QUADRICEPSPLASTY

THE JUDET TECHNIQUE AND RESULTS OF SIX CASES

H. DAoud, T. O'Farrell, R. L. Cruess

From the Shriners Hospital for Crippled Children, the Royal Victoria Hospital and McGill University, Montreal

This paper describes the Judet technique of quadricepsplasty along with slight modifications and compares it to the Thompson technique first described in 1944. Six cases are presented and the results, together with those of Judet, are compared to those of Thompson. It is concluded that the Judet technique is superior to that of Thompson.

Quadricepsplasty is a technique devised to release extra-articular adhesions or contractures which prevent useful flexion of the knee.

The cause of most such adhesions or contractures is an injury leading to fibrosis and scarring of all or part of the quadriceps. The adhesions may be between the vastus intermedius and the femur or between the patella and the femoral condyles, or there may be a contracture of the medial and lateral retinacula or of the rectus femoris as described by Nicoll (1963).

Extension contracture of the knee is much less common than flexion contracture and, perhaps because of this and earlier mobilisation, there have been no reports in the English literature on quadricepsplasty since Hesketh (1963) and Nicoll (1963) evaluated the Thompson quadricepsplasty. Extension contracture of the knee may also be due to intra-articular causes, mainly adhesions. In their efforts to relieve extension contractures of either aetiology, Judet, Judet and Lagrange (1956), using as a basis a technique devised by Payr (1914), initiated a new technique of quadricepsplasty which has been used with some success in Montreal at the McGill teaching hospitals. The purpose of this paper is to describe this procedure, to demonstrate its superiority over the Thompson quadricepsplasty and to document six cases in which it was used.

METHODS AND MATERIAL

Operative techniques. Using one short anteromedial incision (8 to 12 centimetres in length), the medial retinaculum is freed as are any intra-articular adhesions. The suprapatellar pouch is mobilised or excised via the intra-articular route. The knee is then bent and a few extra degrees of flexion are generally gained, but the adhesions of the quadriceps then limit further flexion. A long posterolateral incision (Fig. 1) is next made from just lateral to the patella to three finger-breadths below the greater trochanter. The vastus lateralis is completely freed from the linea aspera and from the greater trochanter. With meticulous haemostasis, the vastus intermedius is lifted extraperiosteally from the lateral and anterior surfaces of the femur.

The vastus medialis is not disturbed as its origin is solely from the linea aspera and it has an oblique course to the patella therefore playing only an accessory role in contractures (Judet et al. 1956; Judet 1959; Judet, Judet and Lord 1959; van Nes 1962). The rectus femoris with its iliac origin is unaffected by this...
dissection. All incisions are closed over continuous suction drains, and all patients are given peri-operative antibiotics (Keflin).

**After-care.** The routine after operation is extremely important. The hips and knees are flexed to 90 degrees over a box frame and heavy sedation is used. Passive exercises are started at 48 hours, when the drain is removed. Active assisted exercises are begun as soon as possible, usually at three to five days.

**Modifications.** In three of the cases described, the above technique was modified by using a single long lateral incision from just medial to the tibial tubercle to three finger-breathings above the fracture line; through it both the intra-articular and extra-articular portions of the release can be done. Also, if adequate flexion during the operation is not obtained, the incision is extended proximally and the rectus femoris is freed from the ilium and superior acetabulum; this is an important addition, as will be seen later.

We have also allowed our patients up on crutches at three to five days with the knee in as much flexion as possible using an anterior Thermoplast splint with a string tie between its proximal and distal ends. Special care in bandaging the wound is necessary to avoid problems with the skin. The bandage must neither be too tight nor too loose and it must be applied with the knee in maximal flexion to avoid pressure in the popliteal area.

**CASE REPORTS**

**Case 1.** A 14-year-old boy was first seen in July 1975 for swelling and pain of seven months' duration in the right leg which was associated with sitting. There was no history of loss of weight, recent infection or injury. The family history, past history and reviews of systems were unremarkable.

On examination, pitting oedema was found from the groin to the foot with bruising. There was tenderness around the knee. No discrete masses were palpable. The range of movement of the knee was from 0 to 95 degrees with pain at the extremes. His quadriceps' strength was 4/5 (MRC grading). Remaining muscles were 5/5. Neuromuscular status was normal. Initial investigation included a complete blood count, erythrocyte sedimentation rate, rheumatological and immunological tests: all were normal. Technetium-99 bone scan showed diffuse increased uptake in the right femur. Gallium scan was equivocal. Standard radiographs showed osteosclerosis of the proximal third of the femur and multiple lytic areas in the distal two-thirds. On July 27, 1975, an open biopsy was performed. The bone was found to be soft and the histological appearances were consistent with chronic osteomyelitis.

