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Who performs neonatal hip assessment: is there a cause for concern?

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ABSTRACT

Objective The UK falls behind other European countries in the early detection of developmental dysplasia of the hip (DDH) and screening strategies differ for early detection. Clinical detection of DDH is challenging and recognised to be dependent on examiner experience. No studies exist assessing the number of personnel currently involved in such assessments.

Our objective was to review the current screening procedure by studying a cohort of newborn babies in one teaching hospital and assess the number of health professionals involved in neonatal hip assessment and the number of examinations undertaken during one period by each individual.

Methods This was a retrospective observational study assessing all babies born consecutively over a 14-week period in 2020. Record of each initial baby check was obtained from BadgerNet. Follow-up data on ultrasound or orthopaedic outpatient referrals were obtained from clinical records.

Results 1037 babies were examined by 65 individual examiners representing 9 different healthcare professional groups. The range of examinations conducted per examiner was 1–97 with a median of 5.5 examinations per person. 49% of individuals examined 5 or less babies across the 14 weeks, with 18% only performing 1 examination. Of the six babies (0.48%) treated for DDH, one was picked up on neonatal assessment.

Conclusion In a system where so many examiners are involved in neonatal hip assessment, the experience is limited for most examiners. Currently high rates of late presentation of DDH are observed locally, which are in accordance with published national experience. The potential association merits further investigation.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Late detection of developmental dysplasia of the hip (DDH) is not prevented by the current screening programme in the UK. Neonatal hip examination should identify the majority of cases but, as a subtle skill, it is dependent on the experience of the examiner.

WHAT THIS STUDY ADDS

⇒ This study demonstrates the large number of healthcare professionals involved in neonatal hip assessment in a single unit and the subsequent dilution of experience/expertise. It, therefore, demonstrates the inconsistent, and invariably inadequate, opportunities to acquire the necessary expertise required to reliably examine an infant's hips.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ When faced with an unacceptable number of late presenting cases of DDH, all avenues should be explored and inconsistent examiner experience merits further investigation. This study is further evidence of the change required in the current UK screening programme.

INTRODUCTION

Developmental dysplasia of the hip (DDH) has a prevalence of 1%–3% of all newborns[1 2] and is a common but treatable cause of childhood disability.[3 4] Treatment is dependent on the age at diagnosis. Early detection enables non-operative management in the form of an abduction brace or harness in the majority of cases,[2 3 5–7] resulting in a normal hip in over 90% of cases.[8] However, abduction splinting is not benign and can cause avascular necrosis in up to 3%.[9] Operative management becomes increasingly complex with age. Surgery can range from simple adductor tenotomy and closed reduction to open hip joint reduction with or without femoral and pelvic osteotomies. An increased risk of osteoarthritis may be the result in some cases.[2 7]

It is clear that early detection improves outcomes by avoiding surgery and its long-term sequelae.[2 5 8] However, currently, there is no international consensus on the most effective method of hip screening.

In the UK, most centres use a combination of clinical examination and selective ultrasound scan (USS) to screen for DDH in accordance with the NIPE (Newborn and Infant Physical Examination) guidelines.[10] All babies are examined using the Ortolani and Barlow manoeuvres within 72 hours of birth (baby check) and again at 6–8 weeks (general practitioner, GP check). US imaging is performed on abnormal clinical examination or if they have a positive risk factor, including a history of breech presentation and a family history of an early hip problem requiring treatment.

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Additional risk factors are not included in the national screening policy. In our unit, these risk factors included firstborn females weighing more than 4 kg and those with packaging disorders,[10–12] that is deformity resulting from intrauterine crowding such as torticollis and calcaneovalgus foot deformity.

Only 40% of babies with DDH have one of the above risk factors[13] so identification of DDH in the majority of cases is dependent on clinical examination. Barlow and Ortolani tests are the accepted means of assessing for hip instability. In Barlow's test, the examiner tests whether through manipulation they can sublux or dislocate a hip from its position sitting in the acetabulum. In Ortolani's test, the examiner attempts to relocate a hip that is sitting dislocated from the acetabulum. The tests are reported to have high specificity of 98%, but low sensitivity of 66%[14] and are dependent on examiner experience,[7 15] although even experts can misdiagnose dislocation.[16]

Any delay in application of a harness in a dislocated or dislocatable hip may result in failure of conservative management with the subsequent need for operative intervention. This accounts for the recent recommendation by the British Society of Children's Orthopaedic surgeons consensus statement[17] in which it states that US examination for at-risk children with abnormal examination or positive risk factors, should be performed within 2 weeks of birth. This contrasts with the most recent NIPE handbook[10] in which trusts are still advised to meet a recommendation that US should be performed in 4–6 weeks so that 'babies who require treatment enter the treatment pathway within 6 weeks'.

