The Role of Hamstring Muscles after Supracondylar Osteotomy in Poliomyelitis

M. S. Moukaied, N. R. Naccache

A retrospective study was undertaken of 53 femoral supracondylar osteotomies on 46 patients to correct flexion contractures of the knee due to poliomyelitis. The flexion deformities ranged from 15 to 70 degrees, with a mean of 30 degrees. The age range was 4–30 years. All patients had grade 0 quadriceps power; hamstring power was below grade 3 in 24, and grade 3 or more in 22.

Following osteotomy, no patient with hamstring power below grade 3 was able to walk independently. Of the 22 who had grade 3 or better hamstring power, 12 were able to walk without aid. The ten remaining required calipers, five because they had never walked, three because they were already caliper-dependent, one because of postoperative complication, and one as a protective measure due to very thin bone.

It was concluded that, providing the patient had hamstring power of grade 3 or better, supracondylar osteotomy provided a prospect of independent walking. The mechanism postulated was that the hamstrings after osteotomy functioned as extensors, stabilizing the knee in full extension when weight-bearing.

Poliomyelitis is still a common problem in Saudi Arabia. Limping due to true limb shortening or joint contracture is the main complaint. Depending on the severity of the condition, and whether one limb or both are affected, the patient will be either fully mobile, probably with or without supporting his knee (hand-knee gait), or unable to walk. After a careful examination of the patient and accurate individual muscle grading, joint contractures can usually be treated successfully either by passive stretching or surgical release of contractures.

Several surgical procedures have been described to release contractures and they can be divided into two types:

1. Soft tissue release: hamstrings tenotomy, tensor fascia lata release, posterior capsulotomy, and hamstrings transfer.

2. Bony correction: in the form of supracondylar femoral osteotomy.
For a contracture of more than 15 degrees of the knee joint, soft tissue release is not sufficient and it has poor results and a high recurrent rate. Complete correction can be obtained by a one-stage supracondylar femoral osteotomy.2

The purpose of this paper is to review the results of this operation and to clarify the following points:

1. which patients will obtain the most benefits;
2. which patients will be relieved from having to use hand-knee gait;
3. which patients will need a caliper;
4. which patients will be able to walk without a caliper.

Material and Methods

Since this hospital was opened in July 1982, the Orthopaedic Department has conducted a special clinic for poliomyelitis—each clinic consisting of an orthopaedic consultant, registrar, physiotherapist and orthotist. An average of 35 patients used to be seen every month. Until December 1989, 380 different surgical procedures were carried out including 72 supracondylar femoral osteotomies. In December 1989 the medical records of all these patients were reviewed. Nineteen operations were excluded due to incomplete records and short follow-up. In the present study, 53 osteotomies on 46 patients were included. There were 22 males and 24 females; 29 osteotomies were done on the right side and 24 on the left. The ages of the patients at operation ranged from 4-30 years with an average of 13 years and 8 months (Table 1). The angle of fixed flexion contracture ranged from 15 to 70 degrees with an average of 30 degrees (Table 2). Twenty-four patients had between 15 and 60 degrees contracture of the hip joint on the same side, 14 on the right side and 10 on the left; 15 of these patients needed surgical release of the hip joint at the same time as the osteotomy. Two patients had contracture of the opposite hip of between 30 and 55 degrees, and both of these were released surgically at the same time. Seven patients had equinus deformity, four on the right side, three of whom needed surgical correction, and three on the left side, all of whom were corrected surgically. Nineteen patients had received previous surgery as follows: 13 soft tissue release of the hip (seven on the right and six on the left); 12 operations on the knee (eight on the right including three failed osteotomies, and four on the left); eight had elongation of the Achilles tendon (five on the right and three on the left); seven had different surgical procedures on the foot (four on the right hand and three on the left) in the form of triple arthrodesis, Grice arthrodesis, and tendon transfer.

Surgical Technique and Postoperative Care

The operation was done under pneumatic tourniquet, using different surgical approaches, depending on the surgeon’s preferences: 15 through antero-medial, 22 through anterior mid-line, and 16 using antero-lateral approaches. The distal end of the femur was exposed, the growth plate was identified and, proximal to it, an anterior wedge was resected subperiosteally keeping the posterior cortex intact. Then the gap was closed with or without internal fixation depending on the amount of correction needed. In certain cases where a large wedge needed to be resected and the continuity of the posterior cortex was lost, an internal fixation was preferred, staples usually being sufficient. This technique was used in 15 cases. The wound was closed with suction drainage and a plaster-of-paris cast was applied. Twenty-nine patients had a cylinder cast, 13 had a long-leg cast and four had a hip spica. The drain was removed after 48 h, then the patient was allowed to sit out of bed. After 12 days the sutures were removed through a window when the radiograph was satisfactory. If there was any residual deformity or displacement the patient was taken to the operating theatre again for change of plaster, removal of sutures and manipulation. After the wound had healed the patient was discharged home, and followed up as an out-patient. When the osteotomy was solid clinically and radiographically the patient was referred to the physiotherapy department for exercise and mobilization.

