

**SURGICAL MANAGEMENT OF GROSSLY COMMINUTED FRACTURES
OF DISTAL POLE OF PATELLA**

**A STUDY DONE AT NALCO HOSPITAL
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BY

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INTRODUCTION

Patella is the largest sesamoid bone in the body. The quadriceps tendon insert at the superior pole of the body and the patellar tendon originates from the inferior pole and inserts into the tibial tuberosity. The articular surface has the thickest layer of cartilage in the body, upto 5 mm. The patella is of importance for the extension of knee joint.

Fractures of the patella constitute almost 1% of all skeletal injuries, resulting from either direct or indirect trauma. The anterior subcutaneous location of the patella makes it vulnerable to direct trauma, such as the knee striking the dash board of an automobile or from a fall on the anterior knee. These injuries often are comminuted or displaced and may include chondral injury to the distal femur or patella. Fractures caused by indirect mechanisms result from a violent contraction of the quadriceps with knee flexed. These fractures usually are transverse and may be associated with tears of the medial and lateral retinacular expansions. Most patellar fractures are caused by a combination of direct and indirect forces. The most significant effects of fracture of the

patella are loss of continuity of the extensor mechanism of the knee and potential incongruity of the patello-femoral articulation.

Fractures of the patella can be classified as un-displaced or displaced and sub classified further according to fracture configuration such as , transverse, oblique, vertical and comminuted or stellate patellar fractures, which is associated with a variable amount of displacement. Inability of the patients to extend the affected knee actively usually indicates a disruption of the extensor mechanism and a torn retinaculum, which require surgical treatment.

The treatment of comminuted fractures of the patella varies. There are proponents for patellectomy and those for repair. Often only the distal pole of the patella is fragmented, leaving a substantial and relatively normal proximal fragment. This fragment is an important part of the extensor mechanism and should be preserved. To perform partial patellectomy of distal pole with retention of proximal pole and suturing of patellar tendon to it seems to be reasonable.

MATERIALS AND METHODS

In this series only the grossly comminuted fracture of distal pole of patella which were managed by partial patellectomy with patellar tendon suturing to proximal major fragment are taken for study.

Over a period of 11 years (2000 to 2011), 22 cases of comminuted fracture of distal pole of patella were treated in Nalco Hospital, Damanjodi. Out of 22 cases, 16 were male and 6 were females. The age ranged from 30 years to 50 years; and 14 fractures were of the right side and 8 of the left side.

At admission aspiration of the knee was done and a compression bandage with knee back slab applied. Those who had superficial skin injuries, were treated with cleaning and dressing initially. All patients were kept under antibiotic coverage. All the cases

were radiologically evaluated with AP, lateral and axial views pre-operatively and were thoroughly evaluated for medical fitness for surgery. All were operated within one week to 10 days of admission.

All the 22 cases were managed by partial patellectomy and suturing by stainless steel wire of patellar tendon to the major proximal fragment transosseously taking care to avoid a tilt of the fragment so that to prevent its sharp edge erode the patellar groove.

OPERATIVE PROCEDURE

After spinal or general anaesthesia surgery was performed under tourniquet through standard transverse incision in majority of cases and through longitudinal incision in 6 cases to avoid deep skin wound present over the knee at incision site and the joint was cleaned thoroughly and loose fragments of bone and cartilage were cleared.

The intact proximal half of patella was preserved and the comminuted fragments of distal pole were excised, leaving a small fragment of the distal and anterior part of the patella buried deep within the tendon to facilitate anchorage. The articular edge of the proximal fragment was trimmed and smoothen with a rasp. Then two holes were drilled beginning on the fracture surface of the proximal fragment just anterior to the articular cartilage in a proximal direction. A No.18 stainless steel wire was passed through the patellar tendon distal to the small fragment of bone and then inserted its ends through the holes in the remaining part of the patella. Then the wire was drawn tightly so that the small fragment of bone in the patellar tendon was evaginated and remained in the axis at a right angle to its original position and apposed the fractured surface. By placing the wire suture in a posterior position through the fracture surface, the patellar tendon was come in contact with the articular edge of the fragment and not its anterior edge. Thus by this method of wire suturing, the tilt of the proximal fragment was prevented and its raw surface did not contact the femur. In majority of cases a cerclage wiring was done for additional protection and early mobilisaiton of patient.

