

## Results of surgical treatment of quadriceps femoris/contracture in children

**E.N. Muteti**, MBChB (Moi), MMed Ortho(Mak),FCS(ECSA), **J. T. Theuri**, MBChB(Nrb), MMed Ortho(Mak), **T.C. Mead**, MD, AAOS, FCS(ECSA) and **E. C. Gokcen**, MD, AAOS.

Correspondence to: **Dr. E.N. Muteti**, AIC-Cure International Children's Hospital, P. O. Box 81-00220, Kijabe, Kenya.  
Email: emuteti@curekenya.org

### ABSTRACT

**Background:** The child presenting with quadriceps femoris/contracture that is resistant to serial manipulation and plaster casting and the older child with a fixed contracture of the quadriceps is treated surgically at the African Inland Church-Cure International Children's Hospital. The surgery involves soft tissue release and lengthening of the quadriceps tendon. Open reduction of the knee and femoral osteotomy is done as indicated.

**Objective:** To analyze the outcome of surgical treatment of quadriceps femoris contracture in children.

**Setting:** AIC-CURE International Children's Hospital in Kijabe, Kenya.

**Methodology:** This is a review of files of children in our hospital treated surgically for quadriceps fibrosis over a period of three years (January 2005 to December 2007).

**Results:** There were fifty one cases of quadriceps fibrosis in thirty six patients treated surgically over the study period. Thirty one cases were excluded due to incomplete records or patients lost to follow-up. Consequently, the remaining twenty cases were analyzed. The pre-operative range of motion of the knee was grouped as follows: two cases had dislocated knees, three had hyperextension contractures, thirteen (0-30 degrees) and two (31-60 degrees). The final post-operative range of motion was grouped as follows: three (0-30 degrees), four (13-60 degrees), three (61-90 degrees), one (91-120 degrees) and nine (full range of flexion). Gain in flexion ranged from minus forty degrees to positive 140 degrees. The average gain in flexion was 94.7 degrees. Five patients underwent a second procedure to improve flexion. Soft tissue complications developed in four cases.

**Conclusion:** Quadriceps femoris/contracture responds well to surgical treatment with an expected gain in flexion of 94.7 degrees. The commonest complication is skin breakdown.

### INTRODUCTION

Children with an extension contracture of the quadriceps muscle are frequently seen at the AIC-Cure International Children's hospital and its outlying ten clinics. In this hospital, this problem is treated initially by manipulation and serial plaster of paris casts in progressively increasing flexion of the knee. The case resistant to serial casting and the older child with an established contracture is

treated surgically. This involves release of the contracture and lengthening of the quadriceps tendon. Osteotomy of the femur, open reduction of the knee and Z-plasty of the skin is done as indicated. This study evaluates the results of the surgical treatment given in this hospital. There is no previous report of the effectiveness of surgery in the treatment of this problem in our hospital and in the larger eastern, central and southern Africa region. It is the intention of this study to do so.

## MATERIALS AND METHODS

This study was carried out at the AIC-CURE International Children’s hospital, Kijabe, Kenya. The records of all patients treated surgically for quadriceps fibrosis over the period January 2005 to December 2007 were retrieved and analyzed. A total of fifty one cases were found. Thirty one of these had incomplete data and were thus excluded from the study. The remaining twenty were then analyzed.

## RESULTS

Twenty cases of quadriceps fibrosis/contracture were studied in seventeen patients. The youngest patient was one year old while the oldest was eighteen years old. The mean age was 8.9 years. There were fourteen males and three females (Figure 1).

