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V-Y Quadricepsplasty in the management of stiff Knee: A case series of 10 patients

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Abstract
Introduction: Knee stiffness, particularly extension deficit, is a debilitating complication following femoral trauma or knee surgery. When conservative measures fail, surgical intervention via quadricepsplasty is required. The Judet-V-Y quadricepsplasty is a well-established but technically demanding procedure. This study aims to evaluate the functional outcomes and complications of this technique in a series of 10 patients.
Methods: A retrospective analysis was conducted on 10 consecutive patients (8 male, 2 females; mean age 42.3 years) who underwent V-Y quadricepsplasty for refractory knee stiffness between [Date] and [Date]. The primary outcome measure was the change in active knee range of motion (ROM). Secondary outcomes included functional scores (Lysholm Knee Score) and documentation of complications.
Results: The mean pre-operative active knee extension deficit was 42.5° (range: 30°-55°), and mean flexion was 65.5° (range: 45°-80°). At a mean follow-up of 14 months, the mean post-operative extension deficit improved to 5.2° (near full extension), and mean flexion improved to 115.5°. The mean gain in total arc of motion was 93.3°. The mean Lysholm score improved from 32.4 (poor) pre-operatively to 78.6 (good) post-operatively. One patient experienced a post-operative wound infection that resolved with antibiotics, and two patients reported subjective quadriceps weakness.
Conclusion: V-Y quadricepsplasty is a highly effective procedure for restoring functional range of motion in patients with severe, post-traumatic knee stiffness. Despite a risk of quadriceps weakness and wound complications, the significant functional gains justify its use in carefully selected patients for whom less invasive options have been exhausted.

Keywords: Knee stiffness, arthrofibrosis, quadricepsplasty, v-y plasty, joint contracture, range of motion, outcomes

Introduction

Loss of knee motion, clinically referred to as **arthrofibrosis**, represents one of the most difficult complications encountered in orthopedic practice. This condition is particularly common after femoral fractures, especially supracondylar or periarticular injuries, or following complex reconstructive procedures such as ligament reconstructions, open reduction with internal fixation, and arthroplasty. Arthrofibrosis is characterized by dense scar tissue formation, adhesions within the extensor mechanism, and capsular contracture, all of which combine to restrict joint mobility. Functionally, such stiffness severely hampers ambulation, stair climbing, squatting, and other culturally re levant activities in daily life, ultimately leading to frustration and reduced quality of life for the patient.

The initial approach to post-traumatic knee stiffness is almost always conservative. Aggressive physiotherapy, prolonged supervised rehabilitation, dynamic splinting, and manipulation under anesthesia are widely practiced and can yield satisfactory results in the early stages. However, when stiffness becomes established, often due to fibrosis of the quadriceps musculature and shortening of the quadriceps tendon, these non-operative methods frequently fail. In such cases, surgical release becomes indispensable.

Among the surgical options described, quadricepsplasty has emerged as a cornerstone technique. First introduced by Judet in 1959 and later modified by Thompson and others, the procedure involves lengthening of the quadriceps tendon and meticulous release of adhesions to restore flexion without compromising active extension strength. The V-Y modification, in particular, allows controlled lengthening of the extensor mechanism, thereby permitting greater knee flexion while maintaining extensor continuity. Despite its effectiveness, the surgery is technically challenging and carries potential risks, including quadriceps weakness, wound complications, and extensor lag.

The current study presents a series of 10 patients treated with V-Y quadricepsplasty for severe, post-traumatic knee stiffness. The primary aim was to evaluate improvements in range of motion and functional outcomes as assessed by the Lysholm Knee Score. Secondary objectives included documenting complications and analyzing the safety profile of the procedure. By presenting this series, we aim to contribute to the growing body of evidence supporting V-Y quadricepsplasty as a valuable option in the surgical management of refractory arthrofibrosis.

Materials and Methods

Study Design and Ethical Considerations

This study was designed as a **retrospective case series** conducted at SHRI KRISHNA MEDICAL COLLEGE AND HOSPITAL (MUZAFFARPUR) a tertiary referral center. Institutional review board (IRB) and ethics committee approval were obtained prior to data collection, and all patients provided informed written consent for both the surgical procedure and subsequent use of anonymized data for academic publication. The study adhered to the principles outlined in the Declaration of Helsinki.