The standard for those patients detected at the NIPE 6–8 weeks infant screening examination is that they should be referred directly to a paediatric orthopaedic surgeon by 10 weeks of age. However, the 6–8 weeks hip check has been observed to have similar specificity (98%) to the neonatal check but an even lower sensitivity at 19.4%.[7]

The literature reports improved effectiveness of clinical examination when carried out by a small number of experienced staff.[17–20] This model is not the case currently in most UK hospitals. This may account for the ongoing high rates of 'late' DDH despite screening efforts.[2 3 7]

No studies exist which assess the number of personnel currently involved in the first baby check. Our objective was to record the number of healthcare professionals (HCPs) performing neonatal hip examination in one unit during a 14-week period and the number of examinations performed per individual.

METHODS

This was a retrospective observational study assessing all babies born consecutively over a 14-week period, 4 August 2020 to 11 November 2020 in a single teaching hospital. This period represented normal staffing levels within the department and was representative of one rotation of junior doctors. Exclusion criteria were as follows: (1) babies immediately transferred to other health boards at birth; (2) babies who did not have documentation of examiner and (3) death.

All clinical documentation was on an online computerised programme (BadgerNet),[21] an electronic maternity healthcare record system which allows for real-time recording of all events in the hospital, community or at the patient's home. Records of each initial baby check are entered into BadgerNet wherever the assessment is performed, that is, in the neonatal unit or maternity wards.

The following information was recorded: (1) type and grade of HCP involved (anonymised); (2) hip examination finding; (3) US referral reason and results and (4) number of examinations each anonymised individual performed within the study period. A $\chi 2$ test was used to compare the relative number of examinations performed by each HCP group.

Clinical portal (an online application providing one unified gateway to longitudinal health records and data from integrated source systems) was reviewed for all babies during this period to identify any subsequent referrals from the community to the paediatric or orthopaedic departments and to review outpatient clinic letters providing information on treatment and progress. Referrals for US imaging before or after discharge from the maternity unit were identified from Integrated Clinical Environment records (ICE—Clinisys) and PACS (picture archive and communication system). ICE provided information on when, where, who and why referrals were made as well as access to the sonographic report. PACS was used to review the hip images, both US and X-ray.

The initial data retrieval from BadgerNet was when the babies were 3–7 months old and subsequent scrutiny of Clinical Portal, ICE and PACS was performed at between 36 and 39 months old, to identify late presentations not picked up during initial data collection.

What constitutes a pathological DDH case requiring treatment is controversial with widely differing thresholds on the age and type of treatment that may be necessary for certain sonographic dysplasia and or clinical hip instability. In this study, infants treated with a harness or with surgery were used to denote a pathological DDH and the indications for treatment were recorded.

Neither patients nor the public were involved in the design, conduct, reporting or dissemination plans of our research.

RESULTS

1051 babies were born in Tayside during the 14-week study period, the overall birth rate for this calendar year was 3567. 10 babies were excluded due to not having their examiner identified. Two cases were excluded due to their transfer to another health board at birth. Two cases were excluded due to death. After exclusions were removed, this resulted in a total 1037 babies assessed for this study.

