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Gap Non-union of the Patella: Early outcome of One Stage Surgical Treatment with V-Y Quadricepsplasty and Tension Band Wiring

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1. Abstract

Purpose: Gap non-union of the patellar is rare worldwide though commonly found in developing countries where there is a dearth of orthopaedic surgeons.

It is a management challenge to the surgeon in terms of approximation of the gap between the fragments as a result of the contracture involving the quadriceps.

Methods: We present two cases of gap non-union of the patella treated by a one-stage procedure involving open reduction, tension band wiring with V-Y quadricepsplasty.

Results: First case is a 57-year-old man who had repair of gap non-union of the left patellar, 21 months after injury.

Second case is a 34-year-old lady who had repair of gap non-union of the left patellar, 5 years after injury.

Conclusion: The satisfactory clinical outcome can be obtained including improved quality-of-life of the patient with this one-stage procedure.

2. Keywords: Patella; Fracture; Non-union; Quadricepsplasty; Outcome

3. Introduction

Patellar fractures are challenging injuries to the Orthopaedic Surgeon, particularly when old and unreduced. Patellar fractures are said to account for about 1% of all skeletal injuries [1]. Gap nonunion of the patellar is rare with a reported incidence of 2.4% to 12.5% of patellar fractures [2]. Gap nonunion of the patellar is commonly found in developing countries where there is a flourishing practice of native bonesetters [3]. The management of these conditions can be quite challenging on account of the contracture resulting from the shortening of the quadriceps muscle which makes open reduction and fixation by tension band wiring difficult [4]. Several treatment options are available to the surgeon. Nonsurgical measures may be tried in patients with low functional demands though surgery is necessary for improved outcome in more active patients [2]. Surgical measures may involve a single-stage procedure

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involving quadricepsplasty for lengthening and tension band wiring [3,5,6], or a two-stage procedure involving preoperative approximation of segments by traction or the Ilizarov method followed by tension band wiring [4,7-9]. We present a report of two cases with gap nonunion of the patella who were treated with the single-stage V-Y quadricepsplasty and tension band wiring with a satisfactory outcome.

4. Case Series

Case 1

A 57-year-old male presented to our outpatient department with a 21-month history of a fall with closed injury to the left knee. He had been treated by 3 traditional bone practitioners before a presentation. On examination, he walked aided with a walking stick and drags the left foot along. There was left quadriceps wasting with a deformity over the anterior left knee showing a visible and palpable groove of three finger breadths (6 cm) (Figure 1 left). There was an extensor lag of 30°. Range of Movement of the left knee was 30° -150° and active knee extension was not possible. X-ray of the left knee; anteroposterior and lateral views (Figure 2), showed a fracture of the patella with a gap between the superior and inferior fragments.

Figure 1: Visible and Palpable groove at the anterior knee.

Figure 2: Lateral x-ray showing superior and inferior patella fragments.

Case 2

A 34-year-old female with a 5-year history of a fall sustaining a closed injury to the left knee. She had been treated by 5 traditional bone practitioners during the period. On examination, she walked with a limp. The left quadriceps were wasted. There was an anterior left knee groove and a palpable gap of three and a half fingerbreadths (7 cm) between the patella fragments (Figure 1 right). There was an extensor lag of 35°. Range of Movement of the left knee was 35°-100°. Active left knee extension was, however, not possible. X-ray of the left knee; anteroposterior and lateral views, showed a fracture of the patella with a gap between the superior and inferior fracture fragments.

5. Procedure

After an adequate preoperative assessment, spinal anaesthesia was administered, a tourniquet was applied to the proximal left thigh and the patient was placed supine. Through an anterior longitudinal approach extending from the tibial tuberosity below to about 12 cm above the knee joint line into the thigh (Figure 3), the patella fragments were dissected free from fibrous tissue and mobilized as far as possible. The fracture edges were freshened and a V-Y quadricepsplasty (Figure 4) was done to further mobilize the proximal patella fragment distally to meet the distal fragment. Bone graft was harvested from the proximal tibia of the same limb. Tension band wiring was then affected with the bone graft compressed between the patella fragments. Tourniquet was released, haemostasis secured and a drain inserted before the wound was closed.

Full leg plaster back slab was applied. Sutures were removed at 3 weeks and a full leg cast was applied. At 10 weeks and 8 weeks for the 1st and 2nd cases respectively, the functional brace was applied and the patient allowed active ROM exercises and quadriceps strengthening exercises which continued for another 8 weeks for the first case and 13 weeks for the second case.

Figure 3: Anterior incision scar.

