Original articles

Congenital dislocation of the hip: early and late diagnosis and management compared

P M DUNN, R E EVANS, M J THEARLE, H E D GRIFFITHS, AND P J WITHEROW

University of Bristol Department of Child Health and Departments of Orthopaedic Surgery, Southmead Hospital and the Royal Hospital for Sick Children, Bristol

SUMMARY During the decade 1970–9, 23 002 infants born in the University of Bristol Department of Obstetrics were examined for congenital dislocation of the hip by junior members of the paediatric staff on the first day of life and again on discharge from hospital. Suspected hip abnormality was checked by a senior member of the staff on the same day. A total of 445 (1·9%) infants were found to have a hip abnormality in the neonatal period. Immediate treatment in an abduction splint was undertaken, usually six weeks for dislocatable hips and 12 weeks for dislocated hips. Routine follow up included clinical and radiological examination at six, 12, 24, and 60 months. Altogether 90% completed the 12 month, 85% the 24 month, and 76% the 60 month checks. Five infants (1·1%) required further orthopaedic treatment (adductor tenotomy and abduction splinting) but no major surgery was necessary, nor was avascular necrosis encountered. The radiological results were excellent. Every effort (1970–84) was also made to identify all cases of late congenital dislocation of the hip diagnosed after the neonatal period in infants born to women in Avon during the same decade (n=103 431). Ninety one cases were detected (0·88 per 1000 births), 10 in the university cohort (0·44 per 1000) and 81 in the non-university group (1·00 per 1000) (P<0·01). Seven of 10 in the former group required open surgery and in seven the radiological outcome at follow up was moderate or poor. The early and late diagnosed groups are compared in respect of perinatal factors and management. It is possible to detect most cases of congenital dislocation of the hip at birth and treat them safely and successfully.

In 1948 Ortolani[1] re-introduced the concept of screening the hips of the newborn infant for congenital dislocation of the hip. After his publications and the work of Palmén,[2] von Rosen,[3] and Barlow,[4] neonatal screening became widespread in the United Kingdom (including Bristol) in the early 1960s. In many instances, however, organisation and training was inadequate and early optimism became muted by reports of failure to reduce the incidence of late established congenital dislocation of the hips.[5–8] It has further been suggested that diagnostic manipulation of the hips may actually cause the condition it was designed to prevent and that early abduction splinting may lead to avascular necrosis of the head of the femur.[9–11] The following studies were undertaken in the University of Bristol Department of Child Health as part of the normal clinical service, primarily to determine the effectiveness and safety of neonatal screening and early treatment.

Method

Bristol, created a Royal Borough in 1373, lies on the southern shore of the Bristol Channel, has a population of nearly 600 000, and is the main city in the south west of England. The nearest major urban areas are Cardiff (43 miles), Oxford (69 miles), Southampton (75 miles), and Birmingham (87 miles). In 1974 the city was incorporated with parts of Gloucestershire and Somerset to form the new County of Avon, an area of 440 square miles with a

population of approximately 820 000. The catchment area of the hospitals in Bristol was unaltered by these boundary changes. The social class distribution was not significantly different from the rest of England and Wales. Approximately 5% of births were to mothers born outside Britain.[12]

During the decade 1970–9, 103 431 infants were born in the area that was designated Avon County in 1974. Ninety six per cent were born to Avon area residents, while the great majority of the remaining 4% lived within the Bristol hospital catchment area. Twenty per cent of births took place either in general practitioner units (19%) or in the home (1%). The remaining 80% of births took place in consultant maternity units, all but 3% being at Southmead Hospital and the Bristol Maternity Hospital (Fig. 1).

In ascertaining the incidence of various perinatal factors for the whole Avon population in 1970–9, several techniques were employed. Data on birth order, gestational age, and birthweight were based on an analysis of all births in Avon during 1976 (n=9127), while data on season at birth, sex of infant, and litter size was based on a similar analysis of births for 1979 (n=10 299). The incidence of breech presentation at birth (singleton pregnancies) was based on extensive hospital studies made in Bristol throughout the decade, as was the data on method of delivery and admission to the special care baby unit. The incidences for 'family history of congenital dislocation of the hip', and 'associated talipes' have been estimated from personal records.

