Occasional Review

Difficulties in diagnosing and managing congenital dislocation of the hip

T C NOBLE, C R PULLAN, A W CRAFT, M A LEONARD

British Medical Journal, 1978, 2, 620-623

Summary and conclusions

In a 10-year retrospective study of 25 921 consecutive deliveries in a neonatal unit in Newcastle upon Tyne 271 cases of congenital dislocation of the hips were identified. Of these, the outcome was unsatisfactory in 12: four diagnoses were missed at birth and eight children required further surgical treatment. Radiological abnormalities were detected in a further five children at long-term follow-up examination.

From the results of this study and other published series it was concluded that lack of attention to detail was the main cause of inadequate diagnosis and management of congenital dislocation of the hips. More detailed instruction of junior staff, confirmation of the diagnosis by senior staff, the use of a non-removable splint early in treatment, and thorough follow-up by senior staff are all important.

Introduction

Despite earlier optimism about the ease and accuracy of diagnosing congenital dislocation of the hips in newborn babies,¹ it has since become clear that some are still being missed during neonatal screening examinations.^{2,3} There is also increasing recognition that the routine treatment of unstable hips in the newborn, many cases of which would correct spontaneously, may itself cause ischaemic damage to femoral heads if incorrectly applied.^{4,5}

To try to define the rate of failure of diagnosis and treatment in a busy city maternity unit we studied 25 921 consecutive deliveries in Newcastle General Hospital from the middle of 1964 until the end of 1973. From the results of this investigation and from a study of papers from other centres we tried to identify the causes of failure and to suggest ways of avoiding them.

Patients and methods

Routine screening for congenital dislocation of the hips was started at Newcastle General Hospital in the summer of 1964, and since then all newborn babies have been examined during the first 24 hours of

life and again before being discharged home, using Barlow's modification of Ortolani's routine.^{6,7} These examinations were carried out by registrars in neonatal paediatrics whose tenure of office was six months, and by senior house officers in neonatal paediatrics who remained in the unit only for three months. Treatment and follow-up of diagnosed cases was carried out by consultant paediatricians and registrars, but only infants whose progress seemed abnormal were referred to orthopaedic surgeons.

During the first half of the study von Rosen splints were applied, but contrary to the designer's recommendation⁸ mothers were allowed to remove the splints daily to bathe their babies. Between 1969 and 1973 Aberdeen (Remploi) splints⁹ were used, and these were removed for both napkin changing and bathing. Unless hips remained clinically unstable or x-ray pictures showed abnormalities, most splints were removed between six and 10 weeks later, and the children were re-examined several times during their first 18 months of life until they were walking.

During 1975 we tried to contact the mothers of all babies who were found to have unstable hips during the nine and a half year study, and three-quarters of them brought their children back for clinical and radiological examination. A search of the records of all local orthopaedic units was also made to identify children who had been missed at neonatal screening examination and had subsequently presented with established dislocation. Finally we studied the orthopaedic records of children in whom unstable hips had been diagnosed at birth, and whose management had been complicated by incomplete reduction or the development of radiological abnormality during treatment. We think that all cases of congenital dislocation of the hip that were diagnosed late have been traced.

Results

EPIDEMIOLOGY

During the nine and a half year study 25 921 babies were examined and 271 were considered to have dislocated or unstable hips (table I). Four children, passed as normal at birth, were later found to have established dislocation. The incidence was thus 10.6 per 1000 babies examined. The ratio of girls to boys affected was 3.5:1, and 10.7% were breech deliveries compared with 3.3% of all births. The right hip alone was unstable in 39 (14.4%), the left alone in 129 (47.6%), and both in 103 (38%). There was no consistent seasonal variation.

TABLE I—Short-term outcome in 271 children in whom hip dislocations were diagnosed at birth

Hips stable after simple splintage:	No
For 6-12 weeks	249
For 3-8 months	10
Hips requiring additional surgical treatment	8
Incomplete early follow-up	4

DIAGNOSIS MISSED AT BIRTH

Details of the four cases missed during neonatal examination are given below.

Case 1—A preterm baby with exomphalos and respiratory distress who may not have been examined at birth, and who was eventually diagnosed at 11 months.

