

## EARLY DIAGNOSIS AND TREATMENT OF CONGENITAL DISLOCATION OF THE HIP\*

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The long history of congenital dislocation of the hip is well known and needs no repetition. In the last half century the need for early diagnosis has been increasingly stressed. Putti in 1927 drew attention to the advantages of early treatment; he claimed perfect anatomical and functional results in 94 per cent of children whose treatment commenced before they were one year old.

In 1948 at Malmö in Sweden von Rosen and his colleagues began the routine examination of the hips of new-born children, using Ortolani's test. In Malmö nearly all babies are born in one obstetric department; this of course greatly facilitates their routine examination. By 1958 Andrén and von Rosen were able to claim that no case of established congenital dislocation of the hip had later been found in these children when their simple method of early treatment had been employed (see also this issue of the Journal, p. 284).

### OBJECTS OF THE INVESTIGATION AND CLINICAL MATERIAL

This investigation was commenced in 1957 at the suggestion of Mr W. Sayle-Creer. The objects were threefold: firstly, to determine the incidence of instability of the hip in the first week of life; secondly, to find out whether dislocation occurs after birth, and if so at what age; and thirdly, to clarify the indications for and the methods of early treatment.

The clinical material consists of 9,289 infants born in the Maternity Department at the Hope Hospital, Salford, from June 1, 1957, to the end of January 1962. Every infant has been examined in its first week of life and about 2,000 examinations have been made each year.

It has been said that congenital dislocation of the hip can occur at three distinct times, the first at or just before birth, the second when the hips are extended for the first time, and the third when the child first walks. In order to test this statement it was decided that each child should be examined a second time at the age of one year, because by this time all children have extended their hips and most of them have walked. At the time of writing 6,809 of the 9,289 children have reached one year, and so far 3,647 or 54 per cent have attended for the second examination.

### THE DIAGNOSTIC TESTS USED

In 1936 Ortolani described a simple test which would establish a diagnosis of congenital dislocation of the hip in children one year old. Unfortunately it was published in a little known Italian paediatric journal and did not receive the attention it deserved. Ortolani's test, and indeed my own, which I will describe later, depend upon the fact that the dislocation is a postero-inferior one, a fact stressed by Denis Browne (1959). In Ortolani's test the child is laid on its back with the hips flexed to a right angle and the knees flexed. Starting with the knees together, the hips are slowly abducted, and if one is dislocated, somewhere in the 90 degrees arc of abduction the head of the femur slips back into the acetabulum with a visible and palpable movement described by Ortolani as a "click."

I have found this a satisfactory test for children who are approaching the age of one year and use it in follow-up examinations at that time. I have found, however, that Ortolani's test in new-born babies is not entirely satisfactory. It happens occasionally that when the hips

\* Based on a paper read to the British Orthopaedic Association at Manchester on April 14, 1961.

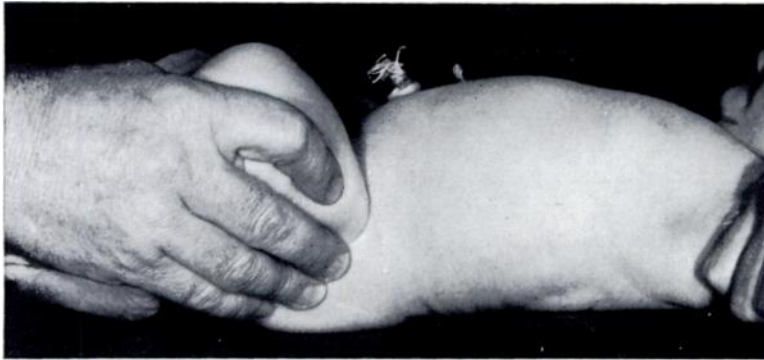


FIG. 1

The new-born child is laid on its back with the hips and knees flexed and the middle finger of each hand is placed over each greater trochanter.



FIG. 2

The thumb of each hand is applied to the inner side of the thigh opposite the lesser trochanter.



FIG. 3

In a doubtful case the pelvis may be steadied between a thumb over the pubis and fingers under the sacrum while the hip is tested with the other hand.

are abducted the dislocated femoral head slides so smoothly over the low rim of the acetabulum that it does not make a click, and the hip therefore appears to be normal. This led to a modification of Ortolani's test.

