PARALYTIC DISLOCATION OF THE HIP

G. Blundell Jones, Exeter, England

From the Princess Elizabeth Orthopaedic Hospital, Exeter, and the Dame Hannah Rogers School for Cerebral Palsy, Ivybridge

The purpose of this review is to amplify some of the observations contained in the author’s previous paper (1954) and to present further conclusions derived from greater experience. The total material available for study is shown in Table 1.

Dislocation of the completely paralysed hip is rare and does not occur when weight bearing has been established (Le Coeur, Lapeyrie, Cartier and Mallet 1959). If weight bearing has not been possible the development of valgus of the femoral neck gradually leads to dislocation; one patient with meningomyelocele with complete paresis of the hip muscles in this series dislocated both hips at the age of six and has never walked because of spinal deformity and hydrocephalus. The valgus deformity evidently develops as the result of growth of the femur uninfluenced by the moulding forces of muscular action and of weight bearing. When some of the muscles about the hip are paralysed and others spared, the growth of the upper end of the femur is modified in various directions, but, unless the abductors are spared, valgus still develops to some degree. Figure 1 shows the hips of a child aged four and a half whose hips were flail except for abductor muscles: the greater trochanters are enlarged but there is no valgus. Varus does not develop to any degree for reasons which will be discussed later. Adductor sparing increases the tendency to dislocation because it increases the “effective valgus’” (Somerville 1959). In a proportion of paralysed hips anteverision of the femoral neck develops, but it has not been found in anything like the degree seen in congenital dislocation and, of course, the straighter or more valgus the femoral neck becomes, the less anteverision it can have. Some authors have doubted the validity of measuring the neck-shaft angle on radiographs because of the effect of rotation; in fact, if all projections of the upper end of the femur could be taken, there would be a highest value of 180 degrees and a lowest value which would represent the true measurement of valgus. The mean value measured in radiographs taken in full lateral and full medial rotation of the hip does not give an accurate measurement. Some paralysed dislocated hips are more mobile than others, and in these the radiograph in full medial rotation may give a satisfactory approximation of the true measurement; in others it may be necessary to vary the projection still further by rotating the pelvis as well. In all the cases studied a true valgus has been demonstrated, and in seven patients (twelve hips) this was so nearly 180 degrees that there was no significant variation of the angle measured in any projection.

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</tr>
<tr>
<td>Meningomyelocele</td>
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A child aged four and a half years who had poliomyelitis, leaving active abductor muscles but all other hip muscles paralysed.

An attempt to demonstrate the effect of muscular forces acting on the upper end of the femur was made by Brookes and Wardle (1962). In these studies forces were applied to the various tendons after decalcification of the cadaveric femur, the other side of the hip joint being left intact. The pull of the iliopsoas caused a valgus deformity of the femoral neck with retroversion, and a varus deformity was produced by the unbalanced pull of the abductors of the hip. In life, however, there must be some limiting factor to the development of a varus deformity, because it does not become severe unless the inner wall of the upper end of the femur is deficient. Only once have we seen increasing varus occur after a varus osteotomy, and that was in a patient in whom the lower limb bones had sustained multiple spontaneous fractures, as seen in osteogenesis imperfecta (Fig. 2). Other patients studied in whom the hip abductors were spared while all other muscles were paralysed developed a moderate degree—but never a severe degree—of varus of the femoral neck. In the comminuted pertrochanteric fracture, with the lesser trochanter detached and the inner wall of the femur destroyed, we see a severe varus deformity produced by the remaining muscles. The response
of the femoral neck to weight bearing is to produce increased strength in the bone, notably
along the inner side and in the calcar, and a similar stimulus from transplants of the iliopsoas
to the greater trochanter is probably limited in effect by the same mechanism. If this were
not so one would expect the change in the neck-shaft angle during the period of growth to be
much greater than the 20 to 30 degrees normally seen. We can thus continue to perform
transplantation without fear of producing another deformity, and we need not worry about
overdoing the varus osteotomy. In fact, the partly paralysed limb seldom gets the full effect
of strenuous weight bearing, and in nearly all the observed cases the varus correction has
tended to grow out in part.

