A POST-NATAL SURVEY
FOR CONGENITAL DISPLACEMENT OF THE HIP

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In Southampton, during the years 1965 to 1968, concerted efforts were made to diagnose displacement of the hip at birth. Nevertheless cases continued to be discovered later and the incidence remained about one in a thousand live births. Most of these infant cases had been carefully examined at birth and passed as normal. There were also the disturbing facts that some cases recognised at birth failed to respond to treatment, while in others the splintage interfered with growth both of the acetabulum and of the femur (Fig. 1). It was therefore decided to make a close study of the problem over a period of twelve months, starting on June 1, 1968. The objective was to perfect the orthodox methods of neonatal diagnosis (von Rosen 1962, Barlow 1962) so as to eliminate missed cases (Owen 1968).

In retrospective studies Carter and Wilkinson (1964) found evidence of breech birth or therapeutic version in 25 per cent of infants with congenital dislocation, and pointed out that this figure did not take into account spontaneous versions. As long ago as 1910 Jackson Clarke observed that "soon after birth the presence of a dislocation of the hip may be inferred from the existence of an overflexed position of the thighs, such as seen in breech presentations, and from a tendency for the child spontaneously to assume that position". But no prospective study of either breech-born babies or those with the post-natal moulding of breech malposition (Wilkinson 1966) has ever been published. It was therefore decided that the aims of the survey should be threefold: 1) to record the various forms of normal birth postures; 2) to obtain photographic records of the leg postures in breech-born infants; and 3) to assess the prevalence of hip displacement and other deformities in relation to birth posture, and their response to neonatal splinting.

As it is only two years from the end of the study, this paper presents an early assessment of the results, but only with respect to hip displacement. A follow-up of the other congenital orthopaedic deformities discovered will be reported later.

THE FIELD

Southampton was ideal for the experiment, being a relatively closed community. At the beginning of the survey the population was 374,074. During the year there were 6,272 live births, of which 4,704 (75 per cent) were in hospital.

Because the practising orthopaedic surgeons could not afford the time to examine all babies at birth, it was decided to concentrate their examinations on infants born in the Central Maternity Unit, numbering 3,368. These included most first births and all breech births,
which were considered the more likely to be affected. Infants born in peripheral units and at home were screened by midwives trained to detect not only hip instability, but also the features of breech malposition. All such cases were referred for orthopaedic examination.

NORMAL. BIRTHS

During the first three months 866 babies were born in the Central Unit, 825 with head presentations. The midwives recorded the various types of leg posture on a special form (Fig. 2). Most babies were examined by the orthopaedic surgeon within forty-eight hours, when the birth posture was seldom distinguishable. The midwives were able to recognise the extended knee postures (A and B) and the fully flexed knee posture (E), but the semi-flexed and locked leg postures (C and D) were difficult to separate from each other. The survey showed that very few babies presenting by the head have extended knees, but one in six might be semi-flexed or locked. No plagiocephaly was recorded and prenatal moulding was minimal or absent.

BREECH BIRTHS

These numbered 147, representing 2.6 per cent of the total of 6,272 births that year. There was no seasonal variation of the incidence. The sex ratio (male to female) was 1 to 1.45. As to birth-rank, 59 per cent were first-born, 25 per cent second-born and 10 per cent third-born.
There were twenty-four twins; these included two sets of identical twins, all four with extended breech presentations. All twenty non-identical twins and co-twins were folded in the fully flexed posture. As these were considered to be "coincidental" breech presentations rather than the results of delayed leg-folding, they were not included in this study.

The incidence of lower-limb postures in the 123 single breech babies is recorded in Figure 3. Only 35 per cent had the legs completely folded. Thus, 65 per cent of single breech deliveries revealed varying degrees of arrest of the leg-folding mechanism. This figure was over 80 per cent in the first-born girls.

Three of the 147 babies had plagiocephaly, all left-sided, and in one this was associated with postural torticollis. Prenatal moulding was more marked than in normal births. The birth posture usually disappeared within three days, but in some cases it persisted up to five days.

![Figure 3](image)

**Fig. 3**

The percentage prevalence of birth postures, for comparison.

**REDUCIBLE HIP DISPLACEMENTS**

Babies classified as having "reducible hip displacement" had a positive Barlow test in one or both hips at birth, which persisted after ten days of splintage. Those with instability which disappeared by the tenth day were not included. In each unstable hip the femoral head could be displaced posteriorly and was felt to jump back into the acetabulum when the flexed thigh was abducted. The reduction was stable with the thigh almost fully abducted in 90 degrees of flexion and neutral rotation.

