

THE JUDET QUADRICEPSPLASTY : A RETROSPECTIVE ANALYSIS OF 16 CASES

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Sixteen quadricepsplasties performed for severe extension contractures of the knee were reviewed. Preoperatively all cases showed a severe extension contracture with an average of 23° flexion. Only two patients had more than 30° flexion preoperatively. The average improvement in knee flexion at follow-up was 69° with 11 (68.7%) patients achieving a final flexion of 90° or more. In four cases there was a 15° loss of terminal active extension. In one case a rapid recurrence of the contracture was seen during the initial postoperative weeks. One patient developed a deep infection, and another an acute compartment syndrome.

Keywords : extension contracture ; quadricepsplasty.

Mots-clés : raideur du genou ; libération ; appareil extenseur.

INTRODUCTION

Extension contracture of the knee is much less common than flexion contracture. Although this complication of limited knee flexion has been recognized after severe trauma or surgery at the level of the femur or the knee, only a few reports have been published concerning surgical procedures to increase knee flexion.

Thompson (12), and subsequently Hesketh (3), Pick (9), and Moore (8) have presented their results with the Thompson procedure.

Each of these series noted a severe residual extension lag in a number of patients, averaging 10° in 66% of the cases described by Moore (8) and 18° in 33% of the cases described by Pick (9).

In 1956 Judet proposed an alternative technique of quadricepsplasty. Only 11% of his patients

had significant extension lags, and the majority achieved active flexion beyond 100° (6).

This paper reports the results of 16 cases treated with the Judet quadricepsplasty.

MATERIALS

Sixteen patients, nine females and seven males, with severe extension contractures of the knee underwent a Judet quadricepsplasty (table I). Their average age was 64 years (range 4 to 64 years). The average follow-up was 22 months (range 6 to 72 months). The extension contracture was posttraumatic in 8 cases, whereas it occurred after a femoral fracture in 7 cases, (6 supracondylar, 1 subtrochanteric) and a patellar fracture in one case.

Of the 8 nontraumatic cases, 4 resulted from a femoral lengthening with the Ilizarov method, and 3 from intramuscular injections in the anterior thigh during childhood.

One case developed an extension contracture after primary total knee replacement (table I). The preoperative range of motion averaged 23.7° (range 0° to 75°), and the average maximal flexion was 24.7° (range 10° to 75°) preoperatively, with only two patients exceeding 30°. Three patients had a flexion contracture preoperatively with respectively 5°, 10° and 30° deficit in active and passive extension.

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Legend of Table I. — Details of the patient group.

ORIF : Open reduction and internal fixation
 # : Fracture
 Ext.fix. : External fixator
 Cons. : Conservative treatment by balanced traction
 SC# : Supracondylar fracture
 ST# : Subtrochanteric fracture
 Pat.# : Patellar fracture
 TKA : Total knee arthroplasty
 Length Ili. : Lengthening procedure on the femur, with supracondylar osteotomy.

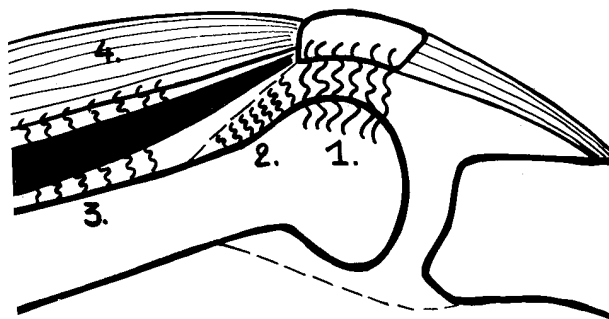


Fig. 1. — The four components of extension contracture (see text).