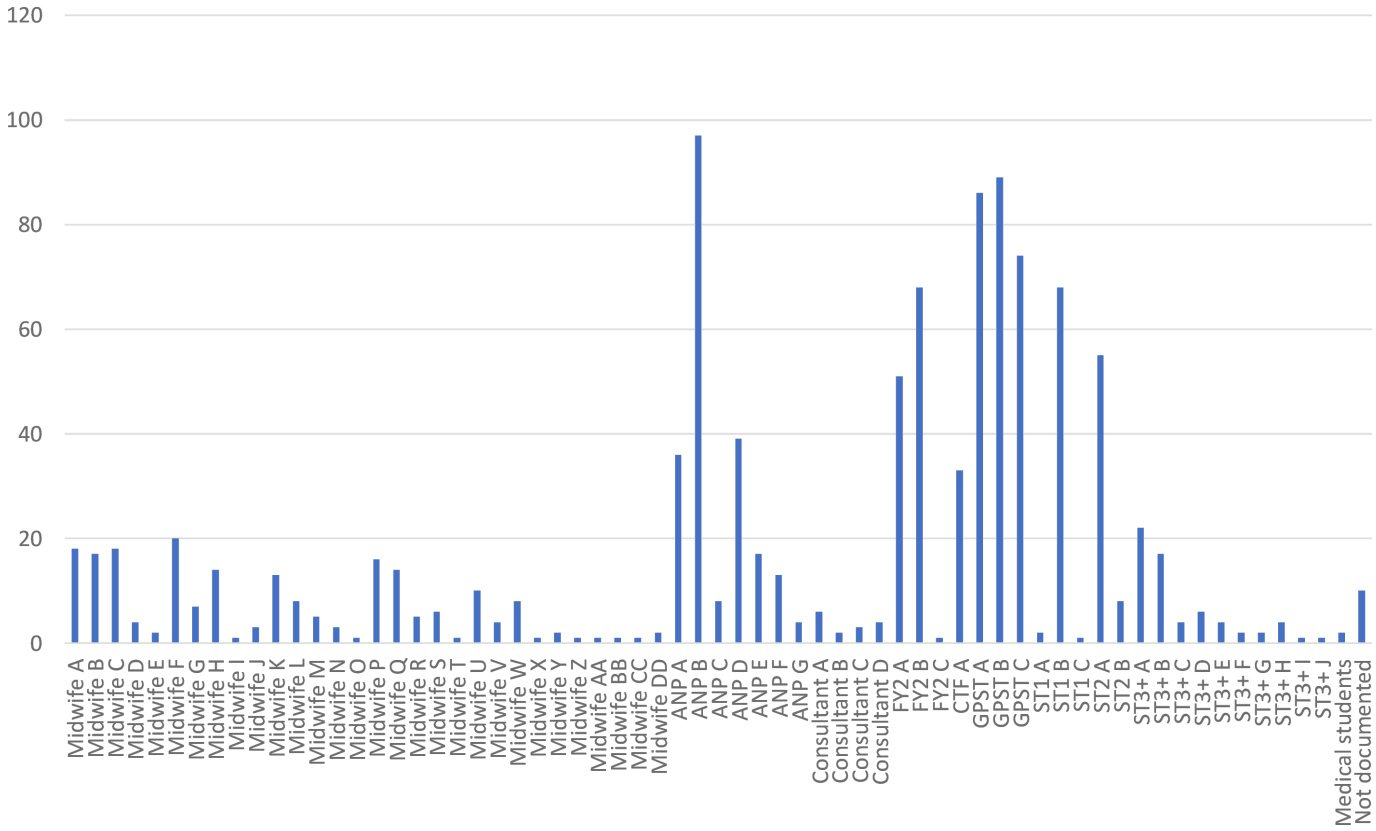

Figure 1 Number of examinations conducted per individual examiner.

This cohort of babies was examined by 65 individual examiners (figure 1) representing 9 different HCP groups (table 1). Median examinations per individual was 5.5 (range 1–97). 49% of examiners examined 5 or fewer babies during the study period. 18% of examiners performed only 1 examination during the study period. 35% of examinations were conducted by foundation year (FY) doctors and GP specialty trainees (GPSTs). Within those HCP groups that performed most examinations, a GPST examined on average 83 babies; an advanced nurse practioner (ANP) 30.6; and a midwife 6.9 (table 1). The number of babies examined by clinicians in the different HCP groups was statistically different ($p<0.001$).

All specialty trainees were paediatric trainees. FY doctors, GPSTs and specialty trainees years 1 and 2 were initially supervised by an ANP or specialty trainee year 3+ when carrying out neonatal hip examinations until deemed competent to do so unsupervised.