There were twenty-three babies in this category. All but three were born in the central unit. Nineteen were first-born and nineteen had breech presentations. None was born prematurely. Eighteen were girls. Both hips were unstable in nine, only the left hip in nine and the right in five.

**TABLE 1**

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<th>Month of Birth of Twenty-three Babies with Reducible Hip Displacement</th>
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**Birth season**—The birth-dates revealed that more were born in the summer months in the proportion of 14 to 9, or 1·4 to 1 (Table 1).*

* In a further series of newborn with reducible hip displacements seen before and after the reported review, twenty-six were born in summer and twelve in winter. This gives an overall seasonal birth summer to winter ratio of 40:21.
Intra-uterine moulding—This was slight in these twenty-three patients and the evidence quickly disappeared within the first few days. Four babies had extended knees and sixteen were folded in the locked-leg posture, including one born by head presentation. The joints of the remaining three born by head presentation were so lax that their postures could not be identified.

Five babies had plagiocephaly, four right-sided and one left-sided. There were eleven with abnormal joint laxity, and these included the five boys (Fig. 4). This laxity persisted during the follow-up period and was eventually traced in one of the parents. Babies with marked laxity usually showed little or no evidence of prenatal moulding.

Response to treatment—Twenty babies were nursed supine, at first on Barlow splints. When they became too large or too strong they were transferred to von Rosen splints. The period of splintage varied between eight and twelve weeks, being terminated when the hips felt completely stable. Three babies were not splinted for medical reasons, but were nursed prone in the frog position with double napkins.

The response to treatment in twenty of the patients was excellent, including the three not splinted; the radiographic appearances were normal at twelve months. Three girls are still being followed up because of minor dysplasia persisting beyond the twelve-month follow-up period; all three have extreme degrees of persistent joint laxity.

IRREDUCIBLE HIP DISPLACEMENTS

There were fourteen babies with two things in common—all the features of hip displacement but a negative Barlow sign. They had above-knee shortening, whether the hips were flexed or extended (Fig. 5), and limited abduction of one or both hips. Six were diagnosed at birth, six presented three or four months after birth and two were discovered later.

Those diagnosed at birth were breech born and severely moulded in one of the extended knee postures. Three had plagiocephaly. Three hips responded to neonatal splinting, although the respective femoral epiphyses did not appear until after the first six months of life and were smaller than those of the opposite hip for at least eighteen months from birth. The fourth child still has unilateral acetabular dysplasia and remains under review. The fifth is a boy whose hips failed to respond to neonatal splinting; at six months both hips remained dislocated. Reduction was attained within three weeks by traction on a vertical frame; abduction splints were then applied, but at sixteen months there was gross dysplasia of the left hip and hypoplasia of the epiphysis. The sixth patient was a girl whose right hip was obviously dislocated at birth and remained displaced after twelve weeks of neonatal splintage. Vertical frame traction gave partial reduction, but complete stability of the hip followed the excision of a limbus through a posterior approach.

Six infants three or four months old were referred to my clinic because of limited abduction of one or both hips and leg shortening. Two were born by breech presentation and had been seen at birth. Although their Barlow tests had never been positive, displacement had been
suspected from the beginning. Four were born by head presentation and their hips had also been recorded as normal. These six infants were examined under general anaesthesia at three months and their hip displacements (all left-sided) were confirmed by Andrèn’s (1962) radiological test. Adductor tenotomy was performed and in one case this enabled a positive Barlow’s sign to be elicited. After this minor procedure the hips were held in abduction in Denis Browne splints for three months. Two fully recovered, with normal radiographs by eighteen months. The other four did not respond; two have acetabular dysplasia and two have fragmentation of the femoral epiphysis; one has already had a posterior limbus removed.

Two infants born in the period of review have since presented in our clinic with congenital dislocation. One was born at home, the other in a nursing home. The first was a third-born girl who had a cephalic delivery at home. The midwife passed the hips as normal because the Ortolani tests were negative. After frame reduction, posterior arthrotomy revealed a

![Fig. 5](image1)

To show inequality of leg length in both the flexed and the extended positions of the thigh.

limbus, excision of which allowed concentric reduction (Fig. 6). The second infant was a first-born girl who had a cephalic delivery, with hips judged to be normal at birth. When first seen the left hip was displaced. An arthrogram revealed a limbus, which was excised.