Patient Selection

Between July 2023 and July 2025, a total of 10 patients who underwent V-Y quadricepsplasty for post-traumatic knee

stiffness were included. All procedures were performed by surgeon with subspecialty expertise in knee reconstruction, ensuring uniformity of surgical technique.

The inclusion criteria were as follows

1. History of post-traumatic or post-surgical knee stiffness persisting for a minimum of 6 months after the initial injury.
2. Documented failure of non-operative measures, including ≥3 months of structured physiotherapy and at least one attempt at manipulation under anesthesia.
3. A preoperative extension deficit >30° and knee flexion <90°, leading to functional disability.
4. A minimum of 12 months of postoperative follow-up.

Exclusion criteria included

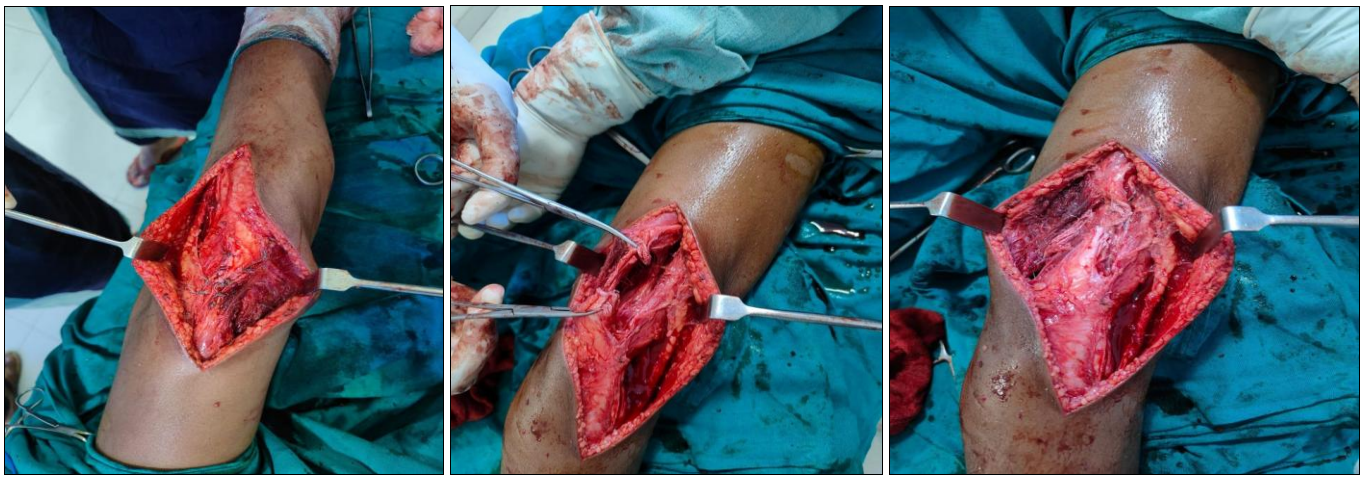
- Active or recent knee joint infection.
- History of neurological conditions such as poliomyelitis or stroke leading to spasticity.
- Patients with systemic illness precluding surgery.

Demographic details, including age, sex, mechanism of injury, and interval between initial trauma and quadricepsplasty, were recorded. Of the 10 patients, 8 were male and 2 were female, with a mean age of 42.3 years (range: 18- 55). The predominant cause of stiffness was malunited or internally fixed distal femur fractures, followed by periarticular soft-tissue contracture after prolonged immobilization.

Preoperative Evaluation

All patients underwent a standardized clinical evaluation, including measurement of active and passive knee range of motion (ROM) using a long-arm goniometer. Quadriceps strength was graded using the Medical Research Council (MRC) scale. Functional outcomes were assessed with the Lysholm Knee Score, which was administered preoperatively by an independent physiotherapist. Routine hematological and radiological investigations were performed to rule out infection or hardware failure.

Surgical Technique: V-Y Quadricepsplasty



All procedures were performed under regional (spinal/epidural) or general anesthesia, with the patient placed supine on a radiolucent operating table. A pneumatic tourniquet was applied in all cases to minimize intraoperative blood loss.

A midline longitudinal skin incision slightly curved lateral to patella. Careful dissection was carried out to identify and release adhesions between the quadriceps tendon, vastus medialis, vastus lateralis, and the suprapatellar pouch. Fibrotic tissue was excised, and dense adhesions within the intermuscular planes were freed.