Table 1 Summary of total number and average number of babies examined per healthcare professional group in the 14-week period

Healthcare professional (HCP) group	Number of individuals within each HCP group	Total number of babies examined per HCP group (% of cohort)	Average number of babies examined by an individual in each HCP group (range)
GPSTs	3	249 (24)	83 (74–89)
FY doctors	3	120 (11.6)	40 (1–68)
Clinical teaching fellows	1	33 (3.2)	33 (33)
ANPs	7	214 (20.6)	30.6 (4–97)
Specialty trainee years 1 and 2	5	134 (12.9)	26.8 (1–68)
Midwives	30	207 (20)	6.9 (1–20)
Specialty trainee year 3+	10	63 (6)	6.3 (1–22)
Consultants	4	15 (1.5)	3.75 (2–6)
Medical students	2	2 (0.2)	1 (1)

ANP, Advanced nurse practitioner; FY, foundation year; GPSTs, GP specialty trainees.

Table 2 Cases of diagnosed DDH

Age	Referrer	Risk factor	Neonatal exam	Alpha angle	Beta angle	Graf	FHC %	US stability	Harness
4 months	HV	No	N N	L 50 R 68	73 42	2 C 1	<50 >50	Lax Stable	Yes
5 weeks	Rad	Br	N N	L 32 R 49	– R 80	3/4 2 D	0 50	Dislocated Stable	Yes
5 weeks	Rad	Br	N N	L 51 R 64	L 45 R 39	2 C 1	<50 >50	Stable Stable	Yes
1 day	Mat	No	L Unstable R N	L 49 R 45	L 69 R 70	4 4	0 0	Dislocated Dislocated	Yes
6 weeks	Rad	Br	L N R N	L 65 R 52	L 36 R 60	1 2A	<50 >50	Stable Lax	Yes
23 months	GP	No	N	n/a	n/a	n/a	n/a	n/a	No

*The Graf type is an ultrasound classification whereby the development of the immature hip and acetabulum are graded. The hip is evaluated by three lines constructed on the ultrasound image formed by the edge of the bony roof (the bony roof or alpha angle), the floor of the acetabulum and the cartilage roofline measured at the edge of the cartilaginous labrum (the cartilage roof or beta angle) all in relation to the vertical cortex of the ilium in the coronal plane. The alpha angle determines the types 1–4 where 1 is normal and 4 is dysplastic and dislocated. The beta angle determines the subtype providing further differentiation of the dysplasia and displacement of the labrum by the femoral head.)
Br, breech; DDH, developmental dysplasia of the hip; FHC, femoral head cover; GP, general practitioner; HV, health visitor; L, left; Mat, maternity; N, normal; R, right; Rad, radiology; US, ultrasound.

1005 (97%) examination findings were documented as normal and 24 (2.2%) were documented as abnormal. Eight (0.8%) were not recorded. Five cases of the 24 documented as abnormal were re-examined by a senior doctor or ANP and thereafter deemed to be normal; however, two of these five were still referred for USS due to having a risk factor (breech presentation and maternal DDH). One hip of the 24 was felt to be clinically abnormal on the neonatal examination while US imaging demonstrated that both hips were dislocated. Nine cases of the 24 documented abnormal were referred for USS and had a normal US examination while for the remaining 9 there was no record of subsequent management or whether they were re-examined by a senior and USS deemed not required. Scrutiny of clinical portal and PACS has confirmed no subsequent USS or further presentation for this group who remain in our catchment area.

Six babies have been diagnosed with DDH (table 2) within the 38 months since the study commenced. One diagnosed with DDH at birth as above. Three infants were diagnosed at between 5 and 6 weeks at their US screening performed for breech presentation. Two were detected late—one at 4 months following a health visitor check and one at 23 months by their GP for an abnormal gait. At the time of neonatal hip check, both had normal clinical examination and no risk factors and so did not meet the criteria for referral for USS.

The decision to treat with a harness was based on a combination of the clinical examination, sonographic dysplasia and instability (table 2). In the child whose harnessing commenced at age 6 weeks the indication was mild dysplasia combined with reduced abduction. The child aged 23 months underwent an open reduction, femoral and pelvic osteotomy. Our treatment rate of 4.8/1000 is as predicted.[4]

DISCUSSION

The prime objective in managing DDH is for early diagnosis as there is irrefutable evidence that early non-operative management results in superior outcomes compared with those in children who later undergo open surgery. This objective is not currently being achieved in the UK.