Departments of Paediatrics and Orthopaedics, Newcastle General Hospital, Newcastle upon Tyne NE4 6BE

T C NOBLE, MB, FRCP, paediatrician
C R PULLAN, MB, MRCP, registrar in paediatrics
A W CRAFT, MB, MRCP, paediatrician
M A LEONARD, MB, FRCS, orthopaedic surgeon

Case 2—A full-term baby who was thought to have dislocation on the first day of life. A splint was applied. Dislocation could not be detected the next day so the splint was removed, but one hip was found to be dislocated at the age of 2 months.

Case 3—An obstetrician's daughter who was passed as normal by a consultant paediatrician and eventually found to have a dislocation at 6 months.

Case 4—A full-term baby who was considered to be normal at birth, but presented at the age of 3 years with a slight limp. X-ray pictures showed dislocation of the left hip and avascular necrosis in the right.

FURTHER SURGICAL TREATMENT

The eight children who needed additional surgical treatment included three who had manipulations under anaesthesia with adductor tenotomies, and four who underwent open reduction of their dislocations, including one femoral and one innominate osteotomy. The eighth child had a femoral osteotomy only. Three of these babies were of low birth weight (1530-2000 g) and of the eight, four became clinically normal.

SIMPLE SPLINTAGE

Of the 263 children in whom dislocation was diagnosed at birth and treated by simple splintage, 191 (73%) were brought back for review between two and 10 years after birth. No symptom or abnormal clinical sign was found in any child. X-ray pictures of the hip were taken in 182 of the 191 children who attended. Minor radiological abnormalities, consisting of slight irregularities of the femoral head or acetabulum, were detected in three. More-obvious radiological abnormalities were found in five, including avascular necrosis of one femoral head in two and appearances suggesting persisting subluxation similar to that reported by Barlow⁷ in three. When x-ray examinations were repeated after a further three years the two with avascular necrosis and one of those with subluxation had returned to normal.

In table II the numbers given for those developing persisting subluxation and ischaemic necrosis represent the total incidences of these complications arising after both simple splintage and additional surgical treatment. The numbers in brackets show the proportion

TABLE II—Comparison of results in 271 cases of congenital dislocation of hips treated with von Rosen and Aberdeen splints. Proportion of complications occurring after surgery given in parentheses

	von Rosen splint	Aberdeen splint
No treated	143	128
No needing splintage beyond three months	1	9
No needing additional surgical treatment	3	5
No who developed persisting subluxation	2 (2)	6 (4)
No who developed ischaemic necrosis	1 (1)	5 (3)

occurring after surgical treatment in which the original type of splintage may have been relatively unimportant in producing the complication.

The figure shows von Rosen and Aberdeen splints. von Rosen splints were incorrectly used, since mothers were allowed to remove them daily, and results might have been better if they had been left undisturbed during the first few weeks. Aberdeen splints, which look less like orthopaedic appliances, caused less anxiety in mothers and were easier to manage, but may have resulted in more complications, though the numbers are too small to prove this.

Photograph showing von Rosen splint (left) and Aberdeen Splint (right).

Discussion

In the years before screening was started the incidence of congenital dislocation of the hips in Newcastle upon Tyne was 1.6 per 1000 live births¹⁰; thus 42 infants might have been affected out of 26 000. In our study the incidence of unstable or dislocated hips was 10.6 per 1000, and among these 271 children the outcome was unsatisfactory in 12 (four missed at birth and eight diagnosed but needing surgical treatment), and doubtful in another five in whom radiological abnormalities were found at long-term follow-up examination. Seventeen problems in a population that would be expected to produce at most 42 cases of congenital dislocation of the hips is a high

TABLE III—Comparison of incidence of missed diagnosis and complications of congenital dislocation of hips (CDH) in published series