Statistical analyses have been based on the χ^2 test (using Fisher's exact probability where necessary) or on Poisson exact probability when comparing incidences in populations of more than 20 000.

Neonatal diagnosis. Screening all hips at birth for congenital dislocation of the hip using the Ortolani/Barlow manoeuvre has been routine practice in Bristol since the 1960s. While this was the policy in consultant units, however, it may not always have been applied to the 20% of infants born in general practitioner care. These babies may have been examined by either the general practitioner or the midwife and sometimes the records were incomplete. In consultant units the results of hip examinations were noted in the infant's record. In units without resident paediatric staff, babies were examined by obstetric residents. This applied to 28% of consultant unit deliveries. The remaining 72% (59 264 infants) were examined by paediatric residents on the first day of life and again before discharge from hospital, usually between the second and 10th days.

The 23 002 infants delivered in the university department form the cohort (early congenital dislocation of the hip) on which the data on neonatal screening and follow up is based. They were all born either at Southmead Hospital (1970–9) or at the new Bristol Maternity Hospital (1975–9) where they represented 37% of all deliveries in these two units during that time. Both hospitals had paediatric resident staffing. In broad terms, each unit had three paediatric senior house officers (SHO) supported by a resident paediatric registrar. These residents shared the care of both the university and NHS (non-university) babies. Usually the paediatric SHOs were in post for six months and the registrars for a year. It is estimated that 124 residents were involved in neonatal care during the decade; an additional and similar number of locum doctors helped with the screening.

Congenital dislocation of the hip was defined as an anomaly of the hip joint, present at birth, in which the head of the femur was or might be partly or completely displaced from the acetabulum. The paediatric residents were instructed to look first for signs of established dislocation (unequal leg length, asymmetry of the thighs, limited abduction etc) and then to manipulate the hips using the Ortolani/Barlow manoeuvre to detect dislocation or dislocatability. All cases of suspected dislocation were checked at once by the paediatric registrar and, if suspicion persisted, rechecked by one of us (PMD or his deputy) whenever possible on the same day and preferably with the resident in attendance. This full procedure was not always possible when the diagnosis was made at discharge examination. Infants with hip dislocation associated with severe malformation were not included in the study cohort.

After examination, hips were classified as dislocatable, dislocated, or normal. Ligamentous 'clicks' without evidence of abnormal movement between the femoral head and the acetabulum were regarded as normal.[13-15] Whatever the conclusion, every effort was made to inform and reassure the

All Avon births
(n= 103 431)

Consultant units
(n= 82 312 (80%))

General practice units
(n= 21 119 (20%))

NHS
(n= 59 310 (57%))

General practice units
(n= 19 619 (19%))
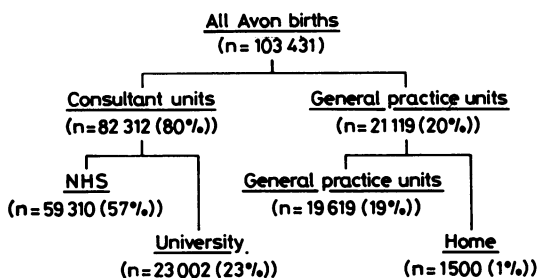
University
(n= 23 002 (23%))

Home
(n= 1500 (1%))

Fig. 1   *Place of birth in Avon, 1970–9.*

parents, and when necessary to instruct them in management.

Radiological examination was not used for neonatal screening or for confirmation of the diagnosis in the neonatal period, though it was sometimes undertaken when the hip was fully dislocated.

Neonatal management and follow up. Abnormal hips were treated at once by the paediatric staff. *Dislocatable* hips were managed in a plastic, over-nappy Aberdeen abduction splint[16] (Fig. 2). Care was taken never to use force to achieve abduction. Splinting was maintained for six weeks. On the rare occasions when instability persisted, splinting was continued for a further four to six weeks. Hips that were *dislocated* at birth were treated for 12 weeks— the first six weeks in a von Rosen splint[3] (Fig. 2) and then, unless still unstable, for six weeks in an Aberdeen splint. If at the age of 3 months there remained any concern, a radiograph was taken and an orthopaedic opinion obtained.