Broadhurst *et al*[22] reported the incidence of DDH diagnosed after 1 year of age in England at 1.28 per 1000 live births while McAllister *et al*[23] reported a risk of 1.18 per 1000 of children in Scotland undergoing surgery under the age of 3. These compare poorly with a recent survey in Sweden[24] which reported a national incidence of 0.12 per 1000 over a 10-year period. This represents a 10th of the incidence of late DDH in the UK. The comparison is even more unfavourable given that a diagnosis after the age of 2 weeks was recorded as a late diagnosis in Sweden.

Both UK studies[22 23] compare poorly with reported rates prior to implementation of the UK's combined screening programme, at which time screening was dependent on a small number of experienced examiners. Dunn *et al*[25] in 1985 reported an incidence of 0.88 per 1000 live births where late diagnosis was regarded as older than 1 month and over half were diagnosed before twelve months of age. Macnicol[26] in 1990 regarded an incidence of 0.5 per 1000 as representative of an unacceptable rate due to inexperienced examiners and found this was reduced to 0.07 per 1000 when experienced examiners were involved. Duppe[20] reported a rate of 0.56 per 1000 of late

diagnosed DDH in Malmo which represented an increase from 0.07 per 1000 in an earlier study from the same unit. This was attributed to a larger number of examiners between the two periods with 22 examiners reported as the maximum during 1 year. Despite this, two-thirds were diagnosed by 6 months of age.

The NIPE infant screening handbook (2024) has specified the examination techniques and timing at which these should be performed; however, there is no reference as to the experience, competence or training of the individual performing the assessment.[10] The Standing Medical Advisory Committee handbook (1986) states 'a number of health professionals may at some time have to examine a child's hips. It is important that whoever actually undertakes the examination should be proficient in the skill'.[13]

This represents a change in clinical hip screening policy such that the neonatal hip examination can be undertaken by a large cohort of health professionals. The effectiveness of this change in policy has not been properly evaluated.

Our concern is not which HCPs are involved in delivering the service. The issue is the number of people involved and the consequent dilution of experience among those individuals and how they can acquire the necessary proficiency.

This study demonstrates the wide range of numbers of examinations performed by nine different HCPl groups in one comparatively small teaching hospital maternity unit. Concern has been expressed previously about large numbers of examiners of different backgrounds and experience performing neonatal hip assessment and the potential for an increase in both false positive and false negative findings.[27]

The use of a dedicated team of examiners has been adopted by some UK centres with favourable results. In Birmingham, screening by a dedicated team of senior physiotherapists demonstrated a better detection rate than screening by junior paediatric physicians.[18] In two health regions in Scotland, it was found that following the introduction of enhanced DDH detection services via experienced examiners the risk of surgery for DDH by the age of three was halved.[23]

Recent UK studies[22 23] were based on retrospective data obtained from hospital databases with the inherent limitations of coding as recognised by the authors. An important step to try and redress the issue of late detection of DDH should be the inception of a national database with data uploaded prospectively by treating clinicians. This would identify regional variation which is known to exist and would hopefully enable adoption of best practice from those units with consistently lower rates of late DDH. A review of training and education of HCPs involved in the physical examination of neonates and infants has previously been suggested[3] and this would further contribute to the appraisal of the current system failure.

Contemporary UK series have demonstrated a higher rate of late detection of DDH compared with historic series in the UK and contemporary series in parts of Europe. This represents a failure of the current system. The authors endorse the BSCOS consensus statement[17] that 'neonatal hip examination should be performed by a small group of 'expert' examiners in the maternity setting, and there should be methods of quality assurance in place for all professionals undertaking the examination'.

CONCLUSION

This study demonstrates the large number of different HCPs currently involved in neonatal hip assessment in a single unit. Contemporary national initiatives in neonatal hip assessment contribute to this scenario and result in the dilution of experience and expertise in neonatal hip assessment. If the current rates of late detection of DDH and subsequent rates of operative intervention are to be reduced either a smaller number of experienced examiners should be introduced or a policy of universal US screening should be adopted.

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Ethics approval Caldicott approval was obtained from NHS Tayside Information Governance Department. This study was an audit of the system and not of individual performance.

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