RESEARCH PAPER

Surgical Management of Non-Union Patella Fracture: A Case Series and Review of the Literature

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Abstract

Background: The neglected patella fracture leading to non-union of the fracture in long term. Non-union patella is the rare entity with incidence of 2.4-12.5%. The fractured proximal fragment of the patella is retracted proximally leading to fracture gap of various centimetres. Various surgical modalities are described to manage such fracture morphologies.

Methods: Ten neglected patella fracture morphology were included in the study. Five patients with transverse fracture was treated with ORIF with TBW. Two patients with communited fracture was treated with ORIF with TBW (K wires) and cerclage wire. Three patients with inferior pole patella was managed by open reduction and Krachow suture using fibre wire. The results were assessed in terms of time of union, knee range of motion, extension lag, quadriceps power, fracture gap, Knee society score, Kujala knee score and any complications. Follow-up with radiographs was done at 2, 4, 6 and 12 months.

Results: All patients presented with a mean duration of 9.3 months (7-13months) after the trauma with mean gap between the fracture fragments of 5.2cm (3.8-6.6cm) in maximum flexion and 2.6cm (2.0- 3.0cm) in full passive extension. The mean duration of the radiological union was 5months (3-6months). The average range of motion achieved at the end of 12 months ranges from 10o to 110o. The quadriceps power in all patients were 4+ or 5 at 6 and 12months. The mean Knee Society Score was 75 (Range 72-82) and mean Kujala knee score was 73 (Range 70- 82) at the end of 12 months.

Conclusion: We conclude that in cases of non-union patella ORIF using TBW has the best result. V-Y plasty is rarely required for fracture reduction. The need for bone grafting can be assessed on case to case basis. Partial/total patellectomy should be avoided and Krackow suture technique is helpful in management of inferior pole patella fractures.

Level of evidence: IV

Keywords: Extension lag, Non-union patella, Patellectomy, Quadriceps mechanism, V-Y plasty

Introduction

Patella fracture are the common fracture suffered around the knee joint and constitutes 1% of all skeletal fractures (1). Such fractures are generally treated by ORIF (Open reduction and internal fixation) with Tension band wiring (TBW) or cancellous screws, cerclage wiring, partial or total patellectomy. These fractures rarely progress into non-union as patella is a sesamoid bone and managed mostly with early surgical intervention. Non-union of the patella is rare with an incidence of 2.4-12.5% (2). The quadriceps muscle attached to the proximal fractured fragment pulls it proximally leading to the gap at fracture site. If the gap is too large, there won't be any fibrous union resulting in failure of quadriceps mechanism and extension lag.

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The gap can be large enough so that femoral condyles can be palpated just beneath the skin in the knee joint through the fracture site. The proximal fractured fragment can be retracted proximally in the distal thigh to various centimetres. The management of non-union of the patella poses several unique challenges. Non-union patella may be well tolerated by low functional demand patients but requires surgical intervention in active patients (3). The goal of the surgery is to restore the quadriceps mechanism leading to knee extension without much compromising the knee mobility. The options are few and none of them gives a very good result. There are different treatment modalities for such fractures including ORIF with TBW, cancellous screws, cerclage with or without bone grafting and partial patellectomy. Each surgical modality has its pros and cons & used in different situations. We present our experience in management of such complex problems.

Materials and Methods

The study was conducted in a Tertiary care hospital. Ten cases were included in the study over a period of four years. All the patients were below the age of 60 years of either sex. All patients were initially managed by bone setters with bandages or slab. None of the patients had any open injuries. None of the patient was surgical intervened at any point of time. All the patients had difficulties in performing activities of daily living with extension lag. The femoral condyles could be palpated in the knee joint beneath the skin through the fracture site. There was soft tissue interposition at the fracture site with no complete apposition of fractured fragments in any case.

Out of the ten neglected patella fracture morphology, five patients had transverse patella fracture, two had communited patella fracture and three had inferior pole patella fracture [Table 1].

Patients were treated with open reduction of the fracture site along with internal fixation using TBW (K wires or 4mm cancellous screws), with or without cerclage wiring and Krackow suture with fibre wire.

We assessed the results in terms of time of union, knee range of motion, extension lag, quadriceps power, fracture gap, Knee society score, Kujala knee score and any complications. Follow-up with radiographs was done at 2, 4, 6 and 12 months.

Results

The mean of the patients age in the study was 48 years (32-58 years) with 6 females and 4males. All patients presented to our hospital with a mean duration of 9.3 months (7-13 months) after the trauma. The pre-operative mean extension lag was 500 (400-700) with no ligamentous laxity or bony deformity of the knee. The pre-operative mean range of motion was 700-1200. The mean gap between the fracture fragments were 5.2cm (3.8-6.6 cm) in maximum flexion and 3cm (2.0- 3.6cm) in full passive extension. None of the patients had any flexion deformity.