Table I. — Patient Group

Age	Sex	Cause	Preop.ROM	Steps Judet	FU	Postop.ROM	Gain	Remarks
27 y	F	ORIF SC#	5-25	12	16 m	5°-110°	85°	
40 y	M	ORIF SC#	0-20	123	6 m	0°-100°	80°	
20 y	M	EXTFIX ST#	0-20	123	24 m	0°- 65°	45°	
40 y	M	ORIF SC#	0-20	123	8 m	0°- 90°	70°	
41 y	M	EXTFIX SC#	30-30	123	6 m	30°- 30°	0°	Arthrodesis
38 y	M	CONS. SC#	0-75	12	12 m	0°-115°	40°	
35 y	F	ORIF SC#	0-25	12	14 m	0°- 90°	65°	
38 y	F	ORIF pat#	10-20	12	72 m	10°-130°	110°	-
40 y	F	length Ili	0-30	12	17 m	0°-100°	70°	-
38 y	M	length Ili	0-10	123	4 m	40°- 90°	50°	infection/ext. - 40°
26 y	F	length Ili	0-10	123	11 m	15°- 70°	60°	ext. - 15°
12 y	F	length Ili	0-10	12	18 m	15°-130°	120°	ext. - 15°
7 y	F	IM.Inj.	0-30	23	23 m	0°-110°	80°	
4 y	M	IM.Inj.	0-20	12	71 m	0°- 80°	60°	compart.syndrome
17 y	F	IM.Inj.	0-20	12	46 m	15°- 80°	60°	ext. - 15°
64 y	F	TKA	0-60	12	7 m	0°- 90°	30°	

METHODS

The pathology of extension contracture of the knee is known to consist of 4 major factors (fig. 1) :

1. fibrosis and shortening of the medial and lateral parapatellar retinacula ;
2. adhesions from the deep surface of the patella to the femoral condyles, and in the suprapatellar gutter ;
3. fibrosis of the vastus intermedius, with adherence to the rectus femoris muscle and to the front of the femur ;
4. actual shortening of the rectus femoris.

In the technique of Judet each of these 4 contributing factors is addressed in a staged procedure, with a passive

manipulation after each phase to assess the flexion achieved.

- Phase I involves a release of the medial and lateral retinacula, together with a release of the adhesions in the suprapatellar gutter and between the patella and the femoral condyles. This is performed through a longitudinal lateral and/or medial parapatellar incision.
- When flexion is still limited after passive manipulation, the vastus intermedius is released in phase 2. This requires a long lateral incision extending from just lateral to the superior pole of the patella to the level of the greater trochanter. The vastus lateralis is divided from the linea aspera with meticulous attention to hemostasis of the large perforating vessels. The vastus intermedius is then identified and

lifted extraperiosteally off the lateral and anterior surfaces of the femur. If fibrosis is present, the fibrotic parts of the vastus intermedius are resected. Additional passive flexion is then obtained by manipulation.

- If flexion is still limited phase 3 is performed. This requires extension of the incision proximally and anterolaterally over the hip in the manner described by Watson-Jones (4), so that the origin of the rectus femoris can be detached from the anterior inferior iliac spine.

Postoperatively, the hip and knee are flexed to 90° for 24 hours and continuous passive motion is started. Active exercises and walking are started when the patient is comfortable, usually one week postoperatively. Patients were only considered candidates for the Judet procedure when they had reached a plateau in gaining flexion during physical therapy for at least 6 months, and when flexion remained less than 90° after this period. In our patient group, phase 3 of the Judet procedure was performed 7 times. In one of these patients, no arthrotomy was performed. In the other 9 cases enough flexion was achieved after phases 1 and 2 of the Judet procedure.

RESULTS

Details of our patient group are shown in table I. The average postoperative range of movement (ROM) was 84° (range 0 to 120° which corresponds to an average improvement of 60° (range 0 to 120°). Average flexion at follow-up was 92° (range 30° to 130°), which means an average improvement of 67° (range 0 to 120°). The average flexion that was achieved immediately after the surgical procedure was 103°, indicating that an average of 11° flexion was lost after the procedure.

A preoperative extension deficit was present in 3 patients and 4 other cases developed an active extension lag of 15° (full passive extension) which did not exist preoperatively. One recurrence and 2 major complications were noted. The recurrence was treated with an arthrodesis 6 months after the Judet procedure. The initial gain in flexion in this case (90° flexion intraoperatively) was rapidly lost during the first postoperative weeks. One case developed a deep *Staphylococcus aureus* infection 2 weeks postoperatively. He was treated

with debridement and intravenous Flucloxacillin for 6 weeks. At 6 months follow-up he still had a reduced range of active motion (-40° to 90°), but he had full passive extension. One patient developed a compartment syndrome of the lower leg secondary to a constricting bandage, for which a fasciotomy of the four compartments was performed. At follow-up this patient showed good function with full extension and flexion of 80°.

