



POST SURGICAL STIFFNESS OF KNEE JOINT IN PIGMENTED VILLONODULAR SYNOVITIS: A RARE CASE REPORT

Orthopaedics

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ABSTRACT

Introduction: Post-surgical knee stiffness is a debilitating complication and its treatment ranges from simple arthroscopic adhesiolysis to more extensive Quadricepsplasty. Physiotherapy rarely suffices in most cases. We are presenting a case of surgically intervened pigmented villonodular synovitis (PVNS) with stiff knee treated by open intraarticular adhesiolysis and a modified V-Y quadricepsplasty and extensor mechanism release, a first of its kind. **Case Presentation:** An Indian male in his 20s, a surgically intervened case of PVNS lost to follow-up due to COVID-19 Lockdown presented with a stiff knee with movement of 0-30° flexion in early 2022. An open adhesiolysis of the joint arthrofibrosis using the previous incision was performed, and a separate full thickness V-shaped incision at proximal Musculo-tendinous junction of quadriceps tendon was given to achieve flexion of 130°. The tendon was repaired in its lengthened position, giving the appearance of a V to Y. Post-operatively, muscles strengthening, and Range of motion (ROM) exercises including continuous passive motion (CPM), were included following a specific physiotherapy protocol immediately after surgery. 10 weeks post-op, the patient has 0-120° active and passive ROM of the knee with an extensor lag of 7°. **Conclusion:** A planned and proper surgical approach targeting the primary cause of stiffness augmented with direct extensor mechanism lengthening procedures (quadricepsplasty) if needed, can achieve good per-operative knee ROM. Aggressive surgery specific postoperative physiotherapy and rehabilitation play a major role in achieving satisfactory results.

KEYWORDS

Stiff Knee, Post Surgery Knee Stiffness, Modified V-Y Quadricepsplasty,

INTRODUCTION

Stiff knee, post-surgery, is a dreaded complication and difficult to treat. Knee flexion less than 45° causes problems in gait and hindrance in day-to-day activities. Some degree of knee movement can be increased by gentle manipulation under anaesthesia. However, hemarthrosis and recurrence of stiffness can occur. Intensive physiotherapy is rarely sufficient¹. Surgical treatment for knee extension contracture ranges from simple arthroscopic adhesiolysis to more extensive Quadricepsplasty. Quadricepsplasty is of distal and proximal types. Distal Quadricepsplasty include the Thompson or V-Y technique, and Proximal Quadricepsplasty includes Judet's quadricepsplasty^{2,3}. V-Y quadricepsplasty incision is advantageous as it preserves the inferior lateral geniculate artery blood supply and directly lengthens the extensor mechanism. Extensor lag (seen in distal procedures), avascular necrosis of the patella, or delayed rehabilitation maybe seen^{4,5}.

We present a case of surgically intervened pigmented villonodular synovitis (PVNS) with stiff extension knee treated by open intraarticular adhesiolysis and a modified V-Y quadricepsplasty and extensor mechanism release.

CASE PRESENTATION

An Indian male in his 20s had presented with insidious onset pain & swelling over left knee. MRI revealed moderate sized insinuating lesion with T1 hypointense and T2 mildly hyperintense lesion involving the superolateral compartment and Hoffa fat pad of the knee joint. He was operated in March 2021 with open arthrotomy with subtotal synovectomy. Biopsy revealed Chronic Villonodular Synovitis. Post operatively patient was advised strict physiotherapy but due to the COVID 19 pandemic and the nationwide Lockdown, he was lost to follow-up. Patient showed up a year later with a stiff knee in extension with a range of motion of 0-30° flexion. The patient was planned for open adhesiolysis of joint arthrofibrosis and a modified V-Y quadricepsplasty if required.

Surgical technique: The surgery was done under spinal anaesthesia on 30-05-2022. A vertical midline skin incision extending around 8 cm above the superior border of patella to a few centimetres below the lower patella border superimposed on the previous scar was used. Medial parapatellar incision (as previous surgery) was used for release of widespread intraarticular adhesions within the knee joint. The patella was everted, and the lateral extensor retinaculum was freed from the underlying femur. Since no adhesions were present

proximally on the quadriceps tendon or the vasti, extensive proximal release of the extensor mechanism from the tendon and from the underlying femur was avoided. To achieve the desired intraoperative flexion (>90°), a separate incision was used at proximal Musculo-tendinous junction of quadriceps tendon in a full thickness V-shaped manner. Following this, immediate flexion of 130° was achieved (Video 1). With the knee flexed to approximately 90°, the quadriceps tendon was repaired in its lengthened position, giving the appearance of a V to Y proximal progression. The procedure was carried out using a tourniquet, and the wound was closed over a suction drainage. The tourniquet was released, and the appearance of the skin flap was checked. Routine prophylactic antibiotics were administered.

