THE TREATMENT OF FLEXION CONTRACTURES OF THE KNEE IN POLIOMYELITIS

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In some parts of the world poliomyelitis is still endemic and there are thousands of young people with joint contractures (Fig. 1). These most commonly occur at the knee, and the aim of treatment must be a straight knee with a useful range of painless flexion so that a hinged caliper can be worn. This paper reports experience in correcting flexion contractures of the knee following poliomyelitis and advises a regime which improves the results.

FIG. 1

Case 1—Severe flexion contractures of both knees.

Since the turn of the century hamstring tenotomy followed by manipulation has been the accepted treatment of flexion contractures of the knee (Bradford and Lovett 1900). In 1926 Yount demonstrated the importance of the tensor fasciae latae muscle as a deforming force and advised its division. Wilson (1929) recommended posterior capsulotomy as a preliminary to manipulation. These methods produced a straight knee but in severe deformities they often led to posterior subluxation of the tibia on the femur, so that the joint was stiff and painful. To prevent this complication hinged splints (Cravener 1930), hinged plasters (Hart 1934) and balanced traction (Haas 1938) have all been advised.

A recent year spent at the only orthopaedic unit in the Republic of Kenya enabled an assessment of the results of these methods to be made and the causes of subluxation analysed.

CLINICAL OBSERVATIONS

Nineteen patients in whom flexion deformities of the knee had been corrected by division of the hamstring tendons and ilio-tibial band followed by serial manipulations were reviewed. In ten patients the deformity was bilateral, so that twenty-nine knees were studied. In all, the

TABLE I
DETAILS OF NINE KNEES IN THE CONGRUOUS GROUP

Case number	Sex	Age (years)	Side	Deformity (degrees)	Treatment	Result	
						Pain	Passive range of flexion (degrees)
4	Male	8	Left	40	Serial manipulation and plasters	No	90
5	Male	6	Right	30	Serial wedged plasters	No	90
7	Female	16	Right	30	Serial manipulation and plasters	No	Over 90
10	Male	12	Right	90	Serial wedged plasters	No	Over 90
			Left	90	Serial wedged plasters	No	Over 90
14	Female	7	Right	35	Serial wedged plasters	No	Over 90
			Left	35	Serial wedged plasters	No	Over 90
17	Male	7	Left	30	Serial manipulation and plasters	No	Over 90
19	Male	18	Right	30	Serial manipulation and plasters	No	90

TABLE II
DETAILS OF THIRTEEN KNEES IN THE SUBLUXATED GROUP

Case number	Sex	Age (years)	Side	Deformity (degrees)	Treatment	Result	
						Pain	Passive range of flexion (degrees)
2	Male	14	Right	80	Tenotomy, serial manipulation and plasters	No	30
			Left	80	Tenotomy, serial manipulation and plasters	Yes	30
3	Male	7	Right	90	Tenotomy, serial manipulation and plasters	Yes	40
			Left	90	Tenotomy, serial manipulation and plasters	No	60
5	Male	6	Left	45	Tenotomy, serial wedged plasters	No	30
9	Female	10	Right	45	Serial manipulation and plasters	Yes	45
11	Female	14	Left	90	Tenotomy, serial wedged plasters	Yes	20
13	Male	15	Right	90	Tenotomy, serial wedged plasters	Yes	30
			Left	90	Tenotomy, serial wedged plasters	No	60
15	Male	7	Right	90	Tenotomy, serial wedged plasters	Yes	45
			Left	90	Tenotomy, serial wedged plasters	Yes	30
16	Female	7	Right	90	Tenotomy, serial manipulation and plasters	Yes	30
18	Male	17	Left	45	Tenotomy, serial wedged plasters	Yes	20