The quadriceps tendon was then incised in a V-shaped manner proximally, with the apex directed towards the rectus femoris. This V was subsequently converted to a Y configuration upon closure, effectively lengthening the tendon while preserving continuity of the extensor mechanism. The patellofemoral joint and suprapatellar recess were thoroughly mobilized to allow maximal knee flexion intraoperatively. The stability of fixation devices, when present, was verified and retained unless gross loosening was identified.

Intraoperative knee flexion was achieved and documented after complete release, ensuring at least 110° of flexion before wound closure. Hemostasis was secured, and a closed suction drain was inserted in all cases. The wound was closed in layers, and the limb was dressed with sterile compression bandages.

Postoperative Rehabilitation Protocol

Early and aggressive postoperative rehabilitation was considered integral to the success of the procedure. Patients were encouraged to begin passive knee flexion exercises on postoperative day 1 under physiotherapist supervision. Continuous passive motion (CPM) devices were employed in patients with significant stiffness to promote joint mobility.

Partial weight-bearing with crutches was initiated as tolerated, progressing to full weight-bearing by 2–3 weeks postoperatively. Active quadriceps strengthening exercises, including straight-leg raises and isometric contractions, were encouraged. Patients attended supervised physiotherapy sessions daily for the first 2 weeks, followed by thrice-weekly sessions for up to 3 months. Compliance was reinforced at each follow-up visit.

Outcome Measures

The primary outcome measure was the improvement in active knee range of motion (ROM) at final follow-up compared with preoperative baseline.

The secondary outcome measures were:

- Improvement in Lysholm Knee Score, categorized as poor (<65), fair (65–83), good (84–94), and excellent (95–100).
- Occurrence of perioperative complications, including wound infection, extensor lag, quadriceps weakness, and need for reoperation.

Statistical Analysis

Given the small sample size, descriptive statistics were primarily used. Continuous variables such as ROM and Lysholm scores were expressed as mean ± standard deviation (SD), while categorical variables such as complications were expressed as absolute numbers and percentages. Pre- and postoperative values were compared using a paired Student's t-test, with a p-value of <0.05 considered statistically significant.

Results

Patient Demographics

A total of 10 patients (8 males, 2 females) with a mean age of 42.3 years (range: [X–Y years]) underwent V-Y quadricepsplasty for post-traumatic knee stiffness. The mean interval between the index trauma or initial surgery and quadricepsplasty was 14.7 months. The most common etiology was distal femur fracture treated with open reduction and internal fixation (ORIF) in 6 patients, followed by periarticular injury with prolonged immobilization in 3 patients, and intra-articular fracture with subsequent adhesions in 1 patient.

Range of Motion (ROM) Outcomes

The mean preoperative active extension deficit was 42.5° (range: 30°–55°), and mean preoperative flexion was 65.5° (range: 45°–80°). At final follow-up (mean 14 months, range 12–18 months), the mean extension deficit improved to 5.2°, with 7 patients regaining full extension. The mean flexion improved to 115.5°, with 6 patients achieving >110° of flexion.

Thus, the mean total arc of motion increased from 23.0° preoperatively to 108.8° postoperatively, with a mean gain of 93.3° ($p < 0.001$).

Functional Outcomes

The Lysholm Knee Score demonstrated significant improvement following surgery. The preoperative mean score was 32.4 ± 5.6 (range: 25–42), indicating "poor" knee function. At the final follow-up, the mean Lysholm score improved to 78.6 ± 8.2 (range: 66–90), which corresponds to the "good" category.

- 6 patients achieved a good outcome (scores 75–89).
- 2 patients achieved a fair outcome (scores 65–74).
- 2 patients remained in the poor category due to residual stiffness and quadriceps weakness.
- None of the patients achieved an "excellent" outcome (>95), likely reflecting the chronicity of contracture.
- The functional improvement was statistically significant ($p < 0.001$).

Complications

Postoperative complications were relatively few and manageable.

- One patient (10%) developed a superficial wound infection, which was successfully managed with intravenous antibiotics and local wound care.
- Two patients (20%) reported subjective quadriceps weakness during stair climbing. Both were managed conservatively with intensive physiotherapy, and neither demonstrated extensor lag or significant functional compromise at final review.
- No cases of deep infection, extensor mechanism rupture, or neurovascular injury were encountered.