**TYPES OF PARALYTIC DISLOCATION**

Broadly speaking there are three types of paralytic dislocation which present in different
degree these various mechanisms.

1. *Polio myelitis*—The hip is normally developed before paralysis, and the growth deviation
which appears is because of unbalanced muscular forces, pelvic obliquity and lack of weight
bearing. For this reason a flail hip which bears weight with an appliance is less likely to
dislocate than a hip with less paralysed muscles where the abductors are weak and the flexors
and adductors fairly strong.

2. *Cerebral palsy*—Here also the hip is usually normally developed at birth because either
immaturity of the defective central nervous system protects the hip from the full effects, or the
cerebral damage is acquired only at birth or soon afterwards. The development of dislocation is
usually delayed for several years until the combined effect of valgus growth of the femoral
neck, delayed weight bearing and adduction forces make it inevitable. When it does happen
it often takes place rapidly in a few weeks because a starting subluxation reflexly increases
adductor spasm.

3. *Meningomyelocele*—In these cases the unbalanced muscular forces are operating *in utero*
and the hip may be dislocated at birth (Sharrard 1959). If it is not, it must dislocate soon
afterwards when the flexors and adductors are normally innervated but the abductors and
extensors are paralysed. In such cases the remaining muscles have normal power, unlike those
in the preceding groups, and thus the tendency to dislocation is even greater. Flail hips rarely
dislocate unless there is no weight bearing, in which case valgus alone can cause it—but not until
after the age of six. Special vigilance is needed in the first year of life in children who survive
with meningo myelocele.

Each of the three groups has its special problem in treatment, but it is vital to recognise
the development of subluxation as soon as it occurs. In meningo myelocele it may be present
at birth and usually within the first year or two. In cerebral palsy it may happen at any age
while the hip is still growing, and rarely before the age of three or four. In polio myelitis it
rarely happens in children paralysed later than the age of two but it may happen on the less
paralysed side (twenty-two out of twenty-four cases quoted by Le Coeur *et al.* 1959).

**TREATMENT**

The problem of treatment may be considered as follows: 1) Reduction of subluxation or
dislocation; 2) restoration of muscle balance about the hips; and 3) establishment of weight
bearing. It is entirely different from that of congenital dislocation because muscle balance is
permanently lost, and though the effects of this may be modified they cannot be eliminated.
Therefore conservative treatment is ineffective or harmful and only surgery will help. This is
well illustrated by the following case report.

**CASE REPORT**

*Case 1*—Girl with cerebral palsy, mainly spastic diplegia. From a radiograph at the age of ten months
(Fig. 3) a diagnosis of congenital subluxation of right hip was made and treatment was instituted
elsewhere in "frog" plasters. After reduction had been maintained for a year, splintage was discarded.
but the child continued to lie on the back with the legs abducted 90 degrees. There appeared to be no adductor activity and voluntary power in the legs was poor. In spite of physiotherapy the normal position of the legs was not restored and the child was delayed in sitting. When she was seen at the age of three and a half years (Fig. 4) the hips could be brought down under anaesthesia only to the position shown in the radiograph. Varus osteotomy of the right hip was carried out and the leg brought down to the neutral position. The nail plate broke out of the upper fragment because its angle was not low enough and the opposite hip dislocated (Fig. 5). Varus osteotomy was performed on the other side and the result is shown three years later in Figure 6. Sitting has been established, with considerable improvement in the child’s general condition, and she is proceeding to crawling. Adduction spasm returned within a few weeks of removal of plaster and has required regular stretching since.