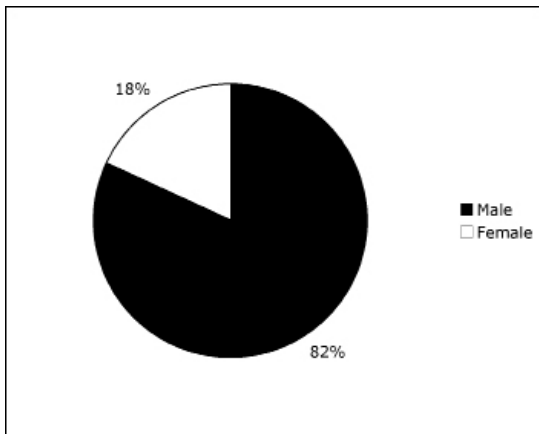


Figure 1: Sex distribution

The quadriceps fibrosis/contracture was unilateral in fourteen cases and bilateral in three cases. The right limb was affected in eleven cases while the left limb was affected in nine cases (Figure 2).

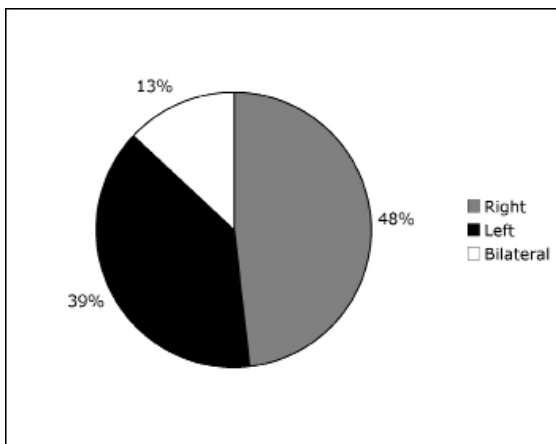


Figure 2: Distribution of affected sides

The most common cause of the contracture was intramuscular injection in twelve cases (60%). Three cases (15%) were as a result of trauma, two (10%) cases were congenital and associated with a syndrome, one case (5%) was congenital and isolated, one case (5%) was due to infection and idiopathic in one case (5%) (Figure 3).

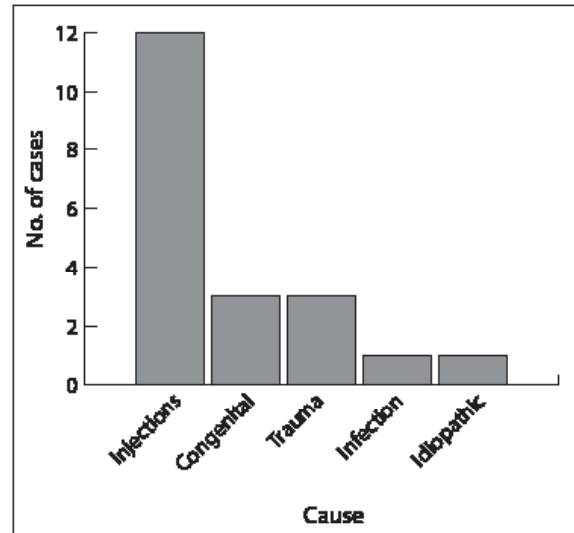


Figure 3: Cause of contracture

The degree of the contracture was defined by the range of flexion observed before surgery and after surgery. The patients had been followed up over a duration of four to thirty seven months. There was a gain in flexion after surgery (Table 1).

Table 1  
The extent of contractures

Flexion Group	Preoperatively (number of cases)	Postoperatively (number of cases)
Dislocation	2	0
Hyperextension	3	0
0-30 deg	13	3
31-60 deg	2	4
61-90 deg	0	3
91-120 deg	0	1
Full flexion	0	9
Total	20	20

The gain in flexion ranged from minus 40 degrees to positive 140 degrees. The average gain in flexion was 94.7 degrees. Five patients needed a secondary procedure to optimize their results. These procedures included repeat lengthening in two cases, open reduction of the knee in

one case, femur osteotomy in one case and manipulation in one case. Soft tissue complications were noted in four cases. These were incision breakdown in three patients and failed Z-plasty in one patient (Table 2).