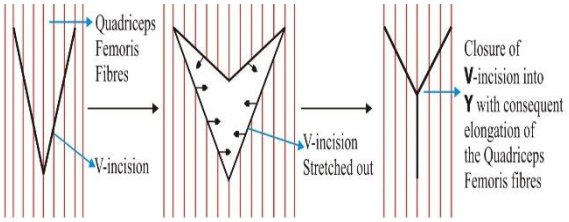

Figure 4: Diagram illustrating the V-Y Quadricepsplasty.

6. Results

The results from follow up at one year were as follows

Case 1: There was straight leg raising (SLR) of the left leg with no quadriceps lag. Active left knee flexion was from 0º-130º which was same with the right knee (Figure 5 and 6). Active left knee full extension is now possible. He walks without a limp or aid. The patient was satisfied with this outcome particularly as he no longer walks with a limp or drags his foot along when walking. He was satisfied with the ability to actively extend his left leg as well as the absence of an anterior knee groove which now gives his left knee a normal look.

Figure 5: Post-operative x-ray at 8 weeks following quadricepsplasty and tension band wiring.

Figure 6: Left: Maximum flexion of the normal right knee (Case1). **Right:** Maximum flexion of the treated left knee (Case1).

Case 2: SLR of the left leg is now possible though with quadriceps lag of 30º. Active left knee flexion was from 30º-90º compared to the right which was 0^0-130^0**.** She now walks without dragging her left foot on the ground and without use of a walking aid. This patient was very satisfied with this outcome being a young female as there was no more an anterior groove over the knee to give the knee an abnormal shape. She was reassured that the quadriceps lag and knee stiffness will improve with further rehabilitation.

7. Discussion

Gap non-union of the patella though rare worldwide are frequently encountered in developing countries for a variety of reasons including delayed presentation, financial constraints, inaccessibility to proper healthcare and non-compliance to treatment [3,7,8]. The major problem in managing these gap non-unions is the difficulty in approximating the bone fragments due to the contracture involving the quadriceps. Conservative management is an option particularly in the elderly but may not lead to good functional outcome in the younger age groups where activity level and body image would be serious considerations. Studies by Uvaraj et al., [3], Lachiewicz [5] and Satku et al., [6] all reported good outcome with one stage operations involving V-Y quadricepsplasty. This was the experience we had in the two cases we reported. However, some other authors have had disappointing results from single-stage procedures mostly from extensive soft tissue damage [4]. Several other reports described a successful outcome with two-stage procedures involving preoperative traction using the Ilizarov method followed later by internal fixation [4,7,8]. This minimizes the soft tissue dissection and

operating time required. Garg and coworkers reported better outcome with preoperative traction using Steinmann's pin followed with Open reduction and internal fixation in terms of time to return to normal activity and complications encountered [4]. However, we found only one (extensor lag of 30°) of the four major complications of Nonunion, Infection, Persistent pain and extensor lag as he encountered in his work in case 2 reported. The outcome in our cases was assessed clinically based on, absence of limp during walking, range of movement of the treated knee compared to the normal knee, clinical assessment of healing of the fracture and patient satisfaction. The stiff knee as we encountered particularly in the second case which was a 5-year-old gap nonunion, was not unexpected. This may be due to increased fibrosis around the knee joint and contracture of the quadriceps muscle over the 5 years. Stiff knee is also reported by Garg et al., [4] as a major complication of surgical treatment. We also experienced extensor lag of 30° in Case 2 which was due to weak muscle power occasioned by disuse atrophy over the 5-year period that the injury lasted. This was a slight improvement over the preoperative extensor lag of 35°. This patient, however, was satisfied with being able to clear her foot properly from the ground when walking, the absence of an anterior groove over the treated knee which now gives her knee a normal appearance and that she can now actively extend her left knee. She was reassured that the extensor lag and left knee stiffness will improve with further rehabilitation. Satku4 and colleague applied additional protection to the tension band wiring in their one-stage procedure using a tension loop between the proximal fragment and the Tibia. This was not required in our patients as the quadricepsplasty provided less tension on the wiring and easy delivery of the proximal fragment to the distal fragment. Additionally, application of a post-operative back - slab for 3 weeks followed by a full leg cast for at least 8 weeks ensured that there was no threat to the tension band wiring or disruption in the event that the patient attempts flexion of the treated knee ahead of instruction. The one-stage procedure has the obvious advantage of avoiding additional surgical intervention and anesthesia as well as a reduction in the length of hospital stay and cost of treatment. Additionally, the increased tendency to wound and implant infection which may add to cost and poor outcome if it occurs in the two-stage procedure, makes this method unattractive in resource-poor countries. These benefits are therefore very important considerations when managing patients in very poor settings.

8. Conclusion

Treatment of gap nonunion of the patella by a one-stage procedure with V-Y quadricepsplasty and tension band wiring can result in a successful clinical outcome with good surgical technique irrespective of the age of the nonunion or the patient. However, knee stiffness could be a post-operative complication particularly when the age of nonunion is 5 years and above.

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