Thus, from the group of fourteen patients, four have already had excision of a limbus, giving concentric reduction and stability. In addition, four patients are still being followed up because of persistent acetabular dysplasia; they will probably require operation in due course.

**DISCUSSION**

The original goal of this research was to find an infallible method to detect displacement of the hip joint at birth, a method which would be superior to the snapping signs of Le Damany (1914), Ortolani (1948) and Barlow (1962). It was hoped that a close study of all postures

* Since this paper was submitted the second infant with femoral epiphysial fragmentation has been operated upon, a large posterior limbus being found.
might identify the "position of dislocation" that was only common to every newborn with this disorder.

The posture identified (Fig. 7) can only be imposed on a newborn with an excessive range of lateral rotation of the flexed thigh. The sign is therefore similar to Ortolani's (1948) original description of "outward rotation of the legs" as a clinical feature of "preluxation" of the hip joint.

It was difficult to estimate the prevalence of this postural sign at birth in normal babies after head presentations, due to the minimal degree of moulding in this group and also because of the rapid disappearance of all such evidence. The forms used to record birth postures did indicate, however, that in only 1 per cent of normal births were there extended knee postures, although 16 per cent might well have been held in the "position of dislocation" for a short time before birth. Such a prevalence is in keeping with the theoretical fifty-fifty chance of breech or head presentations, depending upon the lie of the foetus when the legs lock in the extended knee postures (Wilkinson 1966).

The recording of birth postures in the 123 single breech births was more accurate because of the greater degree of moulding and its persistence for a few days. This allowed time for
careful reappraisal outside the labour ward and photographic records. The high prevalence of extended knee postures in this group certainly sustains Vartan's theory (1945) that failure of the leg-folding mechanism is one of the chief mechanical causes of breech birth. It is also interesting to note that of the twenty twin breech deliveries with no evidence of delayed leg-folding, none had hip displacement. Yet the prevalence of this deformity in single breech presentations was as high as one in five. This last figure certainly confirms the opinion that single breech-born babies are at risk of congenital hip displacement. The higher female sex incidence in breech births may also have some etiological significance, although more recently this has been attributed to a higher prenatal male mortality.

If delayed foetal leg-folding is in fact the chief mechanical reason for intra-uterine hip displacement, it is significant that in this series evidence of such malposition was more conspicuous in babies with abnormal hips than after normal breech births.

For comparison, the prevalence of the postural groups is expressed in percentages in Figure 3. Thus, evidence of delayed leg-folding was present in 80 per cent of newborn infants with hip displacement, compared with 65 per cent of normal babies born by the breech. This indicates that either hip displacement is a cause of delayed leg-folding or that some additional etiological factor is at work, such as persistent or hormonal joint laxity.

James (1970) suggested that plagiocephaly usually represented post-natal postural deformation of the skull. Whereas this series confirms his findings in normal cephalic deliveries, plagiocephaly was found to be present at birth in 4 per cent of normal breech deliveries. The degree of deformity was greater in 30 per cent of newborns with reducible hip displacements and greater still in 50 per cent of babies with irreducible hip displacements. The plagiocephaly was always on the side of the hip displacement when this was unilateral and on the left side in one patient with both hips affected. One patient had an associated left facial palsy which gradually disappeared. Another developed a sternomastoid tumour and secondary torticollis on the side of the original plagiocephaly. In the seven babies with reducible hip displacement there was right plagiocephaly in five and left plagiocephaly in two, one of these being the patient with bilateral displacement. Of six patients with irreducible hip displacement, three had right-sided and three had left-sided plagiocephaly at birth. If the skull is soft enough to undergo post-natal postural deformation, surely its plasticity is greater before birth, when postural forces can be more persistent.

From the total of 6,272 live births, there were thirty-seven newborns with varying degrees of hip displacement, a prevalence of 5·9 per 1,000 births. Out of these thirty-seven, eleven had persistent displacement, with acetabular and femoral dysplasia, without a positive snapping sign—a prevalence of 1·7 per 1,000. This figure is nearer to the 0·7 per 1,000 incidence of infantile congenital hip dislocation previously reported in the British population, and there is little doubt that all these babies would have gone on to develop subluxations and dislocations if they had not been diagnosed and treated earlier.

