

## Modified Judet Quadricepsplasty in Patients with Post-Traumatic Knee Stiffness Safety and Efficacy

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### Abstract

### Original Research Article

**Background:** One difficult side effect of complicated knee fractures is knee stiffness. Clinical outcomes and complication rates continue to be possible disadvantages despite the description of numerous treatment approaches in recent decades. **Objectives:** The purpose of this study was to evaluate the clinical results and side effects of modified Judet quadricepsplasty after knee stiffness brought on by intricate knee fractures. **Methods:** The cross-sectional Observational study was conducted in the Department of Orthopedics, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) from June 2020 to May 2023. A total of 60 patients presenting post-traumatic knee stiffness underwent modified Judet quadricepsplasty were included in the study. All procedures were performed by the same surgical team, and all patients followed the same postoperative pain control and rehabilitation protocols. Data were collected over a period of 36 months and analyzed by appropriate computer based programmed software Statistical Package for the Social Sciences (SPSS), version 24. **Results:** In this study, most of the patients 23 (38.3%) lies between 30 years to 34 years. Mean  $\pm$  SD of the patients was  $32.2 \pm 7.3 \pm 7.3$  years. Most of the patients 52 (86.70%) were male and 8 (13.30%) were female. Most of the patients 22 (36.7%) experienced Extra-articular distal femur fracture + tibial plateau fracture, 13 (21.7%) patients had Tibial plateau fracture, 12 (20.0%) patients had Extra-articular distal femur fracture + patella fracture and 9 (15.0%) patients had Intra-articular distal femur fracture. Average of preoperative flexion was  $34^\circ$  (23–50°). Average of intraoperative flexion was  $122.4^\circ$  (118–135°). Average of final flexion after rehabilitation was  $97.9^\circ$  (75–120°). Average of flexion loss from the intraoperative to final evaluation was  $25.8^\circ$ . Average of flexion achieved using the modified Judet technique in this case series was  $61.8^\circ$ . Average time from injury was 22.2 months, Preoperative KSS score was 61.7 and Postoperative KSS score was 81.5. According to the Judet criteria, functional outcomes were excellent in 25 (41.7%) patients, good in 32 (53.3%), and poor in 3 (5.0%) patients. **Conclusion:** Optimistic functional results with extremely low complication rates using this modified Judet quadricepsplasty validated the safety and effectiveness of this beneficial surgical procedure for the problem of post-traumatic knee stiffness, despite the fact that quadricepsplasty is thought to be a high morbidity surgical procedure.

**Key words:** Modified Judet Quadricepsplasty, Knee Stiffness, Safety and Efficacy.

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## INTRODUCTION

Complex fractures around the knee are becoming more common as high-energy trauma increases. To enable early rehabilitation and hence avoid

knee stiffness, articular congruency, anatomic articular surface repair, knee alignment, and particularly secure fixation are essential. However, knee stiffness can still happen even when all the conventional surgical

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procedures of articular fracture repair are used; therefore, treatment presents a challenge.

A stiff knee has a very high impact on one's quality of life. Full extension and roughly 70° knee flexion are necessary for a normal walk. It takes roughly 80 knee flexion to climb stairs. Depending on the height of the steps, about 100 knee flexion is needed to descend. Depending on the height of the chair, getting out of it may require bending the knee by about 90 degrees [1, 2].

There are three types of knee stiffness: extraarticular, intraarticular, and a combination of the two. Soft tissue retraction, bone impingement as a result of intraarticular malunion, and chaotic fibrous scar tissue development all contribute to intra-articular stiffness. Skin adhesions to the deeper soft tissue layers, muscle retraction, ligament adhesions, and quadriceps adhesions to a femoral callus all contribute to extra-articular stiffness [3].

Physiotherapy, manipulation under anesthesia, arthroscopic release, quadriceps release under endoscopic view, and quadricepsplasty utilizing the traditional Judet and Thompson procedures or their variations are some of the treatment approaches that have been employed for knee stiffness [4–14].

