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Study of Fracture Patella with Tension Band Wiring

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ABSTRACT

Introduction: It is the study of patella fractures treated with tension band wiring.

Objective: We wanted to study the surgical management and to assess its functional outcome in patella fractures, to study the range of movements, functional outcomes, duration of union, complications and compare the results of operated cases with other studies.

Methods: The study consists of 35 patients sustaining patella fracture operated with tension band wiring. Clinical & functional outcomes were assessed by the knee society scoring system.

Results: We have operated a total of 35 cases with tension band wiring in patella fractures. The average union was achieved in 12 - 13 week. We have obtained 85.71 % of an excellent outcome.

Conclusion: In the case of transverse fracture of patella pleasing results were obtained with tension band wiring technique that allows early motion and rehabilitation. This technique has the benefit of early mobilization & early return of independent function. With strict adherence to anatomical reduction, aseptic soft tissue handling & soft tissue repair & proper & in time physiotherapy protocol we can get satisfactory results in almost all the patients.

Key Words: Patella, Tension band wiring, Physiotherapy, Anatomical reduction, Rehabilitation, Union

INTRODUCTION

The patella is a sesamoid bone and serves several important functions. It protects the knee joint from direct trauma. The patella is part of an extensor component mechanism of the knee. It serves to increase the mechanical advantage of the quadriceps muscle. Patella fractures constitute approximately 1% of all fractures.[1] These fractures are most commonly seen in active young individuals. Commonly patella fracture is transverse, comminuted, or chip avulsion. The most common mechanism is direct or indirect trauma. Direct trauma is during a fall onto the anterior aspect of the knee or because of hitting a hard object. An indirect fracture can be due to sudden jumping, or rapid flexion and twisting of the knee against fully contracted quadriceps.[2] Patellar fracture from indirect forces occurs when the intrinsic strength of the patella is exceeded by the pull of musculotendinous units attaching to it. This typically occurs in the act of stumbling or partially falling. Combined direct/indirect injuries are characterized by evidence of direct trauma to the skin and considerable fragment separation. The association between fragmentations of the distal pole has been noted.[3]

Transverse fractures are the most common, constituting 50% to 80% of a patella fracture. Stellate and comminuted fractures account for 30% to 35%, whereas longitudinal or marginal vertical fractures make up 12% to 17%. Osteochondral fractures are usually observed in-patient of 15 to1 20 years of age. Anomalies of ossification usually are related to an accessory, ossification centre at the superolateral corner of the

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patella. This is called a bipartite patella. If a similar lesion is present in the opposite knee, the diagnosis is clear. A major complication when the treatment is not entirely successful is post-traumatic arthritis of the patellofemoral joint and reduction in the range of motion of the knee joint.[3] There are various options available in the literature for the treatment of fractures of the patella. Non-operative treatment has been limited to fracture that shows intact quadriceps component, separation of the fragments for less than two centimetres, and no significant displacement of articular surface.[4] Tension band wiring is a commonly used treatment for displaced transverse fractures of the patella. The principle of tension band wiring is distractive forces at the fracture site are converted to compressive forces. The implant absorbs the tension and bone compression[5]. We have studied 35 cases of displaced transverse fractures of patella treated with tension band wiring in the present series. The study is aimed to evaluate the result of tension band wiring technique in patella fractures and to compare the outcomes achieved by tension band wiring of our study with other studies.[4,6]

MATERIALS AND METHODS

The patients were operated at a tertiary care district hospital after approval from the institutional ethics committee (SVIEC/Medi/BNPG14/D15). It was a prospective study. Inclusion criteria included fractures of patella in all age groups. The exclusion criteria included open patella fractures, undisplaced patella fractures, pathological fractures, patients managed non-operatively. Patients were followed for every month for a minimum period of six months. Patients were treated and admitted in hospital and followed up in orthopaedics outpatient department. In the current study, only those cases which were treated with tension band wiring were included.

The operation was performed with longitudinal skin incision over the affected knee. After approaching the patella by a midline incision, blood clots and small fragments were removed and fracture surface cleaned, the extent of extensor expansion tear explored and trochlear groove inspected for damages to the femur. Proximal and distal fragments reduced and held firmly with clamps, with special attention to restoring the smooth articular surface. Two K-wires were introduced longitudinally across the fracture, wire loop being passed behind the tips of Kirchner wires and over the anterior surface of the patella in the form of the figure of eight. The wire was anchored directly in bone and retinaculum was repaired (tension band wiring). The articular surface of patella checked by palpation in extended knee position. Both upper ends of K-wire were bent at acute angles and anteriorly, cut short, rotated 180 degrees and hammered in with an impactor. The tear in the extensor expansion was repaired with interrupted sutures using ethibond 2-0 (Merville, USA). The tension band wiring procedure was performed with twelve to thirty-six hours after admission.