The test is made in two parts. 1) The baby is placed on its back with the legs pointing towards the examiner. The hips are flexed to a right angle and the knees are fully flexed. The middle finger of each hand is placed over the greater trochanter (Fig. 1) and the thumb of each hand is applied to the inner side of the thigh opposite the position of the lesser trochanter (Fig. 2). The thighs are carried into mid-abduction, and forward pressure behind the greater



FIG. 4



FIG. 5

Figure 4—A radiograph with the legs parallel often shows little difference between the two sides. Figure 5—Von Rosen's technique makes the dislocation of the left hip quite obvious.

trochanter is exerted by the middle finger of each hand in turn while the other hand holds the opposite femur and pelvis steady. If the femoral head slips forward into the acetabulum the hip has been dislocated. If there is no movement of the femoral head the hip is not dislocated. This completes the first part of the test. 2) The second part of the test consists in applying pressure backwards and outwards with the thumb on the inner side of the thigh. If the femoral head slips out over the posterior lip of the acetabulum and back again immediately the pressure is released, the hip is "unstable"—that is to say the hip is not dislocated but is dislocatable.

In a doubtful case the stability of each joint can be further tested with the pelvis firmly held between a thumb on the pubis and fingers under the sacrum (Fig. 3).

This test is very reliable and can be used up to the age of six months. By that time the femora have become so long that it is difficult to reach the greater trochanters with the tips of the middle fingers.

**OTHER METHODS OF DIAGNOSIS**

**Radiography**—It has been found that antero-posterior radiographs taken with the baby lying on its back and the legs extended and parallel are of little value, because the difference between the dislocated and the normal sides is too small (Fig. 4). In 1948 von Rosen described a technique, published in 1956, which I have found reliable. An antero-posterior view is taken with the hips extended and the thighs medially rotated and each abducted 45 degrees—so including an angle of 90 degrees (Fig. 5). When the long axis of the femur on the normal side is produced upwards and inwards it crosses the spine at the lumbo-sacral junction, whereas the long axis of the dislocated femur crosses the lumbar spine at a higher level. With a satisfactory clinical test available there is of course no need to examine every new-born infant radiographically.



FIG. 6  
A baby with asymmetrical skin folds but no dislocation of the hip.

There are two physical signs on which much store has been laid in the past—namely, limited abduction of the hip and asymmetry of the skin folds on the inner sides of the thighs.

**Limited abduction**—This arises from the secondary adaptive shortening of the adductors in the presence of persistent dislocation. Infants examined in the first week of life have not had their hips dislocated long enough to develop this adaptive shortening; consequently there is no limitation of abduction and the test is of no value at this early age. When the test is positive at a later age it is in fact a sign of a neglected dislocation.

**Asymmetry of the skin folds**—In this series far less than half of the infants with dislocated hips had asymmetrical skin folds, and the great majority of children with asymmetrical skin folds were found to be normal (Fig. 6).

**Factors thought to be connected with congenital dislocation of the hip**—Some of these are 1) the position *in utero*; 2) the birth weight; 3) the influence of the season; and 4) the position in the family.

TABLE I  
INCIDENCE OF BREECH BIRTHS IN NORMAL BABIES AND THOSE WITH ABNORMAL HIPs

Number of normal babies	Number of breech presentations	Per cent	Babies with hip abnormalities	Number of breech presentations	Per cent
8,814	391	4.4	139	24	17.3

**Position in utero**—The only one of importance is the breech position. Of the normal infants 4.4 per cent were breech presentations, but of those with abnormal hips no less than 17.3 per cent were breech presentations (Table I). The other positions, normal or abnormal, appear to have no connection whatsoever with the occurrence of congenital dislocation.

*Birth weight*—The distribution of birth weight of 500 normal children was taken as a standard. When the children with abnormal hips were studied according to birth weight it was found that the curves were identical (Fig. 7). So it appears that the birth weight by itself has no influence upon the incidence of congenital dislocation.

*The influence of the season*—In the past, several series of congenitally dislocated hips have shown an apparent seasonal incidence, higher in the darker months—the first and last quarters of each year. The present series shows no such seasonal incidence; in fact over the last four years the infants with dislocated hips were born at irregular intervals throughout the whole period (Fig. 8).

*Position in the family*—There is no evidence in this series that the position of the child in the family affects the incidence of congenital dislocation, which appeared to be just as frequent in second and third children as it was in first.

### RESULTS OF CLINICAL EXAMINATIONS

A total of 9,289 babies were examined in the first week of life. There were 159 abnormal hips, eighty-one dislocated hips and seventy-eight “unstable” hips. The overall incidence is one child with an abnormal hip or hips per sixty-seven births (Table II).