The thirty-seven babies with abnormal hip joints are divided into two groups, those with
a positive snapping sign and those without. The former have been designated “displaced but reducible” hips, and the latter “displaced and irreducible”. There was a slight overlap in that some hips were obviously displaced, but did not snap back. These were cases of unstable reduction and eventually fell into the second group.

Both groups appear to have the same etiological factors, including sex ratio, birth rank and delayed leg-folding. They are probably different degrees of the same deformity. The seasonal variation in birth dates might well indicate an additional factor in the irreducible hips. The high prevalence of summer births (winter conceptions) in the reducible hips was confirmed in another thirty-eight cases seen before and after this series (Table I). It is the reverse of the ratio reported in infants with congenital displacement (Carter and Wilkinson 1964). It has recently been suggested (Elwood 1970) that the prevalence of winter births associated with congenital malformations is partly due to teratogenic factors operating on summer conceptions. Thus there may be some unknown etiological factor that converts a simple hip displacement into a permanent one. This would account for the higher prevalence of reducible hips in summer, compared to a greater incidence of irreducible hip displacements born in winter. The latter would be more difficult to diagnose because of the absence of the snapping sign, and the majority would be recognised later in infancy.

Current opinion is that teratogenic or embryological dislocations are rare and usually associated with other congenital malformations. It is believed that most congenital hip dislocations occur without any major structural abnormality at birth and vary from the normal only in the degree of capsular laxity (von Rosen 1962, McKibbin 1970). This would suggest that all soft-tissue changes, including inversion of the limbus, and all bony deformations develop after birth. Wilkinson (1963) demonstrated experimentally the combination of breech malposition and hormonal joint laxity. These two factors produced an infolding of the posterior capsule to form a soft-tissue obstruction, preventing reduction of the displaced femoral head. Such etiological factors could affect the human foetus, producing a soft-tissue limbus before birth. These experimental findings were later supported by anatomical evidence from necropsies performed on still-born breech births (Wilkinson 1964).

Such findings, if commonly occurring, would provide an explanation for the two groups discovered in this series (Fig. 8). The unimpeded and stable reduction of the femoral head in the first group provides a full stimulation of potential bone growth (acetabular and femoral), with spontaneous and full recovery within six to twelve months from birth. Yet in the second group eccentric reduction of the femoral head secondary to incarceration of the limbus (Somerville and Scott 1957) leads to pressure on and persistent hypoplasia of the acetabular roof and femoral epiphysis.

Thus, abnormal hips at birth can be artificially divided into two groups, those with reducible displacement and those with irreducible displacement, depending on whether or not the snapping sign is positive. Both groups are more likely to affect first-born girls, with a preceding obstetrical history of breech malposition culminating in breech birth.

Babies with reducible displacement usually show spontaneous recovery (Barlow 1966). The displacement can be aggravated by swaddling, but if the mother is instructed to lay the child in a prone position and to use double napkins, most if not all will recover without the use of abduction splints. This does not detract from the responsibility of the accoucheur in diagnosing the condition, and from the responsibility of the orthopaedic service to perform regular assessments during the first year of life.

Irreducible hip displacement is more easily missed, because the snapping sign is absent and diagnosis is more dependent upon the identification of prenatal malposition. In this small series, four of these patients have already required operation to attain complete reduction of the displacements and four are likely to do so in the near future. These eight would more than account for the prevalence of infantile hip dislocations (0.7 per 1,000 as reported by Record and Edwards 1958) expected to be born in this series. The response to neonatal
splintage in this group was poor and not improved by adductor tenotomy. Still more study will be necessary before one can decide whether or not the first three months of life is the time of election for treatment. It might be wiser to treat these babies as suggested for the former group, the surgeon being prepared to reduce persistent or residual displacement after the first three months.

**SUMMARY**

1. There is an increasing prevalence in the evidence of prenatal extended knee postures in the legs of newborn, from normal births to breech deliveries and to babies with hip displacements. The extended knee postures are also commoner in female births.
2. Babies with reducible hip displacements appear to be born more often in summer as the result of winter conceptions. Spontaneous recovery is very high, with or without splintage.
3. Irreducible hip displacement does not respond to splintage during the first six months of life. Even with adductor tenotomy, there is a great risk of acetabular and femoral epiphysial damage. This is thought to be due to incarceration of the limbus, present at birth.

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REFERENCES