Results

The 12 patients who had never walked, were able to do so with calipers. After the osteotomy the 15 patients who had used hand-knee gait were able to walk upright, seven

Orthopaedic Department, King Khaled National Guard Hospital, Jeddah, Saudi Arabia
MOHAMMAD SAMIR MOUKAIED FRCS, Consultant Orthopaedic Surgeon
NAGUI ROBERT NACCACHE MD, Orthopaedic Registrar

Date submitted: 14.11.90.
Date accepted: 07.02.91.
without any aid and eight with calipers. The five patients who had previously required crutches were able to walk following operation with calipers and built-up shoes. The eight patients who had walked with a severe limp, were all improved after surgery, five walking unaided, and three with calipers. All the six patients who had walked with calipers, were relieved of their pressure sores.

The major drawback in our results was the expected poor range of flexion. All had straight knees, but with a reduced range of flexion commensurate with the degree of pre-operative flexion contracture (Table 3).

<table>
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<tr>
<th>Degrees</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
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<tr>
<td>Knees</td>
<td>7</td>
<td>12</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>15</td>
<td>2</td>
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Figure 1. Diagram to show the normal hamstrings insertion and action.

Figure 2. X-ray with with a 90° flexion deformity; note the bulk of soft tissue on posterior aspect.

The overall result of the osteotomy was that all of the 46 patients were able to walk, 12 unaided and the remainder with calipers. We reviewed the preoperative muscle chart of each patient. The striking feature was that those who were able to walk without calipers after operation had preoperative hamstring gradings of 3 or more. We postulated that before operation these muscles played a role in maintaining the flexion contracture, as their tendons of insertion passed posterior to the axis of the shaft of the femur, femoral condyles and knee joint (Figs 1 and 2). After the osteotomy the action of these muscles changed to support the fully extended knee during weight bearing and stabilize it in recurvatum (Figs 3 and 4).

The complications observed were as follows:

1. Postoperative displacement: one patient had a severe displacement immediately after surgery, which was treated by internal fixation.
2. Delayed union: the normal union time was considered to be between 8 and 10 weeks, and any osteotomy needing more time to heal was considered as delayed union. With the anticipated time 34 knees healed and 19 needed between 12 and 32 weeks.
3. Non-union: one patient showed no evidence of callus formation and the osteotomy was mobile; this was treated with bone graft.
4. Mal-union: one patient developed varus angulation which was corrected by valgus osteotomy and plate fixation after 24 months.

5. Over correction: two patients had recurvatum between 10–15 degrees; one needed excision of a posterior wedge due to pain (Fig. 5).

6. Residual deformity: one patient had residual contracture of 15 degrees, and he refused further surgery.

7. Recurrent deformity: one patient had recurrence of the deformity twice, which needed revision.

8. Infection: one patient developed a superficial wound infection.

9. Nerve palsy: two patients developed sciatic nerve palsy; one recovered after 3 months, and the other had permanent foot drop treated with a caliper.

10. Vascular: in three patients in whom the circulation was compromised, the plaster was bivalved and the knee bent gently until a good flush of circulation was obtained.

Figure 3. Diagram to show the action of hamstrings after osteotomy.

Figure 4. X-ray after osteotomy, note the reduction of bulk of soft tissue on posterior aspect.

<table>
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<th>Table 4</th>
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<td>Immobilization in plaster</td>
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<td>Weeks</td>
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<td>Knees</td>
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Discussion

Multiple flexion deformity of a limb is a common finding after poliomyelitis, with the patient mobilizing either by crawling, using one crutch, limping with or without supporting his knee, or by caliper which will depend on the extent of muscle paralysis and the severity of joint contracture. In most cases surgical release of joint contractures will improve the gait. For a patient with residual knee deformity, supracondylar femoral osteotomy is indicated, but the ability to walk subsequently without a caliper will depend on the power of the hamstring muscles. Our results have shown that of the 22 patients who had good hamstring power, 12 were able to walk without caliper, and the rest needed a caliper for other reasons as already mentioned.
So in the present series it was found that the patient was able to walk without a caliper provided he or she had good hamstring power, with four exceptions:
1. the patient who had never walked;
2. the patient who was already caliper-dependent;
3. bilateral deformity;
4. as a protective measure where there was very thin bone;

Our recommendation is that all these patients should be trained to walk without a caliper.

After surgery, a loss of knee flexion must be anticipated, which will depend on the degree of deformity before surgery; the greater the degree of deformity the greater the loss will be. Comparing our results with other publications, our patients had suffered a greater loss, most likely due to having had a more severe contraction deformity.

Delayed union was a noticeable finding in our series; perhaps it was due to weak bone and absence of muscle stress.

Sufficient postoperative immobilization was provided by a plaster-of-paris cylinder. We recommend the use of a hip spica in bilateral cases to avoid displacement, and it is less painful to the patient.

The indication for this operation was to correct knee flexion contracture. The aim was to stabilize the knee in hyperextension during weight-bearing, but this was possible only in the presence of strong hamstrings. The results of this operation were rewarding.

Acknowledgements
We would like to express our sincere thanks to our Orthopaedic Secretary, Miss Kay Webb, for the effort which she has put into this paper, and to the Medical Records Department, Radiology Department, and Medical Photography Department at the King Khalid National Guard Hospital.

References