Comment—Without operation this child could never have been got to the sitting position. Prolonged immobilisation in abduction had deprived her of all reflex adductor action, and low voluntary power made it impossible for her to overcome the plaster-induced deformity.
Reduction of subluxation or dislocation—The reduction of subluxation or dislocation can usually be achieved by abduction of the hips facilitated by adductor tenotomy and occasionally in late cases by division of other contracted structures. Such interference with the remaining muscle control may be harmful, however, and it should be avoided wherever possible and need does not arise if dislocation is diagnosed early. Gradual abduction by traction on a frame is preferred, and the next stage of varus osteotomy is not performed until the hips are reduced. This operation is carried out as described in the author's previous paper (Jones 1954) by removing a wedge of bone, based medially, just above the lesser trochanter, and internal fixation is used with a miniature nail plate. These nail plates are manufactured in three sizes, the smallest being suitable for infants of six months onwards. The angle chosen for the osteotomy was originally 125 degrees, but, although this is satisfactory in older children, a
lower angle is necessary in the younger ones because there is a tendency for the valgus to reappear with growth. For these and a few of the older children the angle of 105 degrees is preferred (Fig. 7). As previously mentioned, we have only once seen varus increase after osteotomy. The postero-lateral approach with the patient prone is recommended because it makes palpation of the femoral head and neck easier, and if the nail plate is inserted into the cut surface of the neck after the wedge has been removed it is easier to obtain full varus correction. Any anteversion noted is corrected at the same time. Immobilisation after operation in a plaster spica for two months helps to restore stability and allows union of the osteotomy before the bone is again subjected to the unbalanced muscular action.

![Fig. 7](image)

There are two sizes of nail-plates with angles of 125 degrees and 105 degrees.

In the same paper a second operation for long-standing paralytic dislocation was described. This included division of contractures, open reduction and femoral shortening. The results have been uniformly poor, with joint stiffness, avascular necrosis and deformity of the femoral head, and the operation should be abandoned. The late cases are probably best left untreated, though occasionally arthrodesis may be indicated. Figure 8 shows the appearance five years after operation in a patient previously reported (Jones 1954, Case 4).

**Restoration of muscle balance**—The most important contribution to the restoration of muscle balance about the hip is the replacement of abductor power. This has been achieved by Mustard (1952) and by Sharrard (1959). Sharrard’s operation routes the transferred muscle more posteriorly through a hole in the ilium just in front of the sacro-iliac joint, and thereby gains the advantage of some extensor action as well. Such transfers are of the greatest value in preventing redislocation in meningomyelocele, especially here because the iliopsoas is often of normal power. In poliomyelitis it is rare to find a muscle spared to a degree making transfer worth while. In cerebral palsy the operation is not indicated. Nevertheless, the varus osteotomy itself often improves the balance of the existing muscles so that function improves with re-education and physiotherapy. Occasionally it may be necessary to perform destructive operations such as obturator neurectomy or nerve root section when the patient has no hope of gaining a stable hip by other means. A completely paralysed hip can be capable of weight bearing, and if it does so it will not dislocate.
Hip dislocation is most common in the true spastic because of the increase in effective valgus by adductor spasm. But it will occur only after some degree of valgus has developed, and is therefore not usually seen before the age of four, and often much later. Once subluxation starts it causes reflex stimulation from capsular stretching, which rapidly increases the spasm, and complete dislocation follows in a few weeks. It is of great importance to recognise this stage, and all physiotherapists should be aware of the reason for deterioration in walking performance and increased spasticity. Some of the children complain of pain from the hip, which makes recognition easier. In children who are only able to sit, the sitting balance may be destroyed by the increased spasm, and even in those who may never walk correction of the dislocation is well worth while for this reason. When the dislocation is recognised early it can usually be reduced easily, but even after adductor tenotomy or obturator neurectomy it invariably recurs unless varus osteotomy is performed.

**Case Report**

**Case 2**—A girl aged eleven with cerebral palsy and a spastic tetraplegia. Radiographs at the age of seven (Fig. 9) showed valgus deformity at a predislocation stage, and walking had not been established. Dislocation of the left hip occurred three years later (Fig. 10) and was treated by adductor tenotomy and immobilisation in plaster. However, after only nine months the right hip dislocated (Fig. 11) and both hips were then treated by varus osteotomy. Figure 12 shows that reduction was maintained a year after operation. In this child operation was undertaken primarily to restore sitting balance because it was thought that the child would never walk. Since the operation she has made considerable progress in walking, aided by a Bonaped, and spasm has been much reduced.