The patient was started on gentamicin and ampicillin and began walking with an ischial weight-bearing brace but he fractured through the biopsy site on October 1, 1975. This was treated in traction for six weeks and then in a hip spica. He had delayed union of the femur and was readmitted four weeks later. On February 4, 1976, he had a further biopsy, a Küntscher intramedullary rod was inserted and an iliac autogenous bone graft was performed. He was then placed in a hip spica and discharged. Four months later the cast was changed to an ischial weight-bearing brace. The histological findings on this occasion were unchanged. A vascular malformation or diffuse angiomatoses were considered as diagnostic possibilities but never confirmed. In November 1976 physiotherapy was begun for stiffness of the knee, but his flexion never increased beyond 20 degrees and he had leg length discrepancy of 5.5 centimetres.

On July 6, 1979, a Judet quadricepsplasty was undertaken after a normal venogram. The range of movement that could be obtained at operation was from 0 to 110 degrees. Physiotherapy was begun two days later and six weeks later he had achieved a range of movement from 0 to 110 degrees with a 10-degree extension lag. At follow-up 18 months later, he had a range from 0 to 120 degrees and no extension lag. Quadriceps strength was 5/5. The rod was left in place as the cortex remained persistently thin.

**Case 2.** A 46-year-old man, first seen on October 11, 1976, had sustained a low subtrochanteric fracture of the left femur two and a half years previously. He had been treated with tibial skeletal traction for two months, followed by a spica for four months. He had had a range of movement of the knee after treatment of 0 to 20 degrees which had not improved after two years of physiotherapy.

He underwent a Judet quadricepsplasty on October 13, 1976, and at operation the range of passive movement was 0 to 120 degrees. Traction was applied with the hip and knee flexed to 90 degrees and he had a manipulation under general anaesthesia one week later and began therapy the next day. He had no complications and at follow-up two years later had a range of movement from 0 to 90 degrees with a five-degree extension lag.

**Case 3.** A 37-year-old man was admitted on March 13, 1973, after a motor vehicle accident, with a comminuted fracture between the middle and distal thirds of the left femur. He was treated with tibial skeletal traction for three months, followed by a fracture brace. Three months later he was readmitted with a delayed union and an autogenous bone graft was performed. He was admitted for a third time on November 3 for treatment of a post-traumatic ankylosis of the left knee which was unresponsive to physiotherapy. The range of flexion of the knee was from 0 to 20 degrees.

A Judet quadricepsplasty was performed on March 14, 1975, when passive movement ranged from 0 to 100 degrees. Ten days later, when the patient underwent manipulation under general anaesthesia, 95 degrees of flexion were obtained. He was discharged on April 23, 1975, with a range from 0 to 80 degrees. Follow-up at two years showed a range from 0 to 100 degrees without an extension lag.

**Case 4.** An 18-year-old girl was involved in a motor vehicle accident on September 1, 1979, and sustained an open fracture of the junction of the middle and distal thirds of the right femur and a comminuted fracture of the right patella. She underwent debridement and closure of the femoral wound and a patellectomy. The femur was placed in tibial skeletal traction for eight weeks. She was then changed to a femoral fracture brace and discharged. One year later she was readmitted for post-traumatic ankylosis of the right knee which had not responded to physiotherapy. Her range of flexion was from 0 to 30 degrees.

On September 17, 1980, she underwent a Judet quadricepsplasty, when a range of passive movement from 0 to 130 degrees was obtained. She began physiotherapy two days later. At follow-up eight months later she had a range from 0 to 140 degrees with no extension lag.

**Case 5.** A 19-year-old youth was the victim of a motorcycle accident on October 18, 1979, and was admitted with pain in the chest and abdomen, shortness of breath, multiple abrasions, a dislocated left elbow, wounds over the second left metacarpal and the left eleventh rib, and an open wound of the left femur. He was resuscitated and an intravenous pyelogram showed a non-functioning left kidney. After stabilisation, a laparotomy with splenectomy and left nephrectomy were carried out, as well as reduction of the dislocated elbow and debridement and closure of the open femoral wound which was subsequently treated by tibial skeletal traction. The patient became febrile and hypertensive six days later as a result of a right retroperitoneal abscess that, on culture, grew *Bacillus subtilis*. The abscess was drained and he recovered. The fractured femur went on to displace and was treated on December 21, 1979, by open reduction and an intramedullary rod with an autogenous iliac bone graft. He was then placed in a fracture brace and was able to walk. He recovered well.
On October 28, 1980, he was readmitted because of stiffness of the left knee, allowing movement only from 0 to 35 degrees. He underwent a Judet quadricepsplasty; passive movement from 0 to 130 degrees was obtained. He was placed in traction with the hip and the knee at 90 degrees and physiotherapy was begun on the second day. He maintained a range of 130 degrees of passive movement and was discharged on November 11, 1980. At follow-up six months later, his range of movement was from 0 to 120 degrees with no extension lag.