The surgical procedure was performed in three stages, according to Judet, beginning at the level of the tibial anterior tuberosity, a lateral parapatellar incision extended proximally, just below the greater trochanter. The lateral retinal ligament was released, together with the adhesions between the patella and the femoral condyles and in the suprapatellar gutter. In contrast to the original Judet procedure, we didn't use a second medial approach. The lateral technique was used when medial relief was required. Thus, this process is seen as an adaptation of the original Judet quadricepsplasty. All adhesions between soft tissues and any hardware were removed, as well as any bone protuberances that would restrict range of motion. After being released, the vastus intermediate was raised extraperiosteally from the femur's anterior and lateral sides. Up to the greater

trochanter's level, the vastus lateralis was separated from the linea aspera. Careful knee manipulation was done following phases 1 and 2. The rectus femoris separated from its insertion at the anterior inferior iliac spine and the skin incision was extended proximally if knee flexion was still restricted. After that, another knee manipulation was done. Because of the risk of fracture, hardware removal prior to the Judet operation was not done. Once all knee release steps have been completed, hardware removal may be advised if necessary [10, 15–17].

## METHODOLOGY

The cross-sectional Observational study was conducted in the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR) from June 2020 to May 2023. A total of 60 patients presenting post-traumatic knee stiffness underwent modified Judet quadricepsplasty were included in the study. All procedures were performed by the same surgical team, and all patients followed the same postoperative pain control and rehabilitation protocols. No patients underwent medial approach for medial release. When necessary, medial release was performed through the lateral approach. Patients were evaluated using the Judet criteria for final range of motion after 1-year minimum follow-up. Purposive sampling was done according to the availability of the patients who fulfilled the selection criteria. Face to face interview was done to collect data with a semi-structured questionnaire. After collection, the data were checked and cleaned, followed by editing, compiling, coding, and categorizing according to the objectives and variable to detect errors and to maintain consistency, relevancy and quality control. Statistical evaluation of the results used to be obtained via the use of a window-based computer software program devised with Statistical Packages for Social Sciences (SPSS-24).

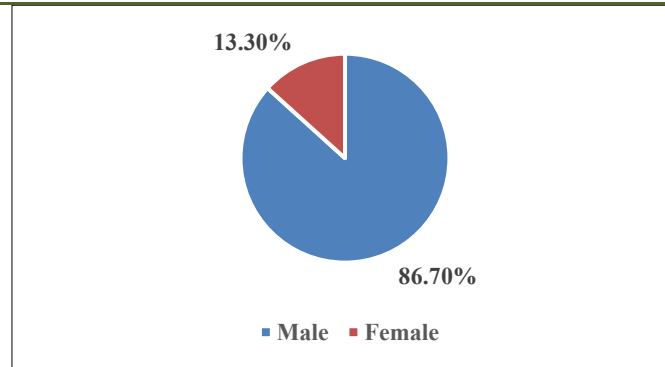
## RESULT

Table I shows that, most of the patients 23 (38.3%) lies between 30 years to 34 years. Mean  $\pm$  SD of the patients was  $32.2 \pm 7.3 \pm 7.3$  years.

**Table I: Distribution of the patients according to age (n = 60)**

Age (years)	Frequency	%
25 – 29	9	15.0
30 - 34	23	38.3
35 - 39	12	20.0
40 - 44	8	13.3
45 - 49	6	10.0
$\geq 50$	2	3.3
<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Mean <math>\pm</math> SD: <math>32.2 \pm 7.3</math> years</b>		

Figure I shows that, most of the patients 52 (86.70%) were male and 8 (13.30%) were female.



**Figure I: Distribution of the patients according to sex (n=60)**

Table II shows that, most of the patients 22 (36.7%) experienced Extra-articular distal femur fracture + tibial plateau fracture, 13 (21.7%) patients had Tibial

plateau fracture, 12 (20.0%) patients had Extra-articular distal femur fracture + patella fracture and 9 (15.0%) patients had Intra-articular distal femur fracture.

**Table II: Distribution of the patients according to type of injury (n = 60)**

Type of injury	Frequency	%
Intra-articular distal femur fracture	9	15.0
Tibial plateau fracture	13	21.7
Extra-articular distal femur fracture + patella fracture	12	20.0
Extra-articular distal femur fracture + tibial plateau fracture	22	36.7
<b>Total</b>	<b>60</b>	<b>100.0</b>

Table III Shows that, Average of preoperative flexion was 34° (23–50°). Average of intraoperative flexion was 122.4° (118–135°). Average of final flexion after rehabilitation was 97.9° (75–120°). Average of

flexion loss from the intraoperative to final evaluation was 25.8°. Average of flexion achieved using the modified Judet technique in this case series was 61.8°.