*Comment*—The increased spasm caused by the dislocating hip may even destroy sitting balance and reflect adversely on the function of the upper limbs. Reduction by varus osteotomy is worth while even if the child is unlikely ever to walk.
Immobilisation in plaster has particular problems for the child with cerebral palsy, first because a considerable reduction in voluntary power is always found after immobilisation particularly if it is longer than three weeks; and secondly because alteration of the reflex pattern can lead to insuperable problems in treatment if any extreme position is adopted and this often applies to the normal extended abducted posture in hip spica plasters.

**Fig. 9**
Case 2—Child aged seven years with cerebral palsy and walking not established.

**Fig. 10**
Case 2—Aged ten years. The dislocation of the left hip has been treated by adductor tenotomy and plaster.

Immobilisation in plaster should therefore be as brief as possible, and two months is adequate with internal fixation by the nail plate in any child. It has lately become our practice to immobilise spastic children in a short double spica in the sitting position with the hips flexed to 90 degrees and abducted 15 degrees with the knees free. Sitting in a chair is encouraged the day after operation, and exercises in the crawling position follow later. On removal of the plaster there has been no difficulty in regaining extension by physiotherapy and the loss of
voluntary power has been much less than in the children previously immobilised in the traditional extended position.

Athetoid and mixed lesions present very difficult problems particularly when torsion spasms are severe. In some of these it is impossible to attempt any reduction; in others anterior root section may be the only way of achieving a sitting position.

![Fig. 11](image1)

Case 2—Aged eleven years. There is a dislocation of the right hip, and the left hip is still unstable.

![Fig. 12](image2)

Case 2—Aged twelve and a half years. Reduction is maintained one year after varus osteotomy of both hips.

**RESULTS**

Twenty-seven operations have been performed (Table II). Hips have remained stable in a surprisingly large number of patients following varus osteotomy, but difficulties inevitably arise over the unbalanced muscular forces. These are especially great in meningomyelocele in which some muscles have nearly normal power while there is none in those muscles that
Case 3—This child aged two years had a meningomyelocele, coxa valga, and shallow acetabula.

Case 3—After inadequate varus osteotomy.

Case 3—After a second varus osteotomy.
oppose them. Three of the six redislocations occurred in these patients. The remaining three were in spastic children where voluntary power was low and adductor spasm remained very troublesome. It is to be hoped that the psoas transfer described by Sharrard (1959) will prevent redislocation but it is too early yet to reach any conclusions on this. No hip has redislocated because of recurrent valgus although most hips have become less varus by subsequent growth.

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<th>Treatment of Paralytic Dislocation of the Hip</th>
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<td>Second varus osteotomy</td>
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<td>Redislocations</td>
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<td>Observed more than 7 years</td>
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<td>Observed 1 to 7 years</td>
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<td>Observed less than 1 year</td>
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Some patients have a tendency to instability because of shallowness of the acetabulum but this can be avoided if the operation is performed early enough. In no hip has avascular necrosis occurred when simple osteotomy was done, but the operation of open reduction, femoral shortening and osteotomy should be abandoned because of this. There will inevitably be a number of patients whose dislocations are best left untreated either because recognition has been too late for effective surgery or because function in the paralysed limb is too poor to justify it. Fourteen patients were in this category.

FURTHER CASE REPORTS

Case 3—A boy with a meningocele at the age of two already had established dislocation of both hips and the acetabula had become shallow (Fig. 13). Varus osteotomy inadequately performed still allowed subluxation (Fig. 14). A further osteotomy using the same nail track and screw holes but a lower angled nail plate has improved the position, but there is still disparity between the femoral heads and the acetabula (Fig. 15).

Comment—Varus osteotomy is best performed early, before the acetabulum has become shallowed by growth because it is not containing the femoral head.

Case 4—A boy with cerebral palsy who was able to walk with sticks at the age of eleven was noted to have increasing tightness of abduction in both hips with some deterioration in gait. Figure 16 shows bilateral dislocation with much shallowing of acetabula. It was thought unwise in this patient to attempt reduction by osteotomy and the results of shelf operation in cerebral palsy have been very disappointing.