Five patients with transverse fracture was treated with ORIF with TBW [Figure 1a; 1b]. Out of which, in two patients TBW was done using 4 mm cancellous screws. Two patients with communited fracture was treated with open reduction and internal fixation with TBW (K wires)

Table 1. Depicting the descriptive and postoperative data

S.No	Age/Sex	Fracture Type	Duration since Injury	Surgical Management	Union time (months)	Pre-operative Extension Lag (degree)	Post-operative Active Range of Movement (degree)	Gap between fracture fragments(cm)		Extension Lag at 12 months postop (degree)	KSS	Kujala Score
								In Max Flexion	In full passive extension			
1	32/M	Transverse fracture	7months	ORIF with TBW (K wires)	3	60	0-110	5.8	2.4	0	82	82
2	42/F	Inferior pole fracture	8months	ORIF with Krackow suture	5	40	0-100	4.2	2.0	0	78	74
3	55/F	Communited fracture	8months	ORIF with cerclage wiring and Bone grafting	6	50	10-90	5.8	2.8	10	72	70
4	58/F	Transverse fracture	13months	ORIF with TBW (K wires)	5	60	0-110	6.6	3.0	0	74	74
5	52/F	Transverse fracture	9months	ORIF with TBW (4mm CCS)	6	70	0-90	5.4	3.0	0	74	72
6	48/M	Inferior pole fracture	11months	ORIF with Krackow suture and Bone grafting	5	40	10-100	3.8	2.4	10	72	72
7	52/F	Transverse fracture	9months	ORIF with TBW (4mm CCS)	5	70	0-100	5.8	3.6	0	74	72
8	45/M	Inferior pole fracture	7months	ORIF with Krackow suture	6	30	10-110	4.0	2.5	10	76	70
9	55/F	Communited fracture	10months	ORIF with cerclage wiring and Bone grafting	4	40	10-100	4.8	3.0	10	74	74
10	40/M	Transverse fracture	11months	ORIF with TBW (K wires)	5	40	0-120	5.6	3.2	0	74	72

Figure 1a. Preoperative radiograph depicting non-union transverse fracture of patella, 1b. Postoperative radiograph depicting ORIF with TBW.

Figure 2a. Preoperative radiograph depicting non-union communited fracture of patella, 2b. Postoperative radiograph depicting ORIF with TBW and cerclage wiring.

and cerclage wire [Figure 2a; 2b]. Autologous ipsilateral iliac crest bone grafting was used in these cases. Three patients with inferior pole patella was managed by open reduction and Krachow suture using fibre wire [Figure 3a; 3b]. Autologous ipsilateral iliac crest bone grafting was used in one of these cases.

The mean duration of the radiological union was 5 months (3-6months). The extension lag progressively decreased in all post-operative patients, with no extension lag in six patients at 6 months. Rest four patients had extension lag of 100 each. The average range of motion achieved at the end of 12 months ranges from 100 to 1100. The quadriceps power in all patients were 4+ or 5 at 6 and 12 months.

The mean Knee Society Score was 75 (Range 72-82) and mean Kujala knee score was 73 (Range 70- 82) at the end of 12 months. [Table 1]

One patient suffered superficial stitch abscess, which was managed with aspiration and antibiotics. Two patients required removal of K wires and one patient required removal of cerclage wire.

Figure 3a. Preoperative radiograph depicting non-union inferior pole fracture of patella, 3b. Postoperative radiograph depicting ORIF with Krachow suture.

Discussion

The neglected patella fracture can lead to non-union. Non-union of the patella is seen infrequently with incidence of 2.4% but not so infrequent in developing countries (4). There are various reasons including noncompliance, delayed care, geographical inaccessibility to hospital, and financial constraints (2, 5, 6). Due to rarity of such fractures there is no standardised treatment protocol. Though there are few English literature defining the management of such complex fractures. Transverse fracture of the patella followed by the inferior pole patella fracture are most notorious to progress into non-union (7). Both non-surgical and surgical treatment options are defined in the literature but none depicts very good results (7). Non-surgical management is used in low demand, morbidant patients. the union rate and functional return to daily activities are not very good. There was better functional outcome in patients who were managed operatively or elective non-operatively (8). Thus, surgical management is sorted in most of the patients. there is no consensus on the surgical management of non-union patella. Nathan et al. published a review article depicting the treatment protocol in such patients (7). the surgical management includes ORIF in most of the such patients having fracture amenable to fixation. Patients with severe chondromalacia, inferior or superior pole fracture & fractures not amenable to internal fixation were treated by partial or total patellectomy. Tension band wiring was the most common modality of internal fixation used in such fracture. Satku et al. used tension loop between the proximal fragment and the tibia along with the conventional anterior tension band wiring to protect the TBW (8). Patella baja was noted in 2 cases probably due to shortening of the patellar tendon. Klassen and Trousdale