Postoperative Regimen and follow-up: In the immediate postoperative period a well-padded crepe bandage was applied, limbs were raised on pillows and ice packs were applied for 72 hours. Parenteral analgesics were given on the first three days and further oral analgesics were continued for another three weeks. The lower extremity strengthening, and ROM exercises including continuous passive motion (CPM), walking, and weight-bearing exercises were included in the rehabilitation program (Video 2). The physiotherapy protocol followed immediately after surgery is shown in Table 1⁶. Post operative assessment was done as degrees of flexion achieved, Hospital for Special Surgery (HSS) Knee-Rating Scale scoring⁷ and outcome as per Judet's criteria⁸. Currently (10 weeks post-op), the patient has 0-120° active and passive ROM of the knee (Video 3), an extensor lag of 7° (Video 4), is mobilizing without support and is strictly adhering to the rehabilitation protocol (Table 2). Currently, the patient has rejoined his profession with no discomforts or complaints.

DISCUSSION

Knee stiffness with extension contracture is a common complication post knee surgery, particularly in the sitting of hampered post-surgery rehabilitation due to the imposed nationwide COVID lockdown. Exaggerated pathologic fibrous hyperplasia (arthrofibrosis), the main cause of post-operative knee stiffness limits joint motion, activation of muscles and eventually decreases the physiologic range of motion (ROM)⁹.

Thompson quadricepsplasty released the rectus femoris completely from both vasti, such that it takes over the action of knee extension. An inherent risk of Thompson quadricepsplasty is the possibility of developing extension lag due to insufficient power of rectus femoris to oppose the hamstrings or maintain extension at the knee as it takes the

body weight when walking². The rectus femoris if tight may need V-Y plasty and lengthening further accentuating extensor lag, a disabling problem¹⁰. The need for rectus femoris lengthening procedures could be avoided by extending the release more proximally.

Proximal procedures are more successful in the seating of post traumatic (femur fracture, etc) knee stiffness, where stiffness is due to the Periarticular and intramuscular adhesions, fracture callus and skin adhesions which prevent free gliding of the muscle fibres upon one another. Judet's quadricepsplasty permits a controlled, sequential proximal release of the intrinsic and extrinsic components limiting knee flexion. During the procedure, if adequate flexion is obtained, the dissection is stopped at that stage. This significantly lowers risk of iatrogenic quadriceps rupture or extensor lag¹¹. However, complication rates of 23% have been reported, including deep sepsis, quadricep tendon rupture, skin dehiscence, delayed wound healing, patella fracture, lateral femoral condyle fracture, and extensor lag, etc^{12,13}.

In our case, intraarticular adhesions and arthrofibrosis were the expected cause of stiffness. Hence, proximal procedures were not taken up. Targeted approach of open intraarticular adhesiolysis using the previous surgical incision was done to minimize skin contracture or scar adhesion around the knee joint. Intraarticular adhesions were seen over the bony articulating surfaces and the parapatellar retinacula. Adhesions were not seen over the quadriceps tendon and the vasti, hence not released proximally. On release of all adhesions, intraoperative flexion of 90° was not achieved. Hence, quadriceps tendon lengthening was undertaken.

Traditional V-Y Quadricepsplasty involves an inverted 'V' shaped incision at the musculotendinous junction with full flexion attempted and sutured in 'Y' shaped manner. However, incision at distal musculotendinous junction leads to increased incidence of extensor lag⁴. We used a separate full thickness V-shaped incision at the proximal Musculo-tendinous junction of quadriceps tendon in an attempt to minimise extensor lag. We achieved 130° of flexion per operatively.

Continuous passive motion and vigorous postoperative active knee exercises reduce the formation of adhesions, prevent quadriceps inhibition, allowing gain in knee flexion and reducing extensor lag. In the post-operative period, a specific rehabilitation program (Table 2) was followed. With the application of this protocol, the functional outcomes and pain levels were improved after surgery. Our patient at 10 weeks follow-up, had a knee ROM of 0-120° (Flexion loss of 10°) and an extensor lag of approximately 7°. Severe extensor lag affects functioning and daily routines, but as in our case, mild extensor lag does not compromise functioning and daily activities.