AFTER TREATMENT

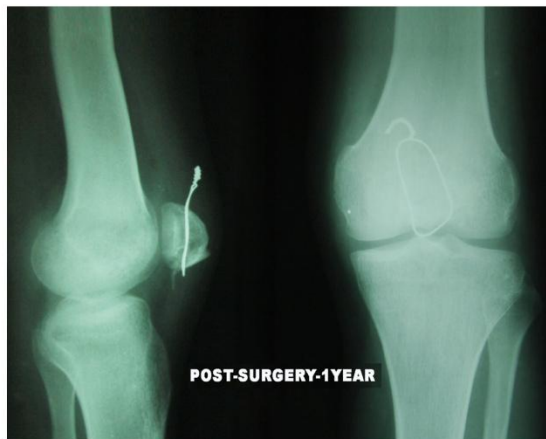
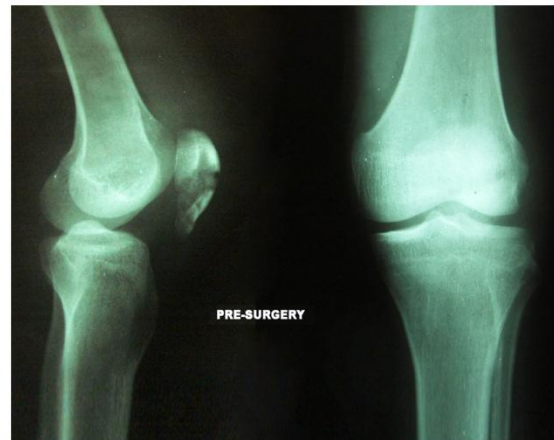
Post operatively, a plaster cylinder cast, ankle to proximal thigh was used. Non-weight bearing, crutch walking was started the day after the operation. Quadriceps setting exercise were started after 2 days of the operation. The patients were discharged on the third or fourth post-op day. At 3 weeks from the operation the patients were readmitted. The plaster cast and sutures were removed. Knee mobilization quadriceps strengthening and weight bearing were started. When the patients were sufficiently adequate in knee function, usually knee bending 90 degrees or more and quadriceps power around grade four, they were once again discharged and continued on physiotherapy on an outdoor basis.

Follow up was continually maintained till the patients had reached maximum recovery and thereafter at 3 monthly intervals for one year. Wires were removed after 8 months and within one year under local anesthesia in all of the cases mentioned and advised to continue physiotherapy.

CASE-1

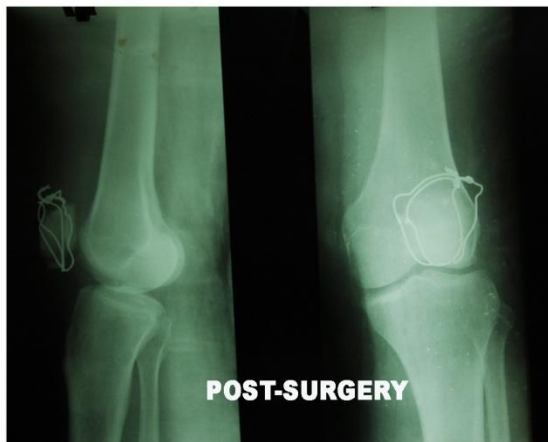
B.GARADA

MALE-30Year



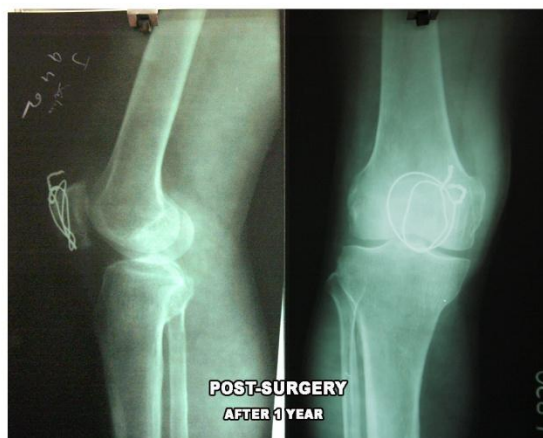
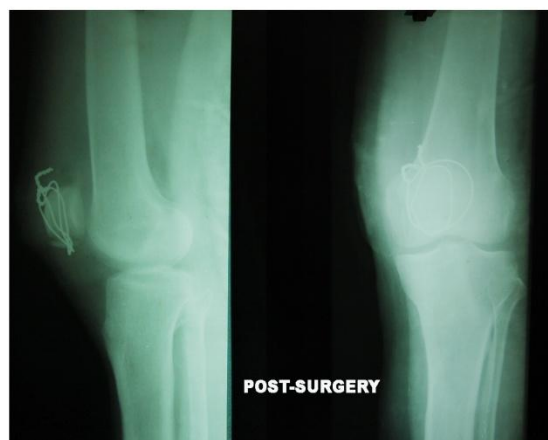
CASE-2