DISCUSSION

An extension contracture of the knee is usually secondary to trauma or surgery in the thigh. Femoral fracture, massive soft tissue injury of the anterior thigh, and intramuscular injection in the anterior thigh in children have all been reported as possible causes (2, 3, 9, 10, 11, 12).

In the Thompson quadricepsplasty the vastus medialis, vastus lateralis, and vastus intermedius are detached from the patella and the long thin rectus femoris is retained as the sole extensor muscle of the knee. An inherent risk of the Thompson procedure is the possibility of a residual extension lag, when the remaining rectus femoris is insufficient to oppose the powerful hamstrings or to maintain extension at the knee as it takes the body weight when walking.

The advantage of the Judet technique is that it permits a controlled and sequential release of the components limiting knee flexion. At any phase of the procedure, if adequate flexion is obtained, the dissection is stopped. This theoretically reduces the potential for iatrogenic extension lag, and provides an advantage over the Thompson technique, which includes significant disruption of the quadriceps mechanism, including the vastus medialis.

In our patient group the Judet procedure resulted in an average gain of flexion of 68°, with a maximal flexion of 90° or more in 69 % of the cases. A loss of active extension was noted in 4 cases (25%). This is worse than the results reported by Judet (6) (average gain of flexion of 62°, 90% more than 80° of flexion, 4% extension lag) but better than those recently reported by Merchan (7) (average gain of flexion of 47°, 28.5% more than 60° flexion, 52% extension lag). Three

of these 4 cases in our study were patients who had a lengthening procedure with Ilizarov instrumentation. These patients had a very severe flexion deficit due to vastus intermedius fibrosis with only a few degrees of flexion possible, necessitating a major release of the vastus intermedius (step 2) with resection of large fibrotic parts with consequently a higher risk of postoperative active extension deficit.

In 3 other cases a preoperative extension deficit (active and passive) was not improved, which could be expected since posterior capsular contractures or other causative factors for extension deficits are not considered in the Judet procedure.

In these 3 cases no specific attempt was made to address possible anterior fibrosis, another possible cause of extension deficit, probably because the significance of this was not recognized at the time of surgery. In view of our current knowledge, resection of this anterior fibrotic and hypertrophic tissue could have resulted in an actual improvement in extension.

In our patient group, one patient developed a deep infection, and one patient an acute compartment syndrome. In one case a rapid recurrence of the contracture was seen during the first postoperative weeks. In view of these data we suggest that the Judet procedure should be reserved for patients with a severe extension contracture, with flexion less than 90°, since the procedure is not free from complications or an extension lag in some cases, despite its theoretical advantages over other techniques such as the Thompson procedure.

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SAMENVATTING

J. BELLEMANS, A. STEENWERCKX, K. BRABANTS, J. VICTOR, J. LAMMENS en G. FABRY. Judet quadricepsplasties. Een retrospectieve analyse van 16 gevallen.

De auteurs beschrijven de resultaten van 16 quadricepsplasties volgens Judet. De ingreep werd telkens uitgevoerd voor ernstige extensie contractuur van de knie. De flexie verbeterde gemiddeld 69° na de ingreep, en 11 patiënten hadden een uiteindelijke flexie van meer dan 90°. Vier patiënten vertoonden postoperatief een extensie verlies van 15°. Een recidief, één acuut compartmentsyndroom, en één diepe infectie werden als complicatie van deze ingreep waargenomen.

RÉSUMÉ

J. BELLEMANS, A. STEENWERCKX, K. BRABANTS, J. VICTOR, J. LAMMENS et G. FABRY. La libération du quadriceps selon Judet. Analyse rétrospective de 16 cas.

Les auteurs présentent les résultats de 16 libérations de l'appareil extenseur du genou selon la technique de Judet. L'indication a été dans tous les cas une limitation de la flexion du genou. Celle-ci s'est améliorée en moyenne de 69°. Une flexion égale ou supérieure à 90° a été obtenue chez 11 patients. Quatre patients ont présenté après l'opération un déficit d'extension active de 15°. Un patient a perdu tout son gain fonctionnel en postopératoire, un autre a présenté une infection profonde ; un troisième un syndrome des loges.