The table below is a more detailed presentation of the twenty cases studied. Note: p= positive, m=minus/negative, lt=left, rt=right

**Table 2**  
*Incision breakdown in patients*

Patient No	Age (Yrs)	Sex	Limb	Initial Contracture	Cause	Follow Up Results	Gain	Follow Up (Months)	Complications
1	18	Male	Rt	m30 deg	Injections	Neutral	30 deg	23	
2	15	Male	Lt	p30 to p10	Infection	p40	10 deg	12	Wound necrosis
3	11	Male	Rt	p10 to p20	Fall	p0 to p90	70 deg	7	
4	6	Female	Lt	p0 deg	Injections	p0 to p80	80 deg	6	
5	13	Male	Rt, Lt	p0 to p20 p0 to p20	Injections	Full RoM	140 deg	22	
6	15	Female	Rt	p0 to p40	Congenital	Full RoM	120 deg	19	
7	3	Male	Rt	p0 to p30	Injections	Full RoM	130 deg	7	Incision breakdown
8	13	Male	Rt	p10 to p40	Unknown	No active extension	m40	9	Z-plasty failure
9	2	Male	Rt, Lt	p0 to p20 p0 to p30	Injections	Full RoM	140 deg	11	
10	13	Male	Rt	m20	Fracture	p0 to p35	55 deg	14	Wound breakdown
11	1	Male	Lt	p0 to p30	Injections	Full RoM	130 deg	7	
12	12	Male	Rt, Lt	p0 to p20 p0 to p30	Injections	Full RoM	140 deg	11	
13	18	Male	Lt	p0 to m25	Trauma #	p0 to p45	70 deg	6	
14	8	Male	Rt	p0 to p30	Injections	p0 to p90	60 deg	4	
15	3	Male	Lt	p0 to p30	Injections	Full RoM	130 deg	14	
16	10	Female	Rt	Dislocation	Arthrogryposis	p0 to p20	40 deg	19	
17	10	Male	Lt	Dislocation	Congenital syndrome	m10 to p40		12	

## DISCUSSION

Quadriceps fibrosis/contracture has been known for several decades with early reports by Morizaki (1), Fairbank and Barrett (2), and Hnevkovsk (3). They reported that the quadriceps muscle was replaced by fibrous and adipose tissues. Subsequently, the causes of the quadriceps were elucidated as being congenital and acquired (4,5). The congenital group presented with the contracture at birth and was in some cases associated with other congenital malformation like arthrogryposis and spinal dysraphism. The acquired cases were shown to arise predominantly from multiple intramuscular injections to the thigh (6,7). Other causes included trauma and infections. In this study of twenty cases, the

same pattern of aetiology was found with 60% of the cases arising from multiple injections to the thigh.

The patients present with variable degrees of inability to fully flex the knee (extension contracture). Two of the twenty cases in this study could flex up to 60 degrees. Thirteen case studies could only flex up to 30 degrees, three cases had hyperextension contractures of the knee (*genu recurvatum*), while two cases had dislocated knees. Bose and Chong (8) described habitual dislocation of the knee and congenital lateral dislocation of the patella as additional features of this problem. These were not noted in this group.

The surgical treatment of quadriceps contracture in literature has included simple division of the fibrosed part (4), proximal release of the quadriceps muscle (9)

and lengthening of the quadriceps tendon (10). In our study, soft tissue release of the fibrosed portion and lengthening of the quadriceps tendon was done. Open reduction of the knee was also done in the patients with dislocated knees. Osteotomy of the femur was done as indicated too.

The gain in flexion postoperatively ranged from minus 40 degrees to 140 degrees. The one patient who lost 40 degrees of flexion had developed failure of a Z-plasty post-operatively. This was the only case with a loss in the range of motion in this study. It also demonstrates that the onset of complications is ominous. One of the patients needed a femoral osteotomy to improve flexion. The average gain in flexion was 94.7 degrees. This average was significantly biased by the one case with the negative result. However, overall this is a significant improvement in the range of motion of the patients knees and is comparable to other studies (11-15).