**Case 6.** A 25-year-old man, the victim of a motor vehicle accident, sustained a comminuted open fracture of the left tibia, a closed fracture of the middle third of the left femur and a closed fracture of the right tibia. He was treated initially with debridement, open reduction and internal fixation for the left tibial fracture, closed reduction and cast for the right tibial fracture and skeletal traction for the left femoral fracture. Six weeks later he was placed in a right Sarmiento brace and a left ischial weight-bearing brace. The range of movement of the left knee was 0 to 55 degrees. His fractures healed without further incident.

One year later he was readmitted because his left knee still did not flex beyond 70 degrees. He underwent a Judet quadricepsplasty, when a range of passive movement from 0 to 130 degrees was obtained. At follow-up six months later his range was from 0 to 120 degrees.

**RESULTS**

Judet reported 53 cases in 1959, 45 of which were post-traumatic. The remaining cases were secondary to arthritis, prolonged immobilisation and patellectomy. Our cases were all post-traumatic.

Judet classified his results as excellent if the flexion achieved was greater than 100 degrees, good if flexion was 80 to 100 degrees, fair if flexion was 50 to 80 degrees, and poor if flexion was less than 50 degrees. His results were 85 per cent good or excellent (45 patients) and four per cent poor compared to Nicoll’s (1963) 33 per cent (10 patients) good or excellent and 13 per cent (four patients) poor. Thirty-five of Judet’s 53 cases achieved a gain of greater than 60 degrees of flexion.

Judet analysed the cases relative to the duration of stiffness and found that all 13 cases of less than one year’s duration had a good or excellent result, 16 of 19 cases of between one and two years’ duration had a good or excellent result and 16 of 21 who had had stiffness varying from 2 to 21 years’ duration had a good or excellent result.

All Judet’s cases had at least six months of intensive physiotherapy before operation, as did Nicoll’s. Judet reported 11 per cent (six patients) with extension lags compared to Nicoll’s 23 per cent (nine patients). Most (37 of 45) of Judet’s good and excellent results were obtained by 24 months.

All patients in Judet’s series were followed for four years or longer and only one result improved after three years. All patients could lift 10 kilograms on straight leg raising at follow-up. There was one infection secondary to haematoma before the routine use of a drain. Two patients were treated for venous thrombosis and five had superficial skin sloughs. Using the modifications mentioned, all our patients had a good or excellent result and we have had no further instance of these complications.

**DISCUSSION**

The original technique of Thompson (1944) sectioned the vasti from their patellar insertions and usually left them alone. The rectus femoris was isolated from the vasti and maintained intact. This often resulted in weak extension and marked extension lags which were often permanent. Nicoll (1963) also reported a 17 per cent failure rate due to a tight rectus that could not be adequately and safely released by the Thompson technique.

Judet had two cases that had a poor result secondary to residual tightness of the rectus (positive Ely tests). Proximal extension of the incision and release of the rectus from its origin, when adequate flexion is not obtained at operation, adds little to the procedure and will improve the overall results. Also, frequent wound breakdown, skin sloughs and hypertrophic scarring were reported due to the location of the incision on the anterior aspect of the knee (Judet et al. 1956; Judet 1959; van Nes 1962).

The Judet technique of disinsertion and muscle sliding is associated with rapid recuperation, little extension lag and almost complete maintenance of the range of passive movement found at operation. Kettulkamp has shown that 110 degrees of flexion is necessary in both knees to get up from a sitting position and 70 degrees of flexion is necessary for a normal gait (Kettulkamp et al. 1970; Kettulkamp and Nasca 1973). Therefore, the aim of surgical treatment should be to achieve flexion of 110 to 120 degrees. We feel that the operation should be a sequential procedure with the range of flexion determined after each stage of the dissection and with the possibility of stopping when the desired range plus 15 degrees is obtained; this allows for some loss after the operation. If there is more than 15 to 20 degrees loss of flexion, manipulation under general anaesthesia may recoup the original amount of flexion achieved.

The technique is versatile and can be tailored to individual needs. It is not difficult to perform and the complication rate is low. We recommend this technique for adhesions of the extensor mechanism of the knee which limit flexion.

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**REFERENCES**