M.BEHERA
MALE-32Year



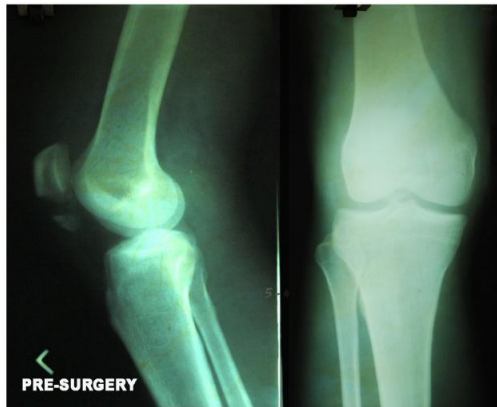
CASE-3

J.SAHU
MALE-30Year



CASE-4

B.M.NAYAK
MALE-40YEAR



CASE-5

P.K.CHOUDHURY

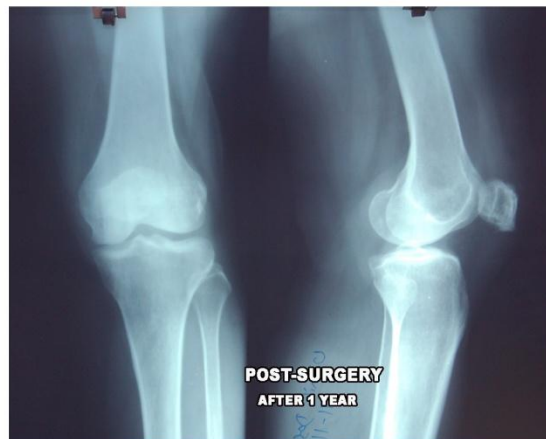
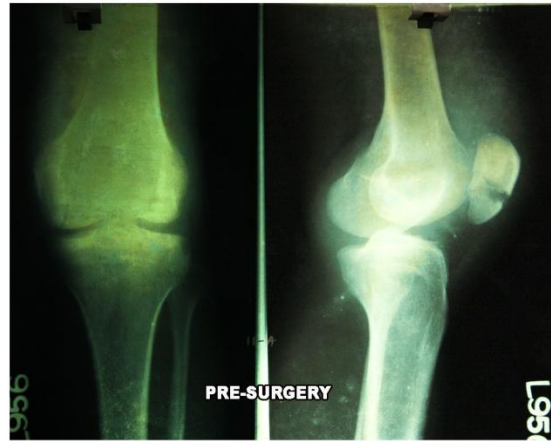
MALE-34YEAR



CASE-6

URMILA DAS

FEMALE-50YEAR



OUTCOMES

The results were graded as follows (Table-1)

Out of the 22 cases, 16 were male and 6 were female with an average age of 40 years.

Maximum recovery took place between 6 weeks to one year averaging 5 months, after removal of the plaster cast and commencement of physiotherapy.

Out of 22 cases, the outcome was excellent in 8, good in 10, fair in 3 and bad in 1.

One of the case aged 48 years with only transosseous suturing walked down immediate post – op day one without any support felt something pulled out inside the knee and in consequence he could not regained appreciable extension of knee in further follow up of one year.

The feeling of subjective weakness persisted in 6 cases. No ossification of tendon was observed in this series.

Table-1 : CRITERIA AND GRADING OF OPERATIVE OUTCOMES

Criteria	Excellent	Good	Fair	Bad
1. Pain	Nil	Mild	Moderate	Severe
2. Wasting	Nil	< ½”	½ to 1”	>1 inch
3. Quadriceps	5	4 +	4	< 4
4. Range of motion (Rom) of knee	Full	No exterior large loss of flexion upto 15 degree	Loss of extension upto 5 degree loss of flexion upto 30 degrees	>5 degree extension lag >30 degree loss of flexion

ANALYSIS

The people who are 20 to 50 years old are more vulnerable to fracture the knee cap and the cases with excellent and good results were of a relatively younger age group.

Men are twice as likely as women to fracture the knee cap, which is reflected in this series.

Failure was occurred in one case having only transosseous suturing after partial patellectomy due to powerful contraction of quadriceps which pulled out the wire from distal fragment. In contrast those who had additional cerclage wiring were more protected post operatively.

The average follow up is 6 years in the series. However, except in few cases, majority of patients had no specific complaint and no arthritic changes in knee joints observed.

DISCUSSION

Opinions differ widely as to the proper treatment of a fractured patella, especially in reference to patellectomy.

