■ CHILDREN'S ORTHOPAEDICS

The management of developmental dysplasia of the hip in children aged under three months

A CONSENSUS STUDY FROM THE BRITISH SOCIETY FOR CHILDREN'S ORTHOPAEDIC SURGERY

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Aims

A national screening programme has existed in the UK for the diagnosis of developmental dysplasia of the hip (DDH) since 1969. However, every aspect of screening and treatment remains controversial. Screening programmes throughout the world vary enormously, and in the UK there is significant variation in screening practice and treatment pathways. We report the results of an attempt by the British Society for Children's Orthopaedic Surgery (BSCOS) to identify a nationwide consensus for the management of DDH in order to unify treatment and suggest an approach for screening.

Methods

A Delphi consensus study was performed among the membership of BSCOS. Statements were generated by a steering group regarding aspects of the management of DDH in children aged under three months, namely screening and surveillance (15 questions), the technique of ultrasound scanning (eight questions), the initiation of treatment (19 questions), care during treatment with a splint (ten questions), and on quality, governance, and research (eight questions). A two-round Delphi process was used and a consensus document was produced at the final meeting of the steering group.

Results

A total of 60 statements were graded by 128 clinicians in the first round and 132 in the second round. Consensus was reached on 30 out of 60 statements in the first round and an additional 12 in the seond. This was summarized in a consensus statement and distilled into a flowchart to guide clinical practice.

Conclusion

We identified agreement in an area of medicine that has a long history of controversy and varied practice. None of the areas of consensus are based on high-quality evidence. This document is thus a framework to guide clinical practice and on which high-quality clinical trials can be developed.

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Introduction

Developmental dysplasia of the hip (DDH) includes a spectrum of abnormalities, ranging from mild acetabular deficiency to subluxation and dislocation of the hip. One in 1,000 newborn babies have a completely dislocated hip, and between 2% and 3% have a degree of dysplasia of the hip.[1-4] It is widely believed that early detection and treatment in newborn babies using a simple splint rapidly restores normal anatomy, thus preventing lifelong abnormalities.[5-7] Detection after early infancy requires surgery to reduce the dislocation. This becomes increasingly complicated and associated with poorer outcomes as the child ages.[8-11] DDH is associated with premature osteoarthritis. It is the indication for 10% of all arthroplasties of the hip,[12] and 25% of those undertaken in patients aged under 40 years.[13]

There is wide variation in screening and treatment practices for children with DDH. Screening

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Table I. The British Society for Children's Orthopaedic Surgery consensus statement for the management of developmental dysplasia of the hip in children aged under three months.

BSCOS believe that surveillance for DDH is valuable, but recognize that the current model of clinical screening has low accuracy and alternative models should be sought. Nevertheless, at present we believe that the current system of screening using clinical examination at birth and a six- to eight-week community examination should continue. The 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. All surveillance systems must be linked to a children's orthopaedic service.
BSCOS advocates for universal ultrasound screening and believes that a randomized clinical trial is necessary to compare universal ultrasound screening to the current screening pathway.
BSCOS believe that, in the context of selective USS screening/surveillance, children with an abnormal neonatal clinical examination must have an ultrasound scan within two weeks. In addition to the current 'risk factors' prompting an ultrasound scan, we believe that 'non-CTEV foot deformities' (i.e. metatarsus adductus / calcaneovalgus) and 'packaging disorders' should be included as risk factors.
Ultrasound scans should take place in a 'one stop clinic', such that treatment can be started at the time of the scan if required. There should be a system of quality assurance in place at both an individual and centre level to ensure the quality of the ultrasound assessment. The Graf criteria of standardized reporting should be employed (i.e. using the headings 'Age'/'Useability'/'Description'/'Measurement'/'Classification'). To accurately measure α angle, the minimum requirement of an acceptable coronal plane scan must include visualization of a straight ilium, the acetabular labrum and the lower limb of the ilium (where the triradiate cartilage begins). The core minimum criteria to be assessed and documented on every scan should include: whether the hip is centred; the α angle (providing the hip is centred) and a sonographic dynamic test of stability.

BSCOS, British Society for Children's Orthopaedic Surgery; CTEV, congenital talipes equinovarus; DDH, developmental dysplasia of the hip.

Table II. Numerous aspects did not reach consensus. These are summarized in the following table.

1. There was no consensus on whether all hips can wait until 4-6 weeks before an USS is undertaken.
2. In the context of a selective USS programme, there was no consensus on whether 'clicky' hips, first born females, high birth weight females (> 4 kg) or CTEV should be included as risk factors for DDH.
3. When undertaking the USS, there was no consensus on whether a Graf cradle and probe holder should be mandatory.
4. When undertaking the USS, there was no consensus on whether the core minimum criteria to be assessed and documented should include beta angle and description of femoral head coverage in terms of percentage.
5. There was no consensus on whether a period of weaning is required at the end of a harness/splint regime.
Regarding treatment, no consensus was reached on whether the following hips at the following timepoints warranted treatment in a harness or splint:
6. The Graf 2c/D hip at 2 weeks of age (immediate treatment versus staged re-scan).
7. The 2a hip at 5 to 7 weeks of age (immediate treatment versus staged re-scan).
8. The 2b hip at 11 to 13 weeks of age.

CTEV, congenital talipes equinovarus; DDH, developmental dysplasia of the hip; USS, ultrasound scan.

guidelines are laid out in the UK in the Newborn and Infant Physical Examination (NIPE) programme for England and Wales, Scotland's 'Best Start' programme and the Public Health Agency of Northern Ireland.[14-16] These programmes are based on guