CONGENITAL DYSPLASIA OF THE HIP

Observations on the "Normal" Joint in Cases of Unilateral Disease

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Since the work of Putti (1929) the subject of preluxation or dysplasia of the hip which is the forerunner of true dislocation has been widely covered in numerous papers published during the second quarter of this century. The recent monograph of Hart (1952) contains a comprehensive summary of our present knowledge of this problem.

There is but one feature which seems to have escaped notice—namely, the condition of the opposite hip in cases of unilateral dysplasia.

While examining infants with signs of unilateral preluxation, I was impressed by the persistent abduction attitude assumed by the opposite hip. The contrast with the adducted, dysplastic hip was striking. On closer examination a more or less pronounced abduction-contracture was evident.

It is the purpose of this paper to consider a series of fifty-one infants all presenting this singular association of a one-sided congenital dysplasia of the hip with an abduction-contracture of the opposite joint; and, further, to suggest an explanation for the pathogenesis of unilateral dysplasia.

CLINICAL AND RADIOLOGICAL FINDINGS

These infants were referred to the specialist because of one or more of the following features: asymmetry of the skin-creases of the thighs, a lessened tendency to move one leg spontaneously, or the shortening of one lower extremity. On examination, in addition to the features mentioned, passive abduction of the hip on the shortened side was found to be limited.

The radiographs disclosed the following abnormalities on the shortened side: obliquity of the acetabular roof, lateral and upward displacement of the femur, and sometimes a retardation in the ossification of the bony nucleus of the head.

The picture so far described is typical of congenital dysplasia of the hip and the only purpose of its recording was to show that in this respect our cases did not differ from those previously described. But when attention was turned from the dysplastic hip to the opposite one the habitual abduction attitude of the latter could not escape notice.

Left to himself, the infant assumed immediately his favourite position: the apparently sound leg drawn up in a slightly flexed and clearly abducted attitude whereas the dysplastic one remained adducted (Figs. 1 and 2). There was also an obvious difference in spontaneous movement of the legs, the abducted one being by far the more mobile. This abducted position is also clearly seen in the radiographs.

When both legs were brought together by the examiner the difference in length was manifest, the abducted extremity appearing to be the longer. There was a downward tilt of the pelvis towards the abducted side as evidenced by the lowering of the anterior superior iliac spine on that side. This pelvic tilt was better appreciated in the prone position, in which the natal cleft was seen to be angulated from the mid-line of the body. Routine measurement of the extremities confirmed the impression that the difference in length was not a true discrepancy.

On closer examination this abducted position of the "normal" hip was seen to be due to a contracture of the hip abductors. The slightest attempt at passive adduction of the
"normal" leg either increased the existing pelvic tilt or, when the latter was prevented by fixation, failed to bring the limb closer to the midline. This was in complete contrast to similar manoeuvres performed on the dysplastic side (Figs. 3 and 4).

The clinical findings can be summarised as follows. Besides the unquestionable unilateral dysplasia of the hip all our cases presented a more or less pronounced but always easily recognisable abduction-contracture of the opposite "normal" hip, with a downward pelvic obliquity towards the abducted side.
CLINICAL MATERIAL

This series concerns fifty-one infants aged from one week to ten months. The distribution according to age is given in Figure 5, which shows that more than half of the total number were aged between two and five months. Most were seen first at the age of three to four months. Distribution according to sex reveals the overwhelming majority of the female sex (forty-eight girls and three boys). The right and left hips were almost equally affected by the dysplasia (twenty-three right, twenty-eight left hips). No instance of hereditary involvement was noted.

The degree of abduction-contracture, the degree of dysplasia, and their respective evolution according to age are shown in Table I. Most of the patients showed a moderate degree of abduction-contracture and only in five instances was the contracture marked, four of them in infants below the age of four months.

More than half of the total number showed what was termed a moderate degree of dysplasia: that is, all the usual signs of this malformation were present without exaggeration of any special feature. In eighteen cases the dysplasia was slight, not all of the classical

TABLE I

Degree of Abduction-Contracture, Degree of Dysplasia and Their Respective Evolution According to Age

<table>
<thead>
<tr>
<th>Age</th>
<th>No. of cases</th>
<th>Degree of abduction-contracture</th>
<th>Evolution of abduction-contracture</th>
<th>Degree of dysplasia</th>
<th>Evolution of dysplasia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Slight</td>
<td>Moderate</td>
<td>Marked</td>
<td>Rapid</td>
</tr>
<tr>
<td>Newborn</td>
<td>7</td>
<td>—</td>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>1 month</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
<td>1</td>
</tr>
<tr>
<td>2-3 months</td>
<td>6</td>
<td>—</td>
<td>5</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>3-4 months</td>
<td>15</td>
<td>2</td>
<td>11</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4-5 months</td>
<td>8</td>
<td>2</td>
<td>6</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>5-6 months</td>
<td>5</td>
<td>—</td>
<td>5</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>6-7 months</td>
<td>3</td>
<td>—</td>
<td>2</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>7-8 months</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>8-10 months</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>8</td>
<td>38</td>
<td>5</td>
<td>13</td>
</tr>
</tbody>
</table>

signs being present at the time of the first examination. Five infants showed a marked degree of dysplasia in which some or all of the habitual features were unusually prominent. The follow-up period ranged from six months to one and a half years.

The evolution of the abduction-contracture was towards spontaneous regression—rather slowly, perhaps because the treatment of the opposite dysplastic hip maintained abduction.
The evolution of the dysplasia ranged from spontaneous recovery to the development of a true dislocation. Spontaneous recovery was noted in thirteen patients, in whom all of the signs of dysplasia regressed in eight to ten weeks. Rapid response to treatment by abduction splint was noted in twenty-six infants. In three to four months restitution to normal was complete (Figs. 6 and 7).

In ten infants the response to treatment was rather slow and the abduction splint had to be applied for a period varying from six months to one year (Figs. 8 and 9). The development of a true subluxation or dislocation occurred in two instances. The reports are given in detail.
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CASE REPORTS

Case 3—Girl. First examination a few days after birth. Marked abduction-contracture of the right hip; moderate dysplasia of the left hip, in which the main feature was the lateral and upward displacement of the femur. At that time no difference in the acetabular index was present. At the end of the first month a true subluxation was evident in the left hip and the acetabular index was greater on that side, indicating flattening of the acetabular rim. The abduction-contracture of the right hip was slow in regressing, as was the reduction and subsequent development of the left hip. Not until the age of one year was recovery complete (Figs. 10 to 12).
Case 3. Figure 10—Immediately after birth: marked abduction-contracture of the right hip, moderate dysplasia of the left hip. There is no difference in the acetabular index. Figure 11—At the age of one month: the abduction-contracture of the right hip is still marked. The left hip is subluxated: there is a difference of 8 degrees in the acetabular index, the left acetabulum being more oblique. Subluxation persisted for several months despite treatment in abduction. Figure 12—At the age of one year: normal appearance of the left hip.
Case 4. Figure 13—At the age of two months: moderate abduction-contracture of the left hip, moderate dysplasia of the right hip. By the time the child was four months old the abduction-contracture of the left hip had regressed. Figure 14—At the age of five months: true dislocation of the right hip. Figure 15—At the age of eleven months: after treatment by plaster the dislocation is reduced but acetabular growth is still inhibited. Three months later normal development was achieved.
Case 4—Girl. First examination at the age of two months. Moderate abduction-contracture of the left hip, moderate dysplasia of the right hip. At the age of four months the abduction-contracture had notably regressed whereas the dysplasia of the right hip had progressed until at the age of five months a true dislocation was evident. It is noteworthy that from the time of the first examination the child was treated by an abduction splint which did not seem to alter the natural evolution. Only after treatment by plaster was the dislocation reduced and subsequent normal development of the hip achieved (Figs. 13 to 15).

Comments on abduction-contracture of the newborn—Cases of abduction-contracture in the newborn deserve a few remarks. Apart from the one already reported (Case 3) the others developed only a slight degree of dysplasia which regressed spontaneously. The only feature
common to all of them was the absence of any difference in the acetabular index immediately after birth (Figs. 16 to 19). The relatively large number of these cases seems to indicate that the incidence of abduction-contracture in the newborn may be high if it is deliberately searched for.

The relationship of the degree of abduction-contracture to the degree and evolution of the dysplasia in the opposite hip is shown in Table II. In some instances there is a direct relationship between these features, especially when they are very slight or strikingly severe. In most of the cases, however, these features seem unrelated. The impression gained from
this study is that abduction-contracture and dysplasia evolve independently. But whereas the course of the abduction-contracture was regular and directed towards gradual regression, that of the dysplasia was not predictable, ranging from spontaneous regression to true dislocation. Neither the degree of abduction-contracture in the opposite hip nor the degree of initial dysplasia gave any indication of the possible course of events.

**TABLE II**

**Relationship Between the Degree of Abduction-Contracture and the Degree and Evolution of the Dysplasia**

<table>
<thead>
<tr>
<th>Degree of abduction-contracture</th>
<th>Number of cases</th>
<th>Degree of dysplasia</th>
<th>Evolution of dysplasia</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slight</td>
<td>8</td>
<td>Slight</td>
<td>Spontaneous recovery</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slight</td>
<td>Rapid response to treatment</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marked</td>
<td>Slow response to treatment</td>
<td>1</td>
</tr>
<tr>
<td>Moderate</td>
<td>38</td>
<td>Slight</td>
<td>Spontaneous recovery</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate</td>
<td>Rapid response to treatment</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate</td>
<td>Slow response to treatment</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marked</td>
<td>Slow response to treatment</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marked</td>
<td>Dislocation</td>
<td>1</td>
</tr>
<tr>
<td>Marked</td>
<td>5</td>
<td>Slight</td>
<td>Rapid response to treatment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate</td>
<td>Rapid response to treatment</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marked</td>
<td>Slow response to treatment</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Marked</td>
<td>Dislocation</td>
<td>1</td>
</tr>
</tbody>
</table>

**DISCUSSION**

The coexistence of unilateral dysplasia and of an abduction-contracture in the opposite hip strongly suggests an etiological relationship. In my opinion it is the abduction-contracture in one hip that leads to the dysplasia in the other. This opinion is based on the chronological sequence in the appearance of these two features and on their respective evolution.

There is no doubt that the abduction-contracture, which represents a retention of a foetal position (Badgley and O'Connor 1953) is present at birth. The evidence of my cases in newborn infants not only corroborates this statement but also suggests that flattening of the acetabulum, generally considered as the primary sign of the dysplasia, is not present at birth. In one of these cases (Case 3) there was an obvious displacement of the femur immediately after birth, but the flattening of the acetabulum was not apparent until the end of the first month. This case emphasises that the only primary feature of dysplasia, present at the earliest moment and contemporary with abduction-contracture in the opposite hip, is upward and lateral displacement of the femur. This displacement can be explained only by relating it to the existence of the abduction-contracture in the opposite hip.

The explanation, indeed, may be sought in an analogous situation—namely, in the abduction-contracture of the hip complicating poliomyelitis. This analogy is quite valid because the mechanics involved are totally independent of the degree and distribution of the paralysis. Mayer (1931) was the first to describe fixed pelvic obliquity from contracture of the hip abductors. Irwin (1947) analysed the faulty mechanics present in the development of a fixed pelvic obliquity caused by an abduction-contracture of one hip. He pointed out...
that so long as the contracted extremity is held in the abducted position the deformity remains localised and has no secondary effects on other parts of the locomotor system. But when the contracted extremity is brought alongside its fellow for weight bearing there is a disturbance of all the normal weight bearing lines, above and below the pelvis. Among the changes that take place in this occurrence the displacement of the femoral heads should be emphasised. Whereas the femoral head on the side of the abduction-contracture is lowered and shifted towards the mid-axis of the body, the femoral head on the opposite side is correspondingly elevated and displaced farther than normal away from the midline. An apparent difference in length of the two extremities is present. The abductors on the side opposite the contracture are stretched and their strength is decreased. The resemblance between the schematic drawings published by Irwin (1947) and the radiographs of our patients is remarkable.