Brooke in 1937 suggested that the patella is inherited phylogenetically and is not a functional organ. He stated that although the patella is a sesamoid bone, there is no evidence that it developed in the quadriceps tendon in response to function and rather the extensor mechanism is more efficient if the patella is excised. Later, however, Haxton in 1945 and Kaufer in 1971 made complete studies that refute these claims. They studied the comparative anatomy, human embryology, human anatomy and experimental anatomy of the patella and also the biomechanical aspects and clinical results of patellectomy. Haxton stated that anyone who has removed the patella can certify that the patella actually gives attachment to most of the fibres of the quadriceps

and patellar tendons and that the bone transmits tension produced by the quadriceps.

In experimental studies of patients with and without patellae he demonstrated that the power of extension of knee increases as the joint extends, in other words the power extension is greater with the knee at 30 degree flexion than at 60,90 or 120 degrees. This is true despite the law of Von Schwann, that the tension of muscular contraction diminishes as muscle fibers shortened. By comparing patients after patellectomy with normal people, he showed that after patellectomy much of this increase in power as the knee is extended is lost. Since extension is the most important function of the knee, it must be concluded that patellectomy definitely impairs the efficiency of the quadriceps mechanism, but this may not be enough to interfere with ordinary activities.

After patellectomy the effective radius of the patella – quadriceps pull from the center of the rotation of the knee is shortened, thereby requiring more quadriceps force to accomplish the same degree of powerful knee extension. The presence of the patella increases the radius from the centre of rotation of the knee, thereby increasing the

mechanical advantage of the patella – quadriceps mechanism and making knee extension more efficient.

Besides this, the patella provides a protective function for the knee and is of cosmetic value. After total patellectomy, weakness of the quadriceps is due to shortening of the distance between the axis of movement of the knee and the quadriceps tendon. Patellectomised knees may require 30% increase in quadriceps power for extension. Patellectomy decreases quadriceps strength permanently by one-third and reduces joint stability in half the cases with complaints of giving way. With partial patellectomy, the continued presence of the pay rope or pulley mechanism and repair of the quadriceps with reattachment of patellar tendon to the retained bony patella giving a strong hold, help in good quadriceps function. However, the feeling of subjective weakness, though there is no demonstrable decrease in quadriceps strength is a known sequelae of patellectomy, partial or total. This was observed in 6 cases in the present series of partial patellectomies. Duthie and Hutchison reported pathological ossification may

develop where the patella was excised which may cause pain and limitation of movement.

In an experimental study in rabbits, early and severe arthritic changes were recorded in the femoral condyles after total patellectomy. This was not corroborated in human as an inevitable sequel, especially with avoidance of patellar tilt and consequent patello femoral arthritis by placing of wire suture correctly in a posterior position through the fracture surface, the patellar tendon will come in contact principally with the articular edge of the fragment and not its anterior edge. This procedure was followed in the present series. To Thomson also goes the credit for the first report on five fractures of the patella treated by excision of the smaller fragments and capsular repair. Cohn recommended partial patellectomy whenever possible and showed reduced arthritis as compared to total patellectomy. Degenerative arthrosis of ageing complicates evaluation of traumatic arthritis and was not used as a criterion for evaluation of results in the present series.

Fixation of the fracture is an alternative. It is however beset with the usual problems of utilisation of implants. Percutaneous tension band wiring may be used in undisplaced or slightly displaced closed patella fracture where the gap is less than half a cm and the patient mobilised immediately after the operation. With open tension band wiring, pain because of skin stretch over the proximal ends of the Kirschner wires with the knee in flexion, bursa over the K-wires, proximal or distal migration of K-wire, have been reported. Inability to start early movements because of inability to fix the fractured patella firmly, especially when comminuted or grossly displaced may compromise movement of the knee following this intraarticular fracture. Potential incongruities of the articular surface after fixation may persist with its consequences. Finally, a second operation for implant removal is required. With these drawbacks, partial patellectomy, whenever possible is a good choice.

Failure of one case was occurred immediate post – op day which was happened due to powerful contraction of quadriceps. In view of this failure, an additional cerclage wiring was given to majority of cases for better protection and early knee movement post operatively in this series.

CONCLUSIONS AND RECOMMENDATIONS

Because of the objections to total patellectomy the patella or at least the proximal or distal half should be tried to save if practical. In simple transverse fractures without comminution, the patellar fragments are opposed anatomically and internally fixed. If the distal or proximal pole of the patella is comminuted, the fragments are removed, but the largest fragment is preserved. When the comminution is extensive and reconstruction of the articular surface is not possible, complete patellectomy is preformed.

In addition to transosseous wire suturing, an additional cerclage wiring gives better protection and early mobilization to patients.

Lastly, with partial patellectomy, especially of either of the poles, patellar replacement can still be considered if needed in future. Patients without patella may be at a higher risk for failure of total knee arthroplasty.

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