Routine clinical examination was undertaken in the paediatric follow up clinic at 6, 12, 24, and 60 months of age. On each occasion a single A–P radiograph was taken of the hips with the legs adducted and parallel. When abnormality was suspected, orthopaedic advice was sought and collaborative follow up instituted. A research file, including copies of all radiographs, was kept for each infant. An effort was made to trace children who failed to attend for follow up. When they had moved away from Avon, information on their progress was sought from their new medical advisors. Selected data on all cases was entered into a computer file for subsequent analysis.

The screening programme and follow up was carried out by the routine clinical staff. From 1975 onwards funding became available for a part time research assistant (RE) to help collate and analyse the data, to assist in the follow up, and to ascertain all late cases of congenital dislocation of the hip among infants born in Avon during the study period and diagnosed after the neonatal period. These studies were continued until the end of 1984.

Late diagnosis. Several strategies were adopted to identify late cases of congenital dislocation of the hip. All orthopaedic surgeons in Avon agreed to inform us of new cases. The three surgeons who undertook the care of most of these children kept personal files which they made available. Regular visits were made to the four hospitals in the area to which children with this disorder might be admitted, and a thorough search carried out of the relevant hospital admission and operating records. From 1978–84 the South Western Regional Health Authority provided us with a list of all Avon hospital admissions with this diagnosis. Once a new case was identified, all relevant maternal, neonatal, orthopaedic, and radiological information was extracted and selected data then entered into a computer file for similar analysis to that undertaken for the university cases diagnosed in the neonatal period.

Results

(1) Early congenital dislocation of the hip (university cohort, n=445).

Neonatal diagnosis
Among the 23 002 infants in this cohort that were screened in the neonatal period, 445 were diagnosed as having dislocated hips, an incidence of 19 per 1000 births. Altogether 370 (83%) were detected at initial examination on the first day of life and the remaining 75 (17%) later in the neonatal period, usually on discharge examination (mean five days); only three cases (less than 1%) were diagnosed between the 10th and 28th days of life. Hip dislocation was bilateral in 126 (28%) cases, affected the left side alone in 273 (61%), and the right side alone in 46 (11%).

Perinatal factors
The incidences of various perinatal factors are shown in Table 1, where they are compared with similar incidences for the infants with 'late congenital dislocation of the hip' and 'all Avon births'.

Management
Neonatal abduction splinting was begun within 48 hours of birth in 78% of cases, between 3 and 10 days in 20%, and later in the neonatal period in 2%. In 11% of cases treatment was commenced using a
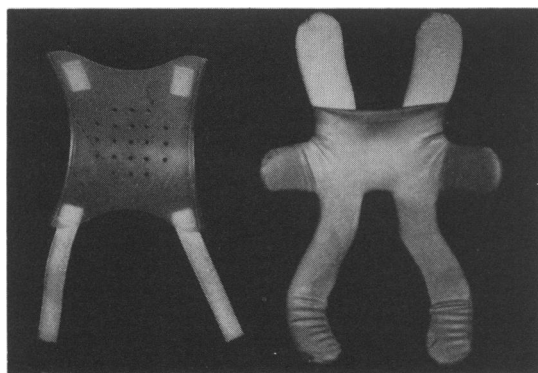

Fig. 2   *The Aberdeen[16] and von Rosen[3] splints.*

Table 1   *Perinatal factors associated with early and late diagnosed congenital dislocation of the hip (CDH) in Avon, 1970–9, and in the whole Avon population*

Factor		CDH		Whole population (n=103 431) (%)
		Early (n=445) (%)	Late (n=91) (%)	
Family history	Parents/sibling	4·0	13·8	1·0§
	All relations	8·8	15·4	—
Season at birth	Summer	50	42	52†
	Winter	50	58	48†
Sex	Female	70·3	90·1	48·6†
Birth order	Firstborn	53·2	47·0	40·1*
Presentation at delivery	Breech	27·8	11·5	3·8‡**
Method of delivery	Breech	18·2	5·7	3·0‡
	Caesarean	13·6	6·8	7·0‡
Gestational age	Preterm	2·7	3·3	6·6*
Birthweight	<2·5 kg	6·1	4·2	6·1*
	>4·0 kg	8·8	8·3	8·4*
Litter size	Twins	0·7	1·1	1·8†
Admission to special care baby units		9·9	7·7	12·0‡
Associated talipes		5·6	8·8	<0·5§

Source of Avon population data:
*Based on all Avon births, 1976 (n=9 127); †Based on all Avon births, 1979 (n=10 299); ‡Based on hospital data, 1970–9; §Estimate; **Singletons only.

von Rosen splint, while in the remaining 89% the Aberdeen splint alone was used. The duration of splinting was less than eight weeks in 81% of cases, 8 to 15 weeks in 18%, and 16 weeks or more in 1%. This last group consisted of five infants, all of whom were referred to an orthopaedic clinic. Three of the cases, without clinical evidence of dislocation, were treated in hip spicas (adductor tenotomy in two) because of radiological concern at poor acetabular cover. The remaining two cases were infants with *dislocated* hips that had been incorrectly treated at birth in Aberdeen rather than von Rosen splints. In one the splint had not been maintained by the mother and the presence of limited abduction of the hip at 4 weeks of age led to adductor tenotomy and five months of splinting (von Rosen). The second child, who received only six weeks' treatment in an Aberdeen splint in spite of bilateral dislocation, exhibited evidence of hip instability at 6 months and received an adductor tenotomy and treatment in a hip spica until 14 months of age. All five children had excellent outcomes.

Follow up examination was carried out at 6 months in 95% of cases, at 12 months in 90%, at 24 months in 85%, and at 60 months in 76%. Study showed that approximately 2·5% of cases were lost to follow up per year due to migration from the hospital catchment area. This factor probably accounted for at least half the children lost to follow up at 5 years.

Once treatment had been completed only two children subsequently complained of symptoms or exhibited signs referrable to their hips. With these two exceptions (see below) no hip that was radiologically normal at one year later deteriorated. There were no cases of avascular necrosis of the head of the femur in this series (one such case has been encountered among university infants 1980–4) and radiological outcome at 5 years was most satisfactory in all cases reviewed.

The two exceptions referred to above were cases of Perthes' disease. The first affected the left hip of a boy aged 4½ years who had previously been treated from birth for six weeks in an Aberdeen splint for a dislocatable left hip and whose subsequent radiograph at 3 years had been entirely normal. The second child, a girl, had also been treated at birth in an Aberdeen splint (8 weeks) for mild dislocatability of the left hip. At 5 years her hips were regarded as clinically and radiologically normal. Six months later she developed bilateral Perthes' disease which was worse on the left side.

(2) Late congenital dislocation of the hip (Avon cohort, n=91).

Late diagnosis
During the 15 years 1970–84, 101 infants born during the period 1970–9 were treated in Avon for congenital dislocation of the hip that had been diagnosed after the first month of life. Ten of these infants had been born outside Avon, the diagnosis in six of the 10 being made after the family had moved into the county. Thus there were 91 cases of late

dislocation identified among the 103 431 infants born in Avon during the decade. A total of 49 cases (53%) were diagnosed during the remainder of their first year (28 cases before the age of 6 months), 30 cases (33%) were detected in the second year, seven (8%) in the third, three (3%) in the fourth, one (1%) in the fifth, and one (1%) in the sixth. Hip dislocation was bilateral in 12 (13%) of cases, affected the left side alone in 47 (52%), and the right side alone in 32 (35%).

Ten of the 91 late cases were infants born in the university department. All had presented by the vertex at birth. The mean age for late diagnosis among the university cases was 12 months (range 2 to 30 months). Four cases were diagnosed before the age of 1 year, four in the second year and two in the third. One case was bilateral; four affected the left hip and five the right.

The incidence of late dislocation among all Avon infants and those for various subgroups is shown in Table 2.

Perinatal factors

The incidences of these factors are shown in Table 1 in comparison with those for the early group and all Avon infants.

Management

The treatment received by the 91 late cases is summarised in Table 3. Although five children moved away from the area before the age of 5 years, they had completed the treatment necessary to correct dislocation. Sixty per cent of all cases required open surgery; this included open reduction in 53%, acetabuloplasty in 33%, rotation osteotomy in 42% and other operations in a further 7%.

Table 2 *Incidence of late congenital dislocation of the hip (n=91) among Avon infants 1970–9 (n=103 431) in relation to the clinical situation at birth*

Group	Per 1000 births	
All infants	0·88	
In consultant care	0·78	} P<0·01*
In GP care	1·41	
Consultant care University	0·44	} P<0·01*
Consultant care NHS	0·90	
Consultant care Obstetric SHO	0·85	} P=NS*
Consultant care Paediatric SHO	0·75	
University department care	0·44	} P<0·01*
All other care	1·00	
University department care	0·44	} P<0·001*
GP care	1·41	

*Using Poisson exact probability test.
SHO=senior house officer.

Table 3 *Influence of age at diagnosis on treatment received for congenital dislocation of the hip (CDH) in Avon, 1970–9*

Treatment	University Early CDH (n=445) (%)	Avon Late CDH (n=91) (%)
Light abduction splinting	99	8
Plaster of paris hip spica	1	92
Tenotomy	1	44
Arthrogram	1	62
Open operation	0	60

Table 4 *Congenital dislocation of the hip: outcome in relation to age at diagnosis among university births, 1970–9 (n=412/445)*

	Outcome			Total
	Good	Moderate	Poor	
Early diagnosis†	402*	0	0	402
Late diagnosis	3	4	3	10
Total	405	4	3	412

P<0·001.
†Excludes 43 infants not followed up for at least 12 months.
*Includes the two infants who subsequently developed Perthes' disease.

If the 10 late cases from the university cohort are considered, seven needed open surgery while the remaining three (all diagnosed at 2 to 3 months) just required adductor tenotomy and splinting. Outcome as assessed radiologically was much less favourable (P<0·001) than that for the cases diagnosed in the neonatal period, three being classified as good, four as moderate, and three as poor (Table 4).

Discussion

During the period 1959–69 one of us undertook extensive studies of congenital dislocation of the hip.[17] As a result of this experience, an approach to the neonatal screening and management was evolved which was introduced in the university department in 1969. The clinical studies reported here were undertaken to evaluate the effectiveness and safety of this approach. This was an audit rather than a scientific study to determine the advantages and disadvantages of alternative approaches. It should also be emphasised that the whole project was carried out by the usual clinical team as part of their routine workload. For obvious reasons it is not possible to discuss every aspect of this complex study. Future publications will explore in greater detail the associated perinatal factors, the laterality

of congenital dislocation of the hip, its incidence, pitfalls in screening and early management, and various aspects of late diagnosis.

The incidence of neonatally diagnosed dislocation in the published reports varies from two to 50 or more per 1000 births.[18 19] This great variation is likely to be due to several factors including the size of the population studied, the ethnic origin of the population, the age of the infant when examined, the thoroughness and skill of the examination, and to local interpretation of the physical signs, which may vary from mild instability to full dislocation. The incidence of 19 per 1000 in the present study matches closely the findings of Barlow,[20] MacKenzie,[21] and others[14 22 23] studying Caucasian populations.

The incidence of late diagnosis in populations screened at birth also varies greatly, the figure in reported studies ranging from 0·07 to 2·2 per 1000.[8 19 24] Clearly, the incidence will again be influenced by the size of the population studied and its ethnic origin. The thoroughness with which late cases are ascertained (including length of follow up), especially when population mobility is high, will have an even greater influence, as will the age at which the late diagnosis is made. There are grounds for believing that a proportion of unstable hips become spontaneously stable (though not necessarily normal) throughout infancy and even as late as the second year of life.[17] Thus, the later the mean age at diagnosis the lower the incidence might be expected to be. In addition, while many authors regard 'late' as postneonatal, others use the term to indicate beyond the second, third, or even sixth month of life. Hopefully though, the most important arbiter of late incidence should be the effectiveness of early screening and treatment. This is not easy to assess, however, from the reports since these do not include any controlled studies. Perhaps the best evidence in support of the effectiveness of neonatal screening comes from the Swedish national study[25 26] which showed a profound fall in late diagnosis (60 to 70%) with the introduction of routine hip examination at birth in the 1950s. Palmén[26] also made a most interesting observation. He noted that the five units in Sweden with the lowest incidence of neonatal instability (mean 2·6 per 1000) had a late diagnosis rate of 1·6 per 1000. In contrast, the five units with the highest incidence of neonatal instability (mean 31 per 1000) had a late diagnosis rate of 0·1 per 1000. He commented that even if there had been some over diagnosis in the latter group, virtually all abnormal hips seemed to have been detected and treated.

The findings in the present study (Table 2) also strongly suggest that the more carefully infants are screened in the neonatal period, the lower the incidence of late diagnosis is likely to be. Thus, the incidence among infants in general practitioner care was 3·2 times higher than among infants in the university cohort (P<0·001). This difference occurred in spite of the fact that the natural incidence of the disorder at birth was almost certainly considerably lower (probably not more than half) among infants born in general practitioner rather than consultant care. Part of the explanation for this belief may be found in Table 1. First born infants and infants presenting by the breech have a high aetiological association with congenital dislocation of the hip[27–29] and are at the same time normally delivered in consultant units. The same observation may be applied to other pregnancy risk factors known to be associated with dislocation such as maternal hypertension, oligohydramnios, and fetal growth retardation.[28 29] Others have also reported a higher incidence of late diagnosis among infants born in general practitioner as opposed to consultant care.[30 31] Lehmann[19] also reported late incidences of 0·3 and 0·8 per 1000 in relation to whether the neonatal examinations had been undertaken by one orthopaedic surgeon or by the hospital residents; the incidence among the infants not screened at birth in his study was 1·4 per 1000.

Perhaps the most compelling evidence in the present study in support of the effectiveness of neonatal examination may be found in relation to infants presenting by the breech. These infants are known to be at very high risk of congenital dislocation of the hip and were therefore checked most carefully. Among the 874 singleton infants in the university cohort presenting by the breech 124 (14%) were found to have dislocation at birth. There were no late cases among the 750 infants passed as normal at birth (P<0·001). It is also of interest to note that over 90% of the paediatric residents never missed a case of hip dislocation during their six month neonatal duties and that in four complete years in the decade there were no late cases among the 9200 infants delivered.

While many reports claim success for neonatal examination,[3 4 24 32] others have reported failure and have even suggested that screening efforts should be stopped.[5–10 33] Such an attitude is hard to justify. The positive and surely correct alternative should be to compare the methodology of successful and unsuccessful programmes and make appropriate modifications to the latter.

It has been suggested that examination of the hips at birth may actually cause the condition it is designed to detect.[11] This charge is difficult to dismiss as it is likely that on the borderline between normality and pathology a small proportion of

hips may indeed be provoked into instability by gentle manipulation.[8] [34] But it could be argued that this is actually an advantage since, without treatment, some of these hips might spontaneously become unstable and progress to full dislocation. Certainly the natural strength of the normal hip joint at birth is beyond dispute. Powerful manipulative efforts at necropsy show that it is easier to fracture the femur than dislocate the hip joint.[17] [35]

Much controversy also exists over the advisability of treating cases of congenital dislocation of the hip diagnosed at birth. Among the viewpoints that have been expressed and with which, on the basis of our experience, we strongly disagree are: 'unstable hips do not require treatment as they always recover spontaneously'; 'treatment of unstable hips should be deferred for a few weeks as they may become stable without treatment'; and 'early treatment is often unsuccessful and is unacceptably hazardous because of the risk of avascular necrosis of the head of the femur; treatment should therefore be delayed until the end of the first year'. A more complete explanation for our disagreement with these observations will be published elsewhere. For the present we would point out that up to 20% of untreated unstable hips subsequently develop hip dysplasia or progress to full dislocation;[17] that the untreated unstable hip may develop serious structural pathology within a few weeks of birth; that in the present study 99% of the cases were treated successfully with simple splinting within six to 15 weeks of birth with no case requiring open surgery; that there were no cases of avascular necrosis among the infants treated in the neonatal period; and that the outcome at follow up of those treated at birth was indisputably better than that for those treated after the neonatal period, most of whom required open surgery.

Many factors are likely to contribute to the experience on which the diversity of views regarding appropriate early management is based. The variables include the method of abduction splinting, the degree of pressure used to achieve abduction, the degree of abduction sought, the mobility of the hip within the splint, and the length of time during which splinting is maintained.[36] The most important consideration, though, is likely to be the different interpretations put on 'early', some using it to indicate the neonatal period and others the first year of life. At birth, most hip joints are very lax and full abduction may be obtained using gentle pressure in almost all cases. By the age of 6 to 12 weeks limitation of abduction is commonplace. The use of pressure thereafter to achieve abduction is fraught with the danger of avascular necrosis. Our study makes no attempt to compare different management

policies. We merely report our results. Such success as we have had we attribute to early treatment (usually within two days of birth), the avoidance of all force in achieving abduction, the use of the Aberdeen splint in most cases, and the limitation of splinting to six to 12 weeks in most cases.

It may be worth commenting on the lessons learned during the five year follow up of the university cohort. In a research sense five years is inadequate, and indeed we are already contemplating a 10 to 15 year review. From the clinical standpoint, however, a much shorter period of surveillance may be sufficient. In the case of the dislocatable hip treated from birth, it may be possible to discharge the infant from follow up as early as six months of age, provided that the hips are clinically and radiologically normal. This should include the presence of well placed, normal, capital epiphyses on radiography. Usually though, and particularly when the hips were dislocated at birth, follow up needs to be maintained for a year or even longer. Once more, discharge should not be contemplated without ensuring radiological normality.

In conclusion, we believe our findings indicate that the great majority of infants with congenital dislocation of the hip may be identified and treated safely and successfully in the neonatal period; and that the greater the effort and care taken, the better the outcome. It is comforting to find how similar our results and conclusions are to those reported from Sweden.[24-26]

References

1 Ortolani M. *La lussazione congenita dell'anca. Nuovi criteri diagnostici e profilatico.* correttivi. Bologna: Editore Capelli, 1948.
2 Palmén K. Preluxation of the hip joint. *Acta Paediatr Scand* 1961; **129**:(Suppl).
3 Von Rosen. Diagnosis and treatment of congenital dislocation of the hip in the newborn. *J Bone Joint Surg* 1962;**44B**:248–91.
4 Barlow TG. Early diagnosis and treatment of congenital dislocation of the hip. *J Bone Joint Surg* 1962;**44B**:292–301.
5 Walker G. Problems in the early recognition of congenital dislocation of the hip. *Br Med J* 1971;**iii**:147–8.
6 Wilkinson JA. A post natal survey for congenital displacement of the hip. *J Bone Joint Surg* 1972;**54B**:40–9.
7 Williamson J. Difficulties of early diagnosis and treatment of congenital dislocation of the hip in Northern Ireland. *J Bone Joint Surg* 1972;**54B**:13–7.
8 Bjerkreim I. Congenital dislocation of the hip in Norway. *Acta Orthop Scand* 1974; **157**:(Suppl).

9 Anonymous, Iatrogenic hip disease. [Editorial]. *Lancet* 1974;ii:266–7.
10 Catford JC, Bennet GC, Wilkinson JA. Congenital hip dislocation: an increasing and still uncontrolled disability? *Br Med J* 1982;**285**:1527–30.
11 Cheetham CH, Garrow DH, Tarin P, Medhurst AWJ. Congenital dislocation of the hip. *Br Med J* 1983;**286**:227.
12 Mutch LMM, Brown NJ, Spiedel BD, Dunn PM. Perinatal mortality and neonatal survival in Avon: 1976–1979. *Br Med J* 1981;**282**:119–22.
13 Sommer J. Atypical click in the newborn. *Acta Orthop Scand* 1971;**42**:353.
14 Cyvin KC. Congenital dislocation of the hip. *Acta Paediatr Scand* 1977;**263**:(Suppl).
15 Dunn PM. Clicking hips should be ignored. *Lancet* 1984;i:846.
16 MacKenzie IG. Congenital dislocation of the hip. The development of a regional service. *J Bone Joint Surg* 1972;**54B**:18–39.
17 Dunn PM. The influence of the intrauterine environment in the causation of congenital postural deformities, with special reference to congenital dislocation of the hip. (Thesis). Cambridge: Cambridge University, 1969.
18 Hansson G. Neonatal hip stability in Goteborg, Sweden, between 1961 and 1970 (Thesis). Goteborg, Sweden: University of Goteborg, 1980.
19 Lehmann ECH. Neonatal screening in Vancouver for congenital dislocation of the hip. *Can Med Assoc J* 1981;**124**:1003–8.
20 Barlow TG. Congenital dislocation of the hip. *Hospital Medicine* 1968;**2**:571–7.
21 MacKenzie IG. Problems encountered in the early diagnosis and management of congenital dislocation of the hip. *J Bone Joint Surg* 1981;**63B**:38–42.
22 Hiertonn T, James U. Congenital dislocation of the hip. Experience of early diagnosis and treatment. *J Bone Joint Surg* 1968;**50B**:542–5.
23 Paterson D. The early diagnosis and screening of congenital dislocation of the hip. In: Tachdjian MO, ed. *Congenital dislocation of the hip*. New York: Churchill Livingstone, 1982.
24 Fredensborg N. The results of early treatment of typical congenital dislocation of the hip in Malmö. *J Bone Joint Surg* 1976;**58B**:272–8.
25 Hansson G, Nachemson A, Palmén K. Screening of children with congenital dislocation of the hip joint on the maternity wards in Sweden. *J Pediatr Orthop* 1983;**3**:271–9.
26 Palmén K. Prevention of congenital dislocation of the hip. *Acta Orthop Scand* 1984;**55**:208(Suppl).
27 Salter RB. Etiology, pathogenesis and possible prevention of congenital dislocation of the hip. *Can Med Assoc J* 1968;**98**: 933–45.
28 Dunn PM. Perinatal observations on the aetiology of congenital dislocation of the hip. *Clin Orthop* 1976;**119**:11–22.
29 Dunn PM. Congenital postural deformities. *Br Med Bull* 1976;**32**:71–6.
30 Jones D. Assessment of the value of the examination of the hip in the newborn. *J Bone Joint Surg* 1977;**59B**:318–22.
31 Place MJ, Parkin DM, Fitton JM. Effectiveness of neonatal screening for congenital dislocation of the hip. *Lancet* 1978;ii:249.
32 Mitchell GP. Problems in the early diagnosis and management of congenital dislocation of the hip. *J Bone Joint Surg* 1972;**54B**:4–12.
33 Parkin DM. How successful is screening for congenital disease of the hip? *Am J Public Health* 1981;**71**:1378–83.
34 Findlay HVL, Maudsley RH, Busfield PI. Dislocatable hip and dislocated hip in the newborn infant. *Br Med J* 1967;iv:377–81.
35 Somerville EW. Development of congenital dislocation of the hip. *J Bone Joint Surg* 1953;**35B**:568–77.
36 Ogden JA. Dynamic pathobiology of congenital hip dysplasia. In: Tachdjian MO, ed. *Congenital dislocation of the hip*. New York: Churchill Livingstone, 1982.

Correspondence to Dr P M Dunn, Department of Child Health, Southmead Hospital, Bristol BS10 5NB.