 (A&B): preoperative lateral and anteroposterior X-rays of the fracture. (C): intraoperative photo showing the semitendinosus tendon used for reinforcement of the repair. (D&E): immediate postoperative lateral and anteroposterior x rays of the fracture showing reduction and two anchors at the center of the patella. (F&G): lateral and anteroposterior x rays at final follow up.

Table 1 patient evaluation according to the patellofemoral rating system.

Criterion	Mean score of the ten patients
Pain (10 points)	9.1 (8 - 10)
Swelling (5 points)	4.8 (4 - 5)
Giving way (5 points)	5 (5)
Movement (15 points)	14.1 (13 - 15)
Work (10 points)	10 (10)
Effusion (6 points)	5.2 (5 - 6)
Active range of motion (12 points)	11.2 (10 - 12)
Extension lag (4 points)	4 (4 - 4)
Patellofemoral compression pain (3 points)	2.8 (2 - 3)
Atrophy (8 points)	7.2 (6 - 8)
Isokinetic quadriceps strength (10 points)	9.3 (8 - 10)
Radiographic analysis (12 points)	12 (12 - 12)
Total (100 points)	94.7 (86, 100)

The patients were evaluated with use of the Cincinnati rating system¹⁴ as adapted by Saltzman et al^[4] to address problems of the patellofemoral joint. The overall score was rated as excellent (90 to 100 points), good (80 to 89 points), fair (70 to 79 points), or poor (< 70 points). The maximum possible score is given in parentheses. The values are expressed as the mean and the standard deviation, with the minimum and maximum scores in parentheses.

suture anchors in treatment of extra-articular Comminuted and displaced fractures of the inferior pole of the patella allows early motion and shows good functional results. The technique is relatively simple and feasible. Additionally, the strength of the graft allows early rehabilitation, and no further surgery for hardware removal is necessary. This method should be the first option for treatment this type of fractures.

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Peer Reviewer: Sameer Haveri