Thus the existence of an abduction-contracture in one hip brings about the upward and lateral displacement of the femoral head on the opposite side, provided the abducted extremity is brought into weight-bearing position—alongside the other one. This accounts for the fact that as long as the hips are held flexed—as during intra-uterine life or immediately after birth—abduction-contracture or dysplasia cannot be easily detected unless the condition is very marked. At the end of the first or second month, when the legs are sufficiently extended both by the spontaneous movements of the infant and by the continuous external pressure of the diapers, the discrepancy in length becomes more obvious.

The fixed pelvic obliquity which leads to the upward and lateral displacement of the femoral head and the stretching of the abductors produces the fundamental features of the dysplasia in the hip opposite the abduction-contracture. Occurring as they do at a time when the growth potential is at its height, they will rapidly lead to secondary adaptive changes which will complete the clinical and radiological features of dysplasia. These are the adaptive shortening and over-action of the adductor group, the elongation of the articular capsule and the flattening of the acetabular rim, the last being the result of inhibition of bone growth at the point of abnormal pressure of the displaced femoral head.

I conclude, therefore, that unilateral abduction-contracture of the hip can be responsible for the appearance of signs of dysplasia in the opposite hip, the faulty mechanism being that of "fixed pelvic obliquity." This conclusion may be followed by two considerations. The first stems from the particular evolution of these features. Whereas the abduction-contracture regresses spontaneously and usually disappears at about the sixth month, the dysplasia of the opposite hip sometimes progresses to its obvious outcome—the true dislocation. When seen at a more advanced age (one year or more) these patients would then present the picture of a unilateral dislocation and nothing abnormal would have been detected in the opposite hip. Such a situation can easily be illustrated in two of our cases (Case 3 and Case 4) if we ignore the early radiographs.

In view of this it is very tempting to consider all unilateral dislocations as the result of an unrecognised and long-regressed abduction-contracture of the opposite hip. Appealing as this hypothesis may be, there is not enough statistical proof to substantiate it.

The second consideration refers to the premonitory significance of abduction-contracture shortly after birth. Whenever such a contracture is present, dysplasia is likely to develop on the opposite side and therefore great care should be exercised in the follow-up of these infants.

**CONCLUSIONS AND SUMMARY**

1. The examination of fifty-one infants presenting signs of unilateral dysplasia (preluxation) of the hip disclosed the existence of an abduction-contracture in the opposite "normal" hip.
2. The abduction-contracture was not infrequently found in the newborn, but seemed to attract attention mostly between the second and fifth month of life. It was seldom found after the sixth month.
3. The dysplasia in the contralateral hip showed the usual features.
4. The relationship between the degree of abduction-contracture and the degree of dysplasia was a direct one only occasionally; in most cases they seemed unrelated to each other.
5. Observation of these patients showed that the abduction-contracture followed a constant course towards gradual and spontaneous regression. The dysplasia progressed in one of the following directions: spontaneous recovery, rapid or slow recovery with treatment by abduction splint, subluxation, or true dislocation.
6. It is submitted that the coexistence of unilateral dysplasia of the hip and abduction-contracture in the opposite hip is not fortuitous. It is believed that the abduction-contracture determines the development of the dysplasia in the opposite hip through the faulty mechanics caused by "fixed pelvic obliquity."
7. The discovery of unilateral abduction-contracture soon after birth should be a warning that dysplasia may develop in the opposite hip. A careful watch should therefore be kept for signs of abduction-contracture and for the later development of dysplasia.

I wish to express my thanks to Sir Harry Platt for his kindly advice and to acknowledge with thanks the help of Dr A. Schoenfeld of the Government Hospital "Zahalon," Tel-Aviv, in recording the cases of the newborn.

REFERENCES