TABLE III
DETAILS OF SEVEN KNEES IN THE DISLOCATED GROUP

Case number	Sex	Age (years)	Side	Deformity (degrees)	Treatment	Result	
						Pain	Passive range of flexion (degrees)
1	Male	16	Right	90	Tenotomy and posterior capsulotomy with cruciate division. Serial manipulation and plasters	Yes	40
			Left	90	Tenotomy and posterior capsulotomy with cruciate division. Serial manipulation and plasters	Yes	35
6	Male	8	Left	90	Tenotomy, serial wedged plasters	Yes	45
8	Male	14	Right	100	Tenotomy, serial wedged plasters	Yes	20
			Left	80	Tenotomy, serial wedged plasters	Yes	30
11	Female	14	Right	90	Serial wedged plasters	Yes	30
12	Female	10	Right	90	Serial wedged plasters	Yes	45

leg was straight and it was possible to fit a caliper; but lateral radiographs showed that after correction only two of nineteen knees in which there had been an initial deformity of 70 degrees or more were congruous. It was a striking finding that all the knees which had a useful range of painless movement fell in the group of congruous joints. Tables I, II and III show how the result is directly related to the degree of posterior displacement of the tibia. Figure 2 shows the radiograph of a patient in the group without congruity. Although such knees were straight they were so painful that even walking with crutches was difficult.

FIG. 2

The second important finding was that the tight posterior capsule could usually be stretched quite adequately by manipulation and serial plasters. In severe deformities in which posterior subluxation had occurred because of attempted correction, the posterior capsule had been stretched more than would have been required if the joint had remained congruous. The recurrent difficulty was to bring the tibial plateau forward on the femoral condyles.

ANATOMY

The knee is a pure hinge joint although the last five degrees of extension are accompanied by medial rotation of the femur on the tibia. This tightens the collateral ligaments and oblique posterior ligament and locks the extended knee (Last 1959). The axis of movement, however,

FIG. 2

Case 8—Radiograph showing false correction after treatment of an 80 degrees flexion contracture of the knee by tenotomy and serial wedged plasters.

FIG. 3

FIG. 4

FIG. 5

Case 1. Figure 3—Radiograph of a knee taken in full flexion. Figure 4—The same knee in the position of contracture. Figure 5—After correction to demonstrate the abnormal rocking motion which takes place. The low position of the patella is also seen.

does not pass through the joint line but through the upper attachments of the collateral ligaments, so that the tibial plateau glides forward on the femoral condyles.

The deformity is caused in the first instance by the unopposed action of the hamstrings, and in early cases the resultant contracture can be easily overcome by stretching or tenotomy. If treatment is delayed secondary changes take place in the joint capsule and correction becomes more difficult, so that the immediate improvement after division of the hamstrings and ilio-tibial band may be no more than twenty degrees.

When radiographs of the knees in this series were studied it was apparent that the normal gliding movement did not take place when severe flexion deformities were corrected. Instead, the axis of movement approached the joint line and a simple rocking motion occurred (Figs. 3 to 5). It was possible to study the intra-articular anatomy of the deformity in six knees, two of which were treated by posterior capsulotomy and division of the cruciates, two by supracondylar osteotomy of the femur and two by arthrodesis.

A low position of the patella in the intercondylar notch of the femur was a common finding in severe deformity (Figs. 3 to 5) and it was thought that the patella might act as a block to correction by preventing the tibia from coming forward. This was not confirmed at operation. Furthermore the evidence that the anterior cruciate ligament was important in preventing correction was unconvincing. Division of the cruciates made no immediate difference to the degree of deformity. Neither did posterior capsulotomy in the two cases in which it was done. The significant operative finding was that the quadriceps expansion, blending with the joint capsule and collateral ligaments, appeared to form an adherent hood over the femoral condyles so that there were no lateral joint recesses. It was therefore impossible for the collateral ligaments to glide over the underlying bone. This had the effect of bringing the axis of joint movement towards the joint line.

TREATMENT

Because shortening of the collateral structures appeared to be the cause of false correction a technique of manipulation to overcome this was used. The condylar region of the tibia was carefully pulled forward on the femur (Figs. 6 and 7) so that the flexion deformity was corrected by the normal gliding movement of the knee joint. In this way all the tight soft tissues were stretched.

Eleven severely flexed knees in children up to the age of fifteen were treated by this method. In six knees the hamstring tendons and ilio-tibial band were divided first.