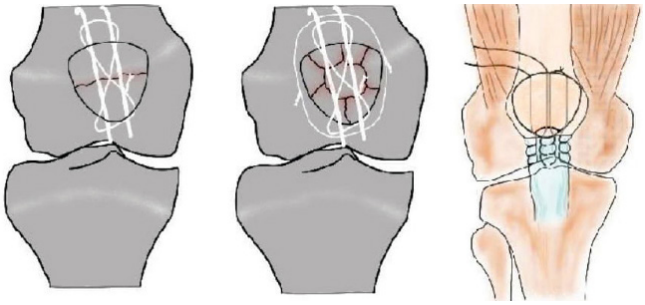

Figure 4. Diagrammatic representation of surgical techniques.

reported the use of bone grafting in two patients. the requirement of bone grafting should be assessed intra-operatively on case to case basis (3). Uvaraj et al. reported good results in 20 patients undergoing surgical fixation (2). The author reported difficulty in reduction in most of the patients. this problem was tackled by a cerclage wiring first followed by tension band wiring. Cerclage wiring was removed at the time of TBW application. Quadricepsplasty was required in no case for reduction of the fractured fragments. Garg et al. presented a case series of 15 cases, which were divided into 3 groups (9). The patients managed with patellar traction followed by TBW without V-Y plasty showed the best results followed by patients treated by patellectomy. The patellar traction was applied with help of single pin. The worst results were depicted by the patients managed with V-Y plasty and TBW. Previous studies treated such patients in a single stage operation in form of V-Y plasty followed by either osteosynthesis or patellectomy. Dhar et al. applied patellar traction with help of ilizarov fixator followed by patellectomy whereas Singhal et al. used 4 pins for patellar traction (5, 6). We present our experience in management of ten patients with different non-union patella fracture morphology. The management was decided on case to case basis considering the functional demand, age, fracture morphology of the fracture. Five patients had transverse fracture, two had multiple fragments whereas three had inferior pole fracture of the patella [Figure 4]. All the patients presented to our hospital after failed conservative management ranging from 7 to 13 months. None of the patient had any surgery previously for the treatment of fracture patella. Pre-operatively the apposition of fractured fragments was not possible in any patient. There was dimpling of soft tissue at the site of non-union and femoral condyles was palpated in the knee joint beneath the skin through the fractured site. Patients with transverse fracture was managed with ORIF with TBW. Cancellous screw was used in two case for TBW owing to osteoporotic patella bone. The communited non-union patella was managed by ORIF with TBW (K wires) and cerclage wiring. Only the larger fractured fragments were opened to clear the fibrotic tissue and rest smaller fragments were not disturbed. Inferior pole fracture was managed with Krachow suture using fibre wire. Though partial patellectomy is described in the literature for such fracture but the author believed the notion that bone to bone healing is better and faster than the tendon to bone healing. Even if a small fragment of inferior pole of patella is there, it should not be excised. The Krackow suture used for such fractures can be augmented by double tension wire technique described by Bhimani et al. (10). Partial patellectomy has various problems including delayed rehabilitation, decreased range of motion, persistent pain in extension and overloading of the knee joint. Patellectomy decreases the lever arm of the quadriceps mechanism, leading to eccentrically loaded knee joint and early degenerative changes (11,12).

To our surprise V-Y plasty was not required even a single case. V-Y plasty has various downfalls including weakness of Quadriceps muscle, extension lag, delayed rehabilitation, more extensive surgery, increased chances of infection and quadriceps rupture in rare cases. No patellar traction was applied in any case. Freshening of the fractured fragment along with fibrotic band release of the patella was good enough for the reduction of the fractured fragments. Bone grafting was done in two cases where there was bone gap on the non-articular surface of the patella. All the fractures were united ranging from 3 to 5 months. Patients managed with ORIF with TBW depicted the best results. The rehabilitation was started earliest in the patients managed with TBW, followed by cerclage wire and lastly in inferior pole patella fracture non-union patients. there are few fallacies in our study including small sample size, no pre-operative measurement of the fracture gap in flexion and extension of the knee, limited variety of fracture morphology and no randomisation was done.

We conclude that in cases of non-union patella ORIF using TBW has the best result. V-Y plasty is rarely required for fracture reduction. The need for bone grafting can be assessed on case to case basis. Patellar traction was no required in our study though can be helpful in some cases. Partial/ total patellectomy should be avoided and Krackow suture technique is helpful in management of inferior pole patella fractures. Rehabilitation should be emphasised upon and should be started immediately in cases of appropriate fixation using TBW.

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