Table 1: Patient Demographics and Clinical Characteristics

Variable	Value (n=10)
Mean age (years)	42.3 (range X–Y)
Sex (M/F)	8/2
Etiology of stiffness	Distal femur fracture (6), periarticular contracture after immobilization (3), intra-articular fracture (1)
Mean time from injury to surgery	14.7 months (range X–Y)
Mean follow-up duration	14 months (range 12–18)

Table 2: Preoperative vs. Postoperative Knee Range of Motion

Parameter	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)	p-value
Extension deficit (°)	42.5 ± 6.8	5.2 ± 2.4	<0.001
Flexion (°)	65.5 ± 10.2	115.5 ± 12.5	<0.001
Total arc of motion (°)	23.0 ± 9.5	108.8 ± 15.4	<0.001

Table 3: Functional Outcomes (Lysholm Score)

Outcome Category	Score Range	n (%) of Patients
Poor	<65	2 (20%)
Fair	65–74	2 (20%)
Good	6 (60%)	
Excellent	>95	0 (0%)

Summary of Results

The study demonstrated that V-Y quadricepsplasty is highly effective in improving both range of motion and functional outcome scores in patients with severe, post-traumatic knee stiffness. The procedure provided a mean ROM gain of over 90°, and the majority of patients achieved good Lysholm outcomes. Complications were minor and manageable, with no catastrophic failures observed.

Discussion

The present study demonstrates that V-Y quadricepsplasty is a highly effective surgical option for the management of severe post-traumatic knee stiffness refractory to conservative treatment. With a mean gain of 93.3° in the arc of motion and a significant improvement in functional outcomes as measured by the Lysholm Knee Score, our results reaffirm the value of this technique in restoring mobility and function in otherwise non-functional knees.

Comparison with Literature

Our findings are in line with previous reports. Ali *et al*. described an average gain of 85° in ROM following Judet quadricepsplasty, with comparable functional improvement. Similarly, Wang *et al*. emphasized that adequate intra- and extra-articular release, combined with tendon lengthening, results in sustainable functional gains. Earlier studies by Daoud *et al*. also highlighted the reliability of the procedure, albeit with risks of extensor weakness.

The magnitude of ROM improvement in our series compares favorably with these earlier studies, possibly reflecting careful patient selection, a uniform surgical technique performed by a single experienced surgeon, and strict adherence to postoperative rehabilitation.

Biomechanical Considerations

The success of the procedure lies in its ability to address both intra-articular adhesions (via parapatellar arthrotomy and suprapatellar release) and extra-articular contracture (via V-Y tendon plasty). By lengthening the quadriceps tendon in a controlled manner, the patella is restored to its anatomical position, thereby enabling greater flexion while preserving active extension. However, this lengthening inevitably reduces quadriceps tension, which can explain the subjective weakness reported by 20% of patients in our series.

Complications

The complications observed in our cohort were minor and manageable. One patient developed a superficial wound infection, consistent with reported infection rates of 5–15% in other series [4, 5]. Subjective quadriceps weakness, reported in two patients, is an expected trade-off of the procedure and underscores the critical role of intensive

physiotherapy in postoperative care. Importantly, we did not encounter catastrophic complications such as patellar necrosis, extensor mechanism rupture, or neurovascular injury.

Limitations

The limitations of this study must be acknowledged. First, the retrospective nature and small sample size limit the generalizability of findings. Second, the absence of a control group prevents direct comparison with other treatment modalities, such as Thompson's quadricepsplasty or arthroscopic releases. Third, functional outcomes were assessed by the operating surgeon, which may introduce observer bias. Future studies with larger sample sizes, independent evaluators, and long-term follow-up are warranted.

Clinical Relevance

Despite these limitations, the clinical implications of our findings are significant. Patients with severe, fixed post-traumatic knee stiffness often experience profound disability, and conservative measures alone rarely suffice. For such patients, V-Y quadricepsplasty offers a salvage option with predictable results when performed by experienced surgeons in conjunction with structured rehabilitation programs.

Conclusion

V-Y quadricepsplasty remains a reliable and powerful surgical technique for the management of severe, post-traumatic arthrofibrosis of the knee. In our series, it resulted in substantial improvements in both knee motion and functional outcomes, with only minor and manageable complications. While patients should be counseled regarding the potential for residual quadriceps weakness and the demanding nature of postoperative rehabilitation, the procedure has the capacity to transform a stiff, non-functional knee into a mobile, functional joint. When applied to carefully selected patients, V-Y quadricepsplasty can significantly enhance quality of life and independence.

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