TABLE II  
INCIDENCE OF ABNORMAL HIPs

Total number of babies examined	Number of babies with abnormal hips	Number of abnormal hips	Dislocated hips	“Unstable” hips
9,289	139	159	81	78

### TREATMENT

The discovery of the first dislocated hip presented the problem of early treatment. The first babies had their legs bound to a diminutive Scaglietti divaricator. Two hips were successfully treated in this way and became stable after two months. Unfortunately the third hip was not held properly reduced; after two months it was still dislocated and required immobilisation for eight months. Later the legs of the divaricator were bent to an angle of 90 degrees at the hips and knees, but again this was not satisfactory.

The splint described by Denis Browne (1948) was next used. This consists of a transverse sacral bar with two cuffs which buckle round the thighs above the knees and hold the legs at right angles, the whole being kept in position by a canvas strap attached to an abdominal band. (The splint occurs in the National Health Service List of Appliances under the heading E.5X.) For new-born children the splint has two disadvantages. Firstly the bar across the sacrum quickly corrodes from being constantly soaked in urine, and secondly not every hip is held completely reduced all the time.

As a result of these experiences I devised a simple splint of my own. It consists essentially of two strips of gauge 16 aluminium one inch wide and twenty-two inches long (2.5 × 55 centimetres). These are held together with a single rivet nine inches (22.5 centimetres) below the top end. The strips are padded on one side with felt and soft leather, and provided with a canvas strap which can be passed through slots in the top end of the splint (Fig. 9). The splint is applied in the manner shown (Figs. 10 to 13), and has proved itself entirely satisfactory for treatment at this early age.

In the early months of the investigation, before increasing numbers revealed the high rate of spontaneous recovery, every child with an abnormal hip was placed on a splint. Because the “unstable” hips became stable in a matter of days, it seemed unlikely that the splint

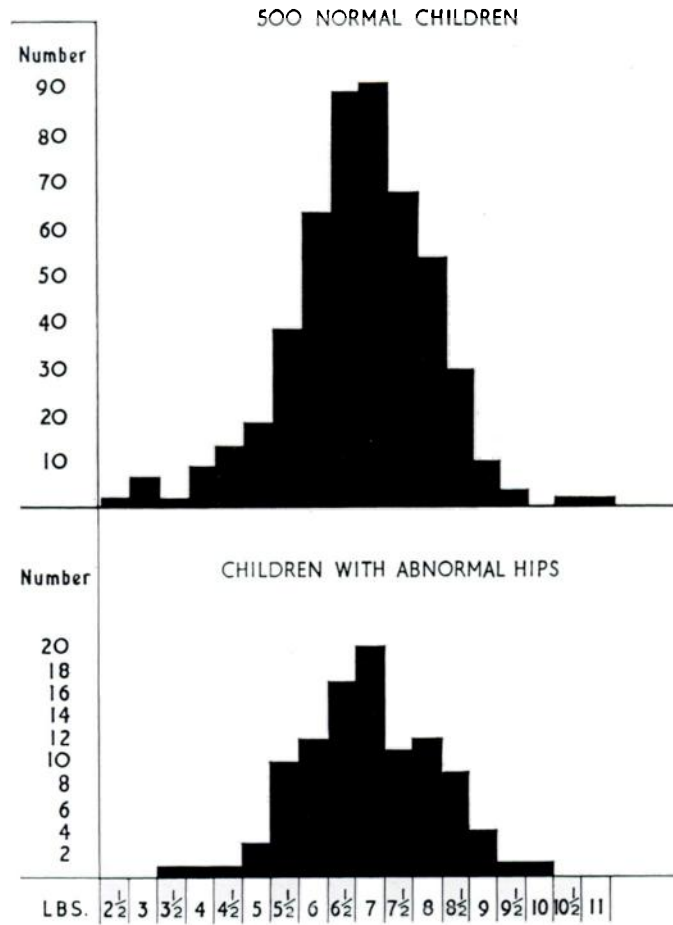


FIG. 7

The birth weight distribution of 500 normal children is shown above, and is compared beneath with the weight distribution of all children in the series with abnormally lax hips.