In stable fixation of simple transverse fracture achieved early rehabilitation of knee joint with partial weight-bearing should be started as soon as the patient became pain-free. Static quadriceps and hamstring strengthening exercises were started immediate post-op. An active extension was started on 4th week.[7,8] Active flexion started from 2nd week. In cases with associated extensor expansion tear flexion exercises were started after 3 weeks and without extensor expansion tear after 2 weeks. Non-weight-bearing walking with extension brace was done till 2nd day and in associated injuries at 8th or 10th week respectively. Partial weight-bearing was continued till 2nd week and in associated injury till 8th and 10th week. Full weight-bearing was started after 2nd week and in associated injury after signs of the union of associated fracture seen. After discharge patients were followed up on 2nd week, 4th week, 2 months, 4th month and 6th month and thereafter every 2months in outpatient clinics. X rays were repeated on 4th week, 2nd month, 4th month and 6th month and thereafter every 2 months till radiological union. At every follow-up movements of the knee, quadriceps strength was noted. All the patients were examined and interviewed for evaluation. We used knee society score to see the results of surgical treatment of patella fracture with tension band wiring each patient was scored according to knee Society score. Patients below the score of 60 were considered poor, score60-69 were considered fair, score 70-79 were considered good, and score 80-100 were considered excellent. The criteria for fracture union were free movements on walking and sitting and union was also assessed by radiographs as well as clinical examination. No case was declared united unless it was fit on criteria of assessment. Non-union has been defined as a lack of healing for short time as six months to as long as 18 months.[9,10]

Statistical Analysis

Statistical analysis was done using SPSS software (Illinois Chicago, USA) with a p-value less than 0.01 considered as significant.

RESULTS

From January 2016 to September 2017 a total number of 35 patients with recent fracture of the patella were treated with tension band wiring technique. All patients were followed for 22 ± 3 months. Those patients were selected in which fracture displacement was more than two centimetres. The best results were in the patients. Out of 35 patients 21 (60 %) patients were between 20-40 years of age, 14 (40%) patients were above 45 years ago. Out of 35, 27 (77.14%) patients were male and 08 (22.85%) were female out of 35 patients. 20 (57.14 %)

patients had left side involvement and 15 (42.86 %) patients had right-sided involvement. The main cause of injury in 27 patients out of 35 (77.14 %) was a road traffic accident. All cases of road traffic accident were from two-wheelers. Eight patients (22.85 %) had a direct injury due to slipping while walking or climbing up on the stairs. Most of the patients were having displaced mid-patellar transverse patella fracture (n= 25 out of 35, 71.42 %). Five patients out of 35 (14 %) were having associated injuries with the majority having ipsilateral shaft femur fracture. Four patients out of 35 (11.42 %) had shaft femur fracture on the same limb and one (2.85 %) patient with an ipsilateral distal femur fracture. Extensor expansion tear was not possible to diagnose on clinical examination, but during surgery on exploration, extensor expansion tear was identified on palpation in seven (20%) patients out of 35 patients. 25 (71.43 %) patient were operated within 72 hours of injury while five (14.85 %) patients were operated between 72 hours to 1 week after injury and five (14.85 %) patients were operated one week after injury. Patients were advised ambulation on the walker with extension knee brace without bearing weight on the next day. Partial weight bearing was started as soon as patient tolerated. Patients having associated fracture were not subjected to weight bearing till fracture shows signs of healing. All patients with delayed weight bearing were due to associated secondary injuries. Average mobilization was started on 2-3 weeks postoperatively the patients with extensor expansion tear were advised knee motion after 3 weeks and in other patients, mobilization was started after two weeks. In none of the patients, CPM (continuous passive motion) was started. 26 patients (74.29 %) were discharged one week after surgery while seven (20 %) patients were discharged between 8-12 days after surgery and two (5.71 %) patients were discharged two weeks after surgery. Patients discharged after two weeks had longer hospital stay due to associated injuries to the femur and tibia. 20 patients came for follow up between 9-12 months for follow up, 13 patients came for follow up more than 12 months after surgery and only two (5.72 %) patients came for follow up for less than 9 months. Meantime of union was 12 – 13 weeks, no non-union occurred in any patient. Post-operative wound infection was seen in one patient (2.85%). One patient (2.85 %) had a postoperative infection and one case (2.85 %) had malunion due to inaccurate reduction. Six patients (17.14 %) had hardware impingement which was removed after the union. Two patients (5.71 %) had extension lag which was due to inaccurate education and osteoarthritis. Five patients (14.28 %) had painful movements which were due to mal-union and osteoarthritis. Thirty patients with early post-op rehabilitation were having excellent results, four patients (11.42 %) with late post-op rehabilitation had a good result and one patient (2.85 %) had the fair result.

Out of 30 patients operated within one week of injury had excellent results in 27 (90 %), good in two patients (2.85 %), fair in one (2.85%) patient. Out of 5 patients operated more than 1 week after injury had excellent results in 03 (60%), and good in 2 (40%). Knee society score for 30 (85.14%) patients was excellent, four (11.42 %) was good and one patient (2.85 %) had the fair result. One patient had ten degree of extension lag which was due to improper reduction with significant step off. Osteoarthritic changes were in one patient (2.85 %) with no marked quadriceps weakness seen. Out of 35, 34 (97.14 %) patients were satisfied with treatment and outcome. One (2.85 %) patient was less satisfied. All the patients had returned to the full level of their daily activities all the patients had returned to their original job.