CONCLUSION

Quadricepsplasty is an extremely rewarding procedure improving quality of life and functional outcome in stiff knee. A well planned and targeted surgical approach treating the primary cause of stiffness augmented with direct extensor mechanism lengthening procedures if required are needed to achieve acceptable per-operative knee ROM. Aggressive surgery specific postoperative physiotherapy and rehabilitation play a vital role in achieving satisfactory results.

Clinical Message

1. Rehabilitation and supervised physiotherapy are essential to prevent stiff knee post knee surgery.
2. Proper planning and surgery treating the primary cause of stiffness is advisable for achieving favourable outcomes.
3. The patient should be explained preoperatively that the gain of knee range of flexion may be at the cost of a persistent mild extensor lag.
4. The importance of education of knee quadriceps as well as hamstring exercises in preoperative period should be taught to the patient. These exercises will prevent the quadriceps inhibition in the painful postoperative period.
5. Continuous passive motion and vigorous postoperative active knee exercises following a specific targeted regimen lead to achievement of excellent functional outcomes.

Abbreviations

1. Pigmented villonodular synovitis- PVNS
2. Range of motion- ROM
3. Continuous passive motion- CPM

Table 1. Post-operative Physiotherapy protocol used for the patient.

Day 1	Cold pack (once every 2 hours for 15 minutes) Quadriceps isometric exercise (once every 2 hours 1×10) Weight bearing as tolerated Elastic compression Bandage for oedema control, Ankle pump exercise Continuous passive motion (CPM) 0°- 45°
Day 2	Continue day 1 exercises Hip adductor isometric exercise (3 sets ×10 repeats) Active assistive heel sliding exercise in bed (3 sets ×10 repeats) Hip abductor isotonic exercise (3 sets ×10 repeats) Hip flexor isotonic exercise (3 sets ×10 repeats) Active assistive straight leg raises (3 sets ×10 repeats) CPM 0°- 60°
Day 3	Continue day 2 exercises CPM 0°- 75°
Day 4-7	Continue day 3 exercises Heel sliding exercise while sitting on chair (3 sets ×10 repeats) CPM 0°- 90°
2nd to 6th Week	Patellar mobilization (on medio-lateral and superior inferior directions) Terminal quadriceps: Short-arc 0° - 30° knee extension (3 sets ×10 repeats) Three-way straight leg raises (3 sets ×10 repeats) Heel sliding exercise on the wall (3 sets ×10 repeats) Hip abductor isotonic exercise (with weight) (3 sets ×10 repeats) Hip flexor isotonic exercise (with weight) (3 sets ×10 repeats) Hamstring stretching exercise (3 sets ×10 repeats) Active knee extension (0°-90°) (3 sets ×10 repeats)
6th to 12th Week	Knee flexion in prone position Wall squat (3 sets ×10 repeats) Weight bearing exercises (forward and side) Low loading eccentric exercises such as step down and up (3 sets ×10 repeats)

Table 2: Follow-up Outcome of our patient.

S. No	Pre-Operative ROM	Per-Operative ROM	Final Knee Flexion (At 10 weeks follow-up)	Final Outcome as per Judet's Criteria	HSS Scoring Pre-op	HSS Scoring 2 weeks Post-op	HSS Scoring 10 weeks Post-op
1.	0-30°	0-130°	0-120°	Excellent	45	67	92



Video 1: Per-operative video showing the Knee ROM from 0-130°.



Video 2: Patient being mobilized on Post Operative Day 1.



Video 3: 10 weeks post-surgery video showing patient with Knee ROM of 0-120° and mobilizing pain free and unassisted.



Video 4: 10 weeks post-surgery video with patient sitting on the edge of examination table depicting active knee flexion upto 120° with an extensor lag of approx. 7°.

Video Legends

Video 1: Per-operative video showing the Knee ROM from 0-130°.

Video 2: Patient being mobilized on Post Operative Day 1.

Video 3: 10 weeks post-surgery video showing patient with Knee ROM of 0-120° and mobilizing pain free and unassisted.

Video 4: 10 weeks post-surgery video with patient sitting on the edge of examination table depicting active knee flexion upto 120° with an extensor lag of approx. 7°.

Consent Statement

Written informed consent was obtained from the patient prior to publication of this case report and the accompanying images. All procedures undertaken were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Competing Interests

The authors declare that they have no competing interests.

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