Serial manipulations were done on five joints at two-weekly intervals under general anaesthesia, the new position being held by a plaster cylinder. Four to six manipulations were

FIG. 6

FIG. 7

Diagrams to show the methods of manipulation which lead to subluxation (Fig. 6) and the recommended method (Fig. 7).

needed to straighten the knees fully. In the other six joints continuous skin traction was used to support the joint, and the manipulations were performed daily without anaesthesia until the deformity was 40 degrees. After the knee had been rested in plaster for four weeks one manipulation under anaesthesia corrected the remaining deformity.

RESULTS

Ten out of eleven knees were fully corrected and congruous (Table IV) with a painless range of movement of more than 0 to 90 degrees.

TABLE IV
DETAILS OF ELEVEN SEVERE FLEXION CONTRACTURES TREATED BY THE RECOMMENDED METHOD

Case number	Sex	Age (years)	Side	Deformity (degrees)	Initial hamstring tenotomy	Result	
						Pain	Passive range of flexion (degrees)
20	Male	11	Right	70	Yes	No	Over 90
			Left	70	No	No	Over 90
21	Male	14	Right	80	Yes	No	Over 90
			Left	60	No	No	Over 90
22	Male	14	Right	75	Yes	No	Over 90
23	Male	13	Left	90	No	Yes	45
24	Male	14	Right	90	Yes	No	Over 90
25	Male	14	Left	80	Yes	No	Over 90
26	Male	10	Right	90	No	No	Over 90
			Left	90	No	No	Over 90
27	Male	12	Right	80	Yes	No	Over 90

TREATMENT IN THE OLDER PATIENT

In young adults—or children over the age of fifteen—attempts to gain a straight knee without loss of congruity were disappointing even after extensive soft-tissue operations. In a small series of severe deformities in young adults treatment was by supracondylar osteotomy

FIG. 8

Radiographs of a knee joint taken eight weeks after supracondylar femoral osteotomy. There is full correction of a 70-degree flexion contracture.

FIG. 9

Radiographs to show union after ten weeks of an arthrodesis of the knee with staple fixation in a man aged 22 who had a 70-degree flexion contracture.

of the femur or by arthrodesis of the knee. Osteotomy—in three patients—was most easily done through a lateral approach, with excision of a wedge of bone based anteriorly. Plaster fixation in the corrected position provided good immobilisation until union occurred at eight weeks (Fig. 8). A useful range of painless flexion was preserved in each case.

Arthrodesis was achieved by excising the articular surfaces so that the tight posterior structures acted as a hinge as the joint was straightened. A large staple held the surfaces in close apposition and early weight-bearing in plaster was allowed (Fig. 9). Two patients were treated by this method.

DISCUSSION

In children under the age of fifteen years a good result can usually be obtained by the treatment described, because careful manipulation and pulling the condylar region of the tibia forward will preserve the joint congruity. Wedged plasters, a common cause of subluxation, are not recommended. Preliminary hamstring tenotomy and division of the ilio-tibial tract are indicated in the more severe cases, but there is no advantage to be gained by posterior capsulotomy: indeed division of the oblique posterior ligament may predispose to posterior subluxation. Preliminary skin traction reduces the number of manipulations needed, an important consideration in areas where general anaesthesia is not widely available.

In long-standing deformities or when manipulation fails (Case 23), supracondylar femoral osteotomy without internal fixation gives good results. Arthrodesis should not be done when there is an associated abduction deformity of the hip, and is of little benefit in the presence of a flail foot because a caliper is still needed. The main indication is in unilateral paralysis with a good hip and a foot in fixed equinus.

SUMMARY

1. Methods of correcting flexion contractures of the knee following poliomyelitis fail if posterior subluxation of the tibia is allowed to occur.
2. Careful serial manipulations will give straight, congruous joints in younger patients. Posterior capsulotomy does not facilitate correction.
3. Supracondylar femoral osteotomy is indicated in children over fifteen and in adults, although sometimes arthrodesis of the knee is necessary.

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