**Table III: Distribution of the patients according to degree of achieved flexion (n=60)**

	Average
Preoperative flexion	34° (23–50°).
Intraoperative flexion	122.4° (118–135°).
final flexion after rehabilitation	97.9° (75–120°)
Flexion loss	25.8°
Flexion achieved using the modified Judet technique	61.8°

Table IV shows that, Average time from injury was 22.2 months, Preoperative KSS score was 61.7 and Postoperative KSS score was 81.5

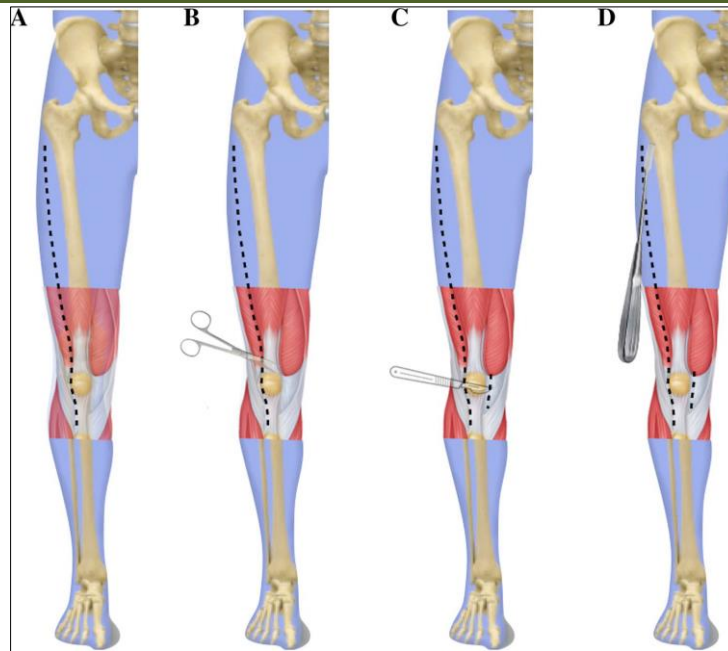
**Table IV: Distribution of the patients according to time from injury, pre- and postoperative KSS (n = 60)**

Degree of achieved flexion	Average
Time from injury (months)	22.2
Preoperative KSS	61.7
Postoperative KSS	81.5

Table V shows that, according to the Judet criteria, functional outcomes were excellent in 25 (41.7%) patients, good in 32 (53.3%), and poor in 3 (5.0%) patients.

**Table V: Distribution of the patients according to functional outcomes (n = 60)**

Functional outcomes	Frequency	Percent
excellent	25	41.7
good	32	53.3
poor	3	5.0
<b>Total</b>	<b>60</b>	<b>100.0</b>



**Figure II:** A) Illustration of the anterolateral parapatellar approach. B) Release of the lateral retinaculum and release of the adhesions in the suprapatellar gutter and between the patella and the femoral condyles. C) Medial release performed through the lateral approach. Vastus intermedius is also released and lifted off the anterior and lateral surfaces of the femur extraperiosteally. D) Vastus lateralis is detached from the linea aspera until the level of the greater trochanter with a periosteal elevator



**Figure III:** A and B Preoperative images showing knee stiffness with 23° of flexion. C Intraoperative image after the modified Judet quadricepsplasty showing 121° of knee flexion. D and E Images of the knee during CPM

## DISCUSSION

Complex knee fractures are still difficult to treat. Due to significant soft tissue damage, extended immobilization or the use of an external fixator, as well as as a result of postoperative complications, high energy trauma can cause knee stiffness. The primary line of treatment for preventing knee stiffness is typically early

physiotherapy. To enable an early gain of mobility, secure fixation, knee alignment, and anatomic articular fracture reduction are essential. Manipulation under anesthesia is an additional therapeutic option. However, premanipulation range of motion (ROM) < 30° or flexion < 40°, as well as a history of extensor mechanism rupture, may be risk factors for treatment failure [18].



The cross-sectional Observational study was conducted in the Department of Orthopedics, National Institute of Traumatology and Orthopedic Rehabilitation (NITOR) from June 2020 to May 2023. A total of 60 patients presenting post-traumatic knee stiffness underwent modified Judet quadricepsplasty were included in the study. All procedures were performed by the same surgical team, and all patients followed the same postoperative pain control and rehabilitation protocols.