Author	No of neonates examined	Instability detected		CDH missed		Examiners	Splint used	No requiring prolonged immobilisation or surgery
		No	Rate per 1000	No	Rate per 1000*			
von Rosen, ⁸ Malmö, 1952-60	24 000	40	1.7	1	0.04	Not stated; possibly author	von Rosen	2 prolonged immobilisation
Barlow, ¹³ Salford, 1957-67	23 138	415	17.9	3	0.13	Not stated; possibly author	Barlow	2 prolonged splintage, tenotomy often done
Fredensborg, ¹² Malmö, 1956-72	58 759	548	9.3	4	0.07	Not stated; possibly paediatricians	von Rosen	2 prolonged splintage, ¹⁴ in 111 cases
MacKenzie, ⁹ Aberdeen, 1960-9	76 675	1671	21.8	86	1.12	Paediatric registrars, general practitioners, and midwives	Aberdeen	86 surgery
Williamson, ¹⁴ N Ireland, 1960-70	150 800	707	4.7	86	0.56	Obstetricians and paediatric registrars, and general practitioners	Aberdeen; Barlow	6 prolonged splintage, 8 "routine conservative treatment," 5 surgery
Finlay, ¹¹ Uxbridge, 1962-6	14 594	60	4.1	1	0.07	Paediatric registrars and paediatricians	von Rosen	4 further treatment
Bjerkreim, ¹⁵ Norway, 1960-9	Not stated	Not stated	7.0	Not stated	2.0	Paediatricians of varying experience	Frejka	175 prolonged immobilisation, 12 open reduction, 12 reduction by traction, 94 rotation osteotomy, in 1121 cases
Jones, ¹⁶ Norwich, 1968-72	29 366	76	2.6	17	0.58	Hospital junior staff and general practitioners	von Rosen	5 prolonged immobilisation, 4 surgery
Present series, Newcastle, 1964-72	25 921	271	10.4	4	0.15	Paediatric registrars and senior house officers	von Rosen; Aberdeen	10 prolonged splintage, 8 surgery

*These figures might be compared with a natural incidence of 1.0-1.5 cases of CDH per 1000 live births, except in Norway where the incidence is higher.

complication rate, and we are concerned to improve our diagnostic and therapeutic techniques.

Study of the many publications dealing with diagnosis and management of congenital dislocation of the hips shows surprising differences between the best^{8 11-13} and the worst^{9 14-16} results (table III). In table III the last column, which shows numbers of infants requiring prolonged immobilisation and surgery, includes cases diagnosed at birth and those diagnosed late, because it was impossible in some publications to separate the two groups. It is difficult to identify the factors contributing to a high rate of diagnosis during the neonatal screening examination. Few authors state unequivocally who carried out the examination and detail the experience of the examiner, though Fredensborg¹² states that when the task was deliberately entrusted to inexperienced physicians for several years they tended to overdiagnose but not to miss dislocations. On the other hand, Moore¹⁷ achieved remarkable results with the help of a single consistent and highly experienced examiner. The age of infants at the time of examination varied considerably, but fewest cases were missed when the test was done in the first week of life. The technique of testing is described precisely in some publications and vaguely in others. We concluded that the two most important aspects are adequate education of examiners and enthusiastic personal supervision by permanent members of the medical staff.

We also had difficulty in obtaining comparative figures from the published work for the proportion of cases requiring prolonged splintage, adductor tenotomy, or major surgery, all of which might reflect on the efficiency of early diagnosis and treatment. Some authors concerned themselves purely with diagnosis, but without information on outcome the picture remains incomplete.

THE EXAMINATION

A trainee paediatrician working for three months in a neonatal unit which deals with 2500 deliveries a year might see six babies with unstable hips (or only three if he is one of two junior staff), and becomes confident only when he has to leave. On the other hand, few consultant paediatricians would find it easy to spare the considerable time needed to examine the hips of 14 newborn babies daily (seven initial examinations and seven before discharge) unless they were mainly engaged in neonatology, which few are. The consultant paediatrician who does not share in daily neonatal screening for dislocation of the hips may be no more effective in diagnosis than junior staff who do; and if this is true it diminishes the strength of the argument which suggests that because dislocated hips are sometimes missed by consultants, there must be cases that cannot be diagnosed at birth. Nevertheless, because of the occurrence of ischaemic necrosis shown in our study and in others we require that all suspected dislocations are confirmed by consultants before splints are applied.

For newly appointed junior staff we are designing an illustrated wall chart to emphasise certain aspects of the examination technique, and recommend the following series of manipulations, all of which must be carried out as gently as possible with the baby relaxed.

(1) Immobilise the pelvis with one hand, and with the thumb and middle finger of the other hand grip the head and neck of the femur. Flex the hip to a right angle and abduct it gently as far as it will go. If the hip is dislocated the head of the femur may return to the acetabulum with a jolt.

(2) Return the flexed hip to the position of adduction and this time press the head of the femur gently in a posterior direction. Now abduct the hip again, but as you do so press the posterior aspect of the femoral head forward with the middle finger. A jolt may be felt if the first half of the manoeuvre has dislocated an unstable hip and the second half has caused it to jump back into its socket.

(3) If both of these tests show no abnormality, abduct the flexed hip to 45° and push gently backwards and forwards on the head of

the femur with the thumb and middle finger. The head may be felt to jump out of the back into the acetabulum.