DISCUSSION

The treatment of fracture of the patella may be either operative or non-operative but in most reports, non-operative treatment has been limited to fracture that show intact quadriceps mechanism less than 2 millimetres of separation and without significant displacement of the articular surface. If there is rupture of quadriceps mechanism and displacement of patellar fragments more than 3mm it should be openly reduced and internally fixed.[6] There are many surgical techniques for open reduction and internal fixation of a transverse fracture of the patella. However, at 90° of flexion of knee joint articular surface was distracted by posterior angulation of fracture fragments.[7] But after application of tension band, wiring technique changes in the articular surface distraction are reduced so that early mobilization can be started.[8] Tensile forces of quadriceps are converted to compressive force by anteriorly placed tension band wires. Surgical treatment of transverse fractures of patella can lead to favourable results after tension band wiring.[9,10] As males are more prone to road traffic accidents there was more number of male patients presented with patella fracture. In this study total number of 35 patients were included out of which 27 were male and 8 patients were female as the most common cause of injury in 27 (77.14%) were due to road traffic accidents and 08 patients were due to direct fall. Out of 35 20 (57.14 %) had left-sided involvement and 15 (42.86 %) had right side involvement.[11] All 27 (77.14%) patients who were injured during road traffic accident were below 45 years age and all 08 (22.85%) patients sustaining injury due to direct fall while walking or climbing stairs were above 45 years ago. This directly correlates the main cause behind the injury in elderly people was primary osteoporosis and the cause of injured patella in the young patient was due to road traffic accident as they are breadwinners for the family, remains outdoor and live more active lives they are more prone to road traffic accidents.[11,12] Levack et al found that men are more prone to road traffic accident due to more outdoor activities.[13,14] Srinivasulu et al in his study reported 10.5 % cases with restriction of movements more than 20 degrees and suggested early mobiliza-

tion and physiotherapy protocol to get better results.[15] Maini et al., 1986 in his study of 30 patients showed extensor lag in 8 (26.6%) patients.[16]

We recommend knot to be bent at the anterolateral edge of the superior pole of the patella and proper bending of wire ends. Also, sharp ends of k wires should be made blunt so that they do not impinge on soft tissues. We recommend hardware should be removed as early as possible after the clinical and radiological union is established to prevent complications such as implant breakage and impingement. Results are always better when supported with proper post-operative physiotherapy protocol, early mobilization, proper intraoperative surgical technique supported by pre-operative planning, gentle tissue handling and less soft tissue damage, and also the full co-operation of patients in the rehabilitation phase as shown in figures 1, 2 and 3.

Knee society score was excellent in 30 (85.71%), good in four patients (11.42%), and fair in one (2.85%) patient. Two patients (5.4%) had mild rest pain, two patients (5.4%) had mild pain while walking and five patients had mild pain in staircase climbing. All such patients responded well to physiotherapy and had good results. Gosal et al., 2016 in his study showed knee society score excellent in 75 % patients good in 20 % patients and fair in 05 patients out of 30 patients[17] as shown in table 1.

CONCLUSION

Out of 35 patients, 34 patients (97.14%) were happy and satisfied with the treatment and outcome. One patient was not fully satisfied with the outcome as he was advised revision surgery to correct articular step-off. All the patients (100%) had returned to the full level of their daily activities. All the patients (100%) had returned to their original job. This was one of the most important and most satisfying criteria for our study as this was the single criteria which explain all the result. In case of fracture of patella in our study satisfactory results obtained with tension band wiring than allow early motion and rehabilitation. This technique has the advantage of early mobilization and early return of independent function. With strict adherence to anatomical reduction, aseptic soft tissue handling and soft tissue repair and proper and in time physiotherapy protocol we can get satisfactory results in almost all the patients.

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Figure 1: 25 year old male patient presented with history of fall from bike with pre-operative radiograph showing displaced transverse patella fracture.

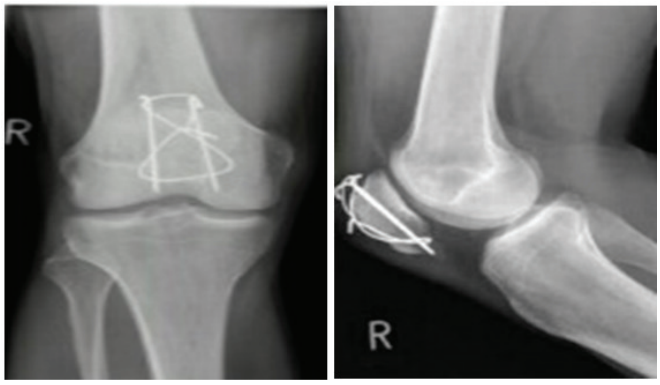

Figure 2: Patient was operated on the next day with tension band wiring with satisfactory fracture reduction seen on post-operative radiograph at 12 weeks

Figure 3: Patient with full range of motion and had excellent result.

Table 1: Knee society score

Study	Total patients	Excelent	Good	Fair
Tarek 2016	30	75 %	20%	05 %
Our Study	35	85 %	11.42 %	2.85 %