The secondary procedures done in these patients were secondary lengthening, manipulation and open reduction of the knee. Repeat lengthening of the quadriceps tendon and manipulation of the knee did not improve the range of flexion significantly in our study. Alvarez (13) reported that pre-operative physiotherapy and manipulation were ineffective except in mild and very early cases. These may also be dangerous because a supracondylar fracture occurred in his cases. The patient who had an open reduction at 10 years, had a reduced but unstable knee on follow-up post-operatively. Consequently, the patient needed a long-term brace.

The most common complication was breakdown/necrosis of the incision. This is because the anterior thigh skin incision is under tension on flexion of the knee, particularly in the older child. We do not extend the incision distal to the superior pole of the patella to avoid this problem. A Z-plasty of the skin is occasionally needed to relax this incision. One of the Z-plasties failed in our group.

## CONCLUSION

Surgical treatment of quadriceps fibrosis/contracture by soft tissue release and tendon lengthening is effective in management of this problem, with an expected gain of 94.7 degrees of flexion. Repeat lengthening and manipulation are not effective. The most common complication is skin or incision breakdown.

## REFERENCES

1. Morisaki N. *J. Japanese Orthop. Assoc.*, 1947; **23**: 180.
2. Fairbank T.J., and Barrett, A.M. Vastus Intermedius Contracture in Early Childhood. *J. Bone Joint Surg.* 1961; **43-B**: 326.
3. Hnevkovsky O. Progressive fibrosis of the vastus intermedius muscle in children. *J. Bone Joint Surg.* 1961; **43-B**: 318.
4. Gammie W.F.P., Taylor J.H. and Ulrich H. Contracture of the vastus intermedius in children. *J. Bone Joint Surg.* 1961; **45-B**: 370.
5. Karlen A. Congenital fibrosis of the vastus intermedius muscle. *J. Bone Joint Surg.* 1964; **46-B**: 488-491.
6. Gunn, D. R. Contracture of the quadriceps muscle. *J. Bone Joint Surg.* 1964; **46-B**: 492.
7. Lloyd-Roberts G.C. and Thomas T.G. The etiology of quadriceps contracture in children. *J. Bone Joint Surg.* 1964; **46-B**: 498.
8. Bose K. and Chong K.C. The clinical manifestations and pathomechanics of contracture of the extensor mechanism of the knee. *J. Bone Joint Surg.* 1976; **58-B**: 478-484.
9. Sengupta S. Pathogenesis of infantile quadriceps fibrosis and its correction by proximal release. *J. Pediatric Orthop.* 1985; **5(2)**: 187-191.
10. Williams P.F. Quadriceps contracture. *J. Bone Joint Surg.* 1968; **15-B**: 278-284.
11. Saunders F.P., Hoeffnagel D. and Staples O.S. Progressive Fibrosis of the Quadriceps Muscles. *J. Bone Joint Surg.* 1965; **47-A**: 380.
12. Shanmugasundaram T.K. Post-Injection Fibrosis of Skeletal Muscle: A Clinical Problem. *Intern. Orthopaedics (SICOT)*. 1980; **4**: 31-37.
13. Alvarez E.V., Munters M., Lavine L.S., Manes H. and Waxman J. Quadriceps myofibrosis. A complication of intramuscular injections. *J. Bone Joint Surg. Am.* 1980; **62**: 58-60.
14. Abtullah M., Metin M.E., Volkan O., Mehmet C., Fehmi K. Injection-induced contracture of the quadriceps femoris muscle in children. *Orthopedics*. 2004; **24(1)**: 65-66.
15. Shong S.C., Furuya K., Takakazu A., Miyozo N. and Masaru I. Congenital contracture of the quadriceps muscle four case reports in identical twins. *J. Bone Joint Surg. Am.* 1974; **56**: 1054-1058.