(4) Finally, having tested each hip with these three manipulations, release the pelvis, grip one femoral head in each hand, and gently abduct and adduct the flexed hips. Note if there is any jolt and, more importantly, if there is any limitation of abduction, unilateral or bilateral, short of the 90° expected in normal infants.

(5) Include all preterm and ill neonates in this screening procedure as soon as their condition allows.

(6) Ignore a sensation of clicking or grating unaccompanied by a jolt or feeling of displacement, but if in doubt ask for another opinion.

Similar charts with modifications of technique and signs to emphasise the increasing importance of limitation of abduction in older babies might be valuable in examinations taking place in well-baby clinics.

THE SPLINT

There are two dangers inherent in using any splint which the mother is allowed to remove for napkin changing or bathing. Firstly, she may be tempted to allow her baby long periods of freedom from the restriction of the splint, and, secondly, the hip may redislocate when the splint is removed and not be reduced when it is reapplied. Having used the von Rosen splint (incorrectly), the Aberdeen splint, and more recently the Frejka pillow,¹⁸ we are now starting to use the von Rosen splint again in the manner suggested by its designer, the splint being applied or removed only by experienced medical or nursing staff until stability is ensured. An additional objection to the Aberdeen splint is its tendency to effect insufficient flexion to maintain reduction and excessive abduction that might predispose to avascular necrosis of the femoral heads.

FOLLOW-UP EXAMINATIONS

If splints are to be left undisturbed during the first weeks of life babies must be examined weekly to confirm that reduction is maintained and to ensure that the skin does not become excoriated. X-ray pictures are taken soon after the splints are removed at 3 months, repeated in children who have any sort of abnormality on clinical examination, and in all patients after their routine visit at 12-16 months. After splints are removed, patients are seen at 4 months, 6 months, and when walking, unless abnormal progress dictates the need for more frequent supervision. The opinion of an orthopaedic surgeon is sought for any patients in whom a clinical or radiological abnormality is detected, but as yet orthopaedic surgeons have not participated in routine screening or in following up uncomplicated cases.

It would be valuable if apparently normal babies attending infant welfare clinics could have their hips re-examined at 2, 6, and 12 months so that dislocated hips missed at neonatal examination could be diagnosed as early as possible. Limited abduction is more important in older children, and there is less chance of producing a palpable reduction in the dislocated hip in older babies.

Conclusions

Adopting the technique for screening newborn babies for congenital dislocation of the hip has not always achieved the good results obtained by the pioneers of the method. Analysis of our results, in which 26 000 babies were screened during nine and a half years in Newcastle upon Tyne, and the results of others suggests that failure may be due to inadequate attention to the details of diagnosis and management rather than to any defect in the validity of the concept.

We suggest that more-detailed instruction of junior paediatric

and other staff who carry out the screening, confirmation of the diagnosis of congenital dislocation of the hip by senior staff before splints are applied, using a non-removable splint in the early weeks of treatment, and frequent re-examination by experienced staff after discharge from hospital would all help to reduce the incidence of missed or complicated cases. Medical officers and health visitors working in infant-welfare clinics should be familiar with the signs of dislocation in older babies and should check all hips at least three times in the first year of life. Orthopaedic surgeons should be asked to see all diagnosed cases showing the least divergence from normal progress immediately, or should, if they wish, see all cases on diagnosis at birth. Supervising established cases of congenital dislocation of the hip should not be left to junior medical staff whose stay in the neonatal unit is brief, though consultant paediatricians are not necessarily more expert than junior staff in diagnosing the condition in neonates unless they regularly participate in screening.

It would be a pity if publications drawing attention to the failure of neonatal screening were to result in loss of enthusiasm, when greater attention to detail might produce a higher yield of satisfactory results.

We thank Mrs Maureen Stewart for secretarial help.