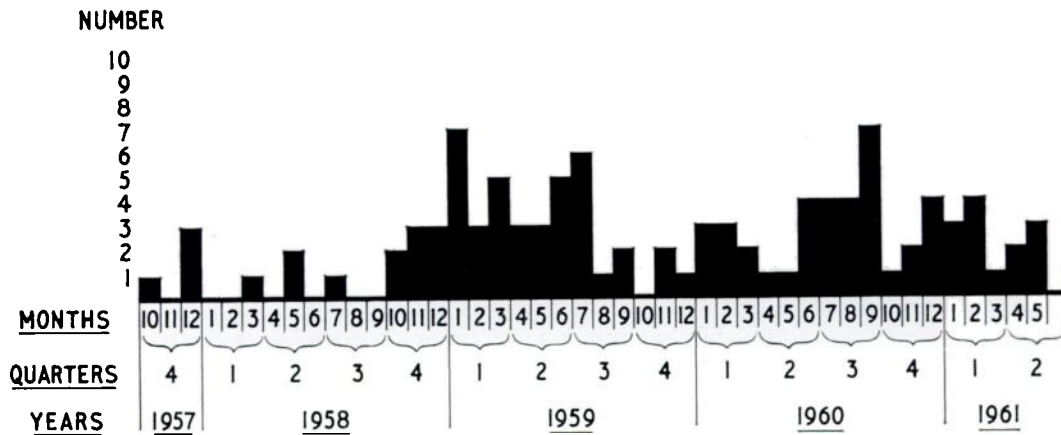


FIG. 8

To show the monthly incidence of children born with abnormally lax hips throughout the period of the investigation. The small numbers recorded up to September 1958 occurred while Ortolani's test was being used; this test failed to reveal minor degrees of hip laxity.

had much to do with this; the splinting of these "unstable" hips was therefore discontinued and has not been resumed. It is, however, essential to splint all dislocated hips.

Owing to the lack of previous experience of dislocated hips at such an early age, the treatment was at first a matter of trial and error. An affected infant was splinted at once and examined at weekly intervals. The time taken for the hip to become stable was recorded and the splint was retained for a further equal period. For example, if a hip took three weeks to become stable, the splint was retained for a total of six weeks. This method proved entirely satisfactory; no hip has reverted to a condition of instability or dislocation after splintage for

this time. On two occasions, however, immobilisation for a shorter period was followed by redislocation demanding further splintage.

At the follow-up examinations of one-year-old children it soon became apparent that the only hips showing the radiological stigmata of congenital dislocation were those which had not become stable by the age of two months. This seemed to indicate that in any dislocated hip spontaneous recovery was a very likely event up to the age of two months, after which any hip which still remained dislocated was unlikely to undergo spontaneous recovery and would need treatment.

Nearly three years ago it was decided to put this theory to the test, and for a year no child with an abnormal hip was treated until it was two months old. During this period fifteen dislocated hips were discovered; only two persisted after two months, the rest having recovered spontaneously. These two children then commenced treatment, but at this point a most important fact came to light. Secondary adaptive shortening of the adductors had already begun, and these children proved just as difficult to treat as children whose dislocated hips are discovered after a year. One child has

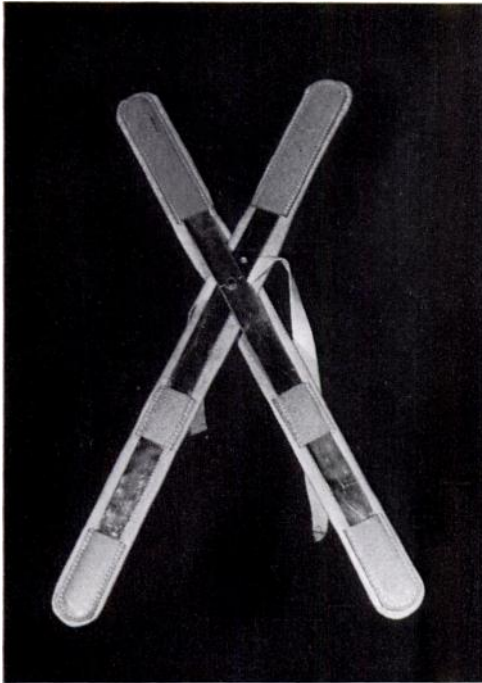


FIG. 9

Posterior view of the malleable splint showing the position of the canvas strap. The slots in the leather covering of the upper end of the splint can just be seen.

made a successful recovery, but the other, whose immobilisation has been interrupted by illness, still had an unreduced dislocation at the age of ten months. We have therefore returned to the original premise that the dislocated hip must be treated immediately it is discovered, preferably within the first week of life.