In this study, most of the patients 23 (38.3%) lies between 30 years to 34 years. Mean  $\pm$  SD of the patients was  $32.2 \pm 7.3 \pm 7.3$  years. Most of the patients 52 (86.70%) were male and 8 (13.30%) were female. Most of the patients 22 (36.7%) experienced Extra-articular distal femur fracture + tibial plateau fracture, 13 (21.7%) patients had Tibial plateau fracture, 12 (20.0%) patients had Extra-articular distal femur fracture + patella fracture, and 9 (15.0%) patients had Intra-articular distal femur fracture. Average of preoperative flexion was  $34^\circ$  ( $23-50^\circ$ ). Average of intraoperative flexion was  $122.4^\circ$  ( $118-135^\circ$ ). Average of final flexion after rehabilitation was  $97.9^\circ$  ( $75-120^\circ$ ). Average of flexion loss from the intraoperative to final evaluation was  $25.8^\circ$ . The average flexion achieved using the modified Judet technique in this case series was  $61.8^\circ$ . Average time from injury was 22.2 months, Preoperative KSS score was 61.7 and Postoperative KSS score was 81.5. According to the Judet criteria, functional outcomes were excellent in 25 (41.7%) patients, good in 32 (53.3%), and poor in 3 (5.0%) patients.

In another study, by combining arthroscopic intra-articular release with endoscopic release of quadriceps adhesions, Blanco *et al.* achieved positive results. Using periosteal elevators inserted through the medial and lateral superior knee portals and arthroscopic scissors, the authors performed a proximal endoscopic subperiosteal extension of the standard arthroscopic intra-articular removal of adhesions. Out of the 26 patients, two had gained between  $20^\circ$  and  $49^\circ$  and had severe quadriceps muscle fibrosis and a risky skin state after burns. The extra-articular treatment resulted in a total flexion of  $75^\circ$  or more for seven individuals, gaining  $50^\circ$  to  $69^\circ$ .

In order to achieve at least  $90^\circ$  of flexion, nine patients received  $70^\circ$  to  $89^\circ$  from the extra-articular treatment. Eight individuals experienced flexion increases of  $90^\circ$  or more [14]. The authors suggest this treatment as a useful procedure in achieving greater flexion in patients with ankylosis induced by extra-articular fibrosis of the quadriceps, and the complications were comparatively mild [14]. Nonetheless, the most common therapy for complicated knee stiffness is still quadricepsplasty, either with or without surgical release. The literature has documented a number of variations of

the common quadricepsplasties that Judet and Thompson characterized.

Thompson explained his method, which involved totally separating the vastus from the rectus femoralis. Thompson suggested V-Y plasty if the rectus femoralis was tight [9, 19]. When treating complex knee stiffness, especially in combination (intra-articular and extra-articular) patterns, Judet quadricepsplasty—as originally described or with minor modifications—is arguably the most popular procedure. Judet quadricepsplasty is undoubtedly a big treatment, but the risks of complications are outweighed by the positive functional results. Deep infection, wound dehiscence, skin necrosis, ruptured patellar tendon, extension lag, and femoral fracture are among the complications that can occur up to 23% of the time, according to published data [17, 20–23]. Even though 45.4% of the 11 patients in our series needed blood transfusions because of a high morbidity operation, no infection or wound dehiscence was noted, and just one patient had a poor functional result.

It is significant that our functional results were fairly comparable to the literature even when we did not use a medial technique for medial release. In comparison to the intraoperative measurement, our ultimate flexion was, on average,  $98.9^\circ$  with a flexion loss of  $27.7^\circ$ . Our functional results are shown in Table 3 in comparison to the literature [17, 20–23].

There was no correlation between the period between the prior injury and quadricepsy and the final range of motion. Notably, there was no correlation between the preoperative flexion and the final range of motion. This would enable anticipating positive outcomes irrespective of the amount of time since the prior injury and the range of mobility prior to surgery.

## CONCLUSION

In the vast majority of cases (90.9%) in the current study, modified Judet quadricepsplasty combined with the postoperative rehabilitation strategy indicated produced excellent and good functional results. The low prevalence of complications attests to the procedure's effectiveness and safety in treating complicated knee stiffness.

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