References

- ¹ *British Medical Journal*, 1967, **3**, 371.
- ² *British Medical Journal*, 1977, **1**, 1303.
- ³ *Lancet*, 1977, **2**, 909.
- ⁴ Putti, V, *Journal of Bone and Joint Surgery*, 1929, **11**, 798.
- ⁵ Gore, D R, *Journal of Bone and Joint Surgery*, 1974, **56(A)**, 493.
- ⁶ Ortolani, M, *Pediatrics (Napoli)*, 1937, **45**, 129.
- ⁷ Barlow, T G, *Journal of Bone and Joint Surgery*, 1962, **44(B)**, 292.
- ⁸ von Rosen, S, *Journal of Bone and Joint Surgery*, 1962, **44(B)**, 284.
- ⁹ MacKenzie, I G, *Journal of Bone and Joint Surgery*, 1972, **54(B)**, 18.
- ¹⁰ Neligan, G A, personal communication.
- ¹¹ Finlay, H V L, Maudsley, R H, and Busfield, P I, *British Medical Journal*, 1967, **4**, 377.
- ¹² Fredensborg, N, *Acta Paediatrica Scandinavica*, 1976, **65**, 323.
- ¹³ Barlow, T G, *Hospital Medicine*, 1968, **2**, 571.
- ¹⁴ Williamson, J, *Journal of Bone and Joint Surgery*, 1972, **54(B)**, 13.
- ¹⁵ Bjerkreim, I, *Acta Orthopaedica Scandinavica*, 1974, suppl No 157.
- ¹⁶ Jones, D, *Journal of Bone and Joint Surgery*, 1977, **59(B)**, 318.
- ¹⁷ Moore, F H, *Journal of the Irish Medical Association*, 1974, **67**, 104.
- ¹⁸ Frejka, B, *Wiener medizinische Wochenschrift*, 1941, **91**, 523.
- ¹⁹ Fredensborg, N, *Journal of Bone and Joint Surgery*, 1976, **58(B)**, 272.

(Accepted 20 April 1978)

Process and Outcome

Modern trends in management of non-albuminuric hypertension in late pregnancy

D D MATHEWS, T P SHUTTLEWORTH, E F B HAMILTON

British Medical Journal, 1978, **2**, 623-625

For many years the standard treatment of hypertension in the last trimester of pregnancy was admission to hospital for bed rest and sedation. The last decade has seen some important modifications to this and some important developments in other aspects of the management of the common hypertensive disorders of pregnancy.

Rest

Although rest is still generally regarded as of prime importance for the common hypertensive disorders of pregnancy, there is less insistence than formerly that the rest should be taken in bed. Three main factors have been responsible for this change.

Firstly, the necessity for absolute rest in controlling hypertension of pregnancy has been questioned. Of the 42 hypertensive patients admitted by Symonds and Anderson¹ for plasma renin studies, 12 had become normotensive by the next morning. After three days'

complete bed rest, the blood pressure had fallen in 18 of the remaining 28 patients in whom it was recorded, while in six it had risen and in four remained the same. Of the 346 nulliparous patients with pregnancy-induced hypertension retained in hospital by Hauth *et al*² but allowed ambulation as desired, 85% had become normotensive within five days, while only 6% needed to be delivered within seven days. Abandoning bed rest in hypertension of pregnancy was associated with a fall in the incidence of eclampsia.³ In a recent randomised controlled trial⁴ rest in bed was found to be no more effective than ambulatory management in preventing proteinuria, serious hypertension, or eclampsia.

Secondly, there is now reason to doubt both that placental perfusion is diminished by exercise and that it can be increased by bed rest. In 1956 Morris *et al*⁵ claimed to have provided a rational basis for treating pre-eclampsia by bed rest when they showed a reduction in the rate of clearance of ²⁴Na from the anterior uterine wall of hypertensive patients using an "exercycle." Unfortunately, there was no control group of hypertensive patients rested in the "exercycle," and any real reduction in myometrial blood flow might have been due to a diversion of blood from non-placental to placental tissue with an actual increase in placental perfusion. Such a change in blood flow has been shown to occur with exercise in the pregnant ewe.⁶ Furthermore, a large increase in uterine blood flow occurs with exercise in the non-pregnant ewe,⁷ suggesting that the uterine circulation might be spared the vasoconstriction that occurs in most of the viscera with severe exercise. The fetal suboxygenation reported to have occurred with exercise in the ewe,⁸ and the sinister fetal heart-rate changes in the human,^{9,10} may have been due to the direct action of maternal adrenaline on the fetal heart and circulation.

Cases in which the urinary excretion of oestriol has seemed to improve with rest in bed have been reported,¹¹ and this "placental

All Saint's Hospital, Chatham, Kent ME4 5NG

D D MATHEWS, FRCS, MRCOG, consultant obstetrician and gynaecologist
T P SHUTTLEWORTH, MRCOG, consultant obstetrician and gynaecologist
E F B HAMILTON, FRCS, MRCOG, consultant obstetrician and gynaecologist