#### FATE OF THE ABNORMAL HIPs

**Spontaneous recovery**—Because the examinations take place at weekly intervals, it follows that half the babies are less and the other half more than three and a half days old at the time of examination. When the cases of abnormality were arranged according to the age in days, it was found that among the infants less than three and a half days old there were 100 with 112 abnormal hips, but among those more than three and a half days old there were only thirty-nine with forty-seven abnormal hips (Table III).

If there were 112 abnormal hips among the younger babies it is reasonable to assume that there had been a similar number among the older ones. If so, only forty-seven out of 112 persisted into the second half-week of life, and the incidence of spontaneous recovery during the first three and a half days must have been the fantastic one of about 58 per cent. (On



FIG. 10



FIG. 11



FIG. 12



FIG. 13

To show the method of application of the splint.



two occasions when I was examining a dislocated hip the baby started to cry, and at the moment when the muscles contracted to produce the expulsive effort I felt the hip reduce spontaneously. Muscular activity appears to be a very potent factor in spontaneous recovery.)

TABLE III  
INCIDENCE OF HIP ABNORMALITIES IN BABIES UP TO THREE AND A HALF DAYS OLD  
COMPARED WITH THOSE FROM THREE AND A HALF DAYS TO SEVEN DAYS OLD

From birth to 3½ days			From 3½ days to 7 days		
Dislocated hips	“Unstable” hips	Total	Dislocated hips	“Unstable” hips	Total
56	56	112	25	22	47

Out of the first 7,742 children examined and reported at Manchester in April 1961 there were 119 abnormal hips, 107 of which had become stable whether treated or not by the age of two months. These hips when examined and radiographed at the age of one year were functionally and radiologically normal.



FIG. 14

Radiograph showing on the left side a sloping acetabular roof and a small capital epiphysis poorly covered in a hip joint during the stage of recovery after treatment.

**Failure of spontaneous recovery**—The remaining twelve hips are in children now more than one year old. Although these children walk with concentric, stable hips and legs of equal length, they show the radiological stigmata of previous congenital dislocation in the form of a small bony nucleus for the capital epiphysis, a sloping acetabular roof, an increased neck-shaft angle and anteversion. These twelve children represent an incidence of one in 645 or 1.55 per 1,000 births. I am sure that these are the children who, but for the treatment given them, would have presented at the age of two or three years with classical congenital dislocation of the hip as we see it so often in England.

At the follow-up examinations of 3,647 infants at the age of one year no case of dislocation was found. Moreover, a recent inquiry at all the hospitals within a radius of twelve miles of Salford has discovered no child with congenital dislocation of the hip who was born in the Hope Hospital after June 1, 1957. This series therefore gives no evidence that "congenital" dislocation of the hip develops at any age later than birth, and one can only conclude that if this ever does happen it must be extremely rare.

**"Pre-dislocation phase"**—The type of radiographic appearance which has been described as the "pre-dislocation" phase is seen in Figure 14, which shows a sloping acetabular roof and a small capital epiphysis poorly covered. Such an appearance is common among children who have had a dislocation treated, and, as in this case, represents a stage of recovery.

So far not a single dislocation occurring after birth has been discovered in 5,496 one-year-old infants. I am therefore convinced that when no treatment has been given such an appearance represents a late stage in the spontaneous recovery of a previous dislocation and not a pre-dislocation stage. These hips do not dislocate again and do not need treatment. The concept of a pre-dislocation phase should be abandoned.

#### CONCLUSIONS

1. A simple test more sensitive than Ortolani's for the diagnosis of instability of the hip in the new-born is described. It takes only a few seconds to perform and can be quickly taught to doctors, nurses and midwives.
2. About one infant in sixty is born with instability of one or both hips. Over 60 per cent of these recover in the first week of life, and 88 per cent in the first two months. The remaining 12 per cent are true congenital dislocations and persist unless treated, giving an incidence of 1.55 per thousand.
3. Treatment with the type of splint described begun within the first week is simple and effective, and gives a hip clinically normal long before the child begins to walk.
4. The concept of a pre-dislocation phase should be abandoned.

I am indebted to Mr William Sayle-Creer for constant encouragement and many helpful suggestions, and also to the Manchester Regional Hospital Board for the provision of a Research Grant which has defrayed certain expenses in connection with this project. My deepest appreciation is also due to Dr C. E. B. Rickards and Dr E. E. Rawlings, who permitted me to use the material and facilities of their department at the Hope Hospital, Salford.

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