Comment—This dislocation should have been recognised and treated by osteotomy several years previously.

Case 5—Case 3 of previous paper (Jones 1954). A girl who developed poliomyelitis four months after birth. At the age of twenty-one months (Fig. 17) she was able to sit up (with some scoliosis) but unable to walk, stand or crawl. Subluxation of both hips was present and was treated by varus osteotomy at the age of two. The hips have remained stable ten years later (Fig. 18) and she walks well, though the treatment of her scoliosis is still a problem.
Case 4—Child aged eleven years, with cerebral palsy. The dislocation was recognised too late for treatment by osteotomy.

Case 5—Child aged twenty-one months, after poliomyelitis at the age of six weeks

Case 5—Aged eleven and a half years. The hips remain stable ten years after varus osteotomy of both. The loss of varus correction was 20 degrees.
Comment—Restoration of hip stability in this child produced a considerable improvement in the effective power of her remaining muscles, including the rectus femoris, with the result that she learned to walk with only below-knee appliances. The corrected neck-shaft angle—originally 120 degrees—is 140 degrees ten years later.

Case 6—Case 2 of previous paper (Jones 1954). A girl with cerebral palsy who has been under treatment from the age of six months. The left hip dislocated at the age of three and was treated by obturator neurectomy with an initially satisfactory result. However, the right hip dislocated at the age of five and the left redislocated at six (Fig. 19). Varus osteotomy was then performed on both sides and the reduction was stable ten years later (Fig. 20).

Comment—Although this child has failed to achieve independent walking, redislocation has not occurred and the corrected neck-shaft angle—originally 120 degrees—remains 130 degrees.

Case 7—A boy with cerebral palsy who has been under treatment since he was aged two was able to walk with calipers and joined sticks at the age of ten, when he had a sudden episode of severe pain in the right hip with considerable flexion and adduction spasm affecting both sides. He was found to
FIG. 21
Case 7—Child aged ten years, with cerebral palsy. Avulsion of the right lesser trochanter and dislocation of the left hip.

FIG. 22
Case 7—Aged ten years, after varus osteotomy of the left hip.

FIG. 23
Case 7—Aged fifteen years, five years after osteotomy. There is no loss of correction.
have sustained an avulsion of the right lesser trochanter and the left hip had dislocated (Fig. 21). Varus osteotomy was carried out on the left hip and the subsequent two months in plaster healed the lesion of the right trochanter (Fig. 22). The reduction was stable five years later, full weight bearing having been re-established (Fig. 23).

Comment—The effective valgus causing dislocation was increased by adductor spasm initiated in the opposite hip. It seems probable that the reduction of power in the right psoas has protected the other hip from dislocation.

SUMMARY

1. Forty-eight paralytic dislocations of the hip have been studied and twenty-seven operations for correction of valgus deformity of the femoral neck have been done.
2. The differing features of dislocations occurring in poliomyelitis, cerebral palsy and meningomyelocele are considered in relation to management after operation.
3. Early recognition of subluxation is essential to a successful varus osteotomy. An angle of 105 degrees rather than the 120 degrees previously recommended is advisable for children under the age of five.
4. Redislocation is most likely to occur in meningomyelocele in which muscular imbalance is greatest, and in later cases where the acetabulum has become shallow by growth without the femoral head within it. It has not occurred as a late complication after weight bearing has been established, from a recurrence of valgus deformity.

I am indebted to my colleagues at Princess Elizabeth Orthopaedic Hospital, Exeter, Mount Gold Orthopaedic Hospital, Plymouth, and the Dame Hannah Rogers School for Cerebral Palsy for their help and encouragement in this work, and particularly to Mr Norman Capener, Mr F. C. Durbin, Mr G. J. Lillie and Mr C. C. Jeffery who have allowed me to include their patients. I am also grateful to the late Mr F. J. Suter for help in the original design of the nail plate and to Mr Maurice Down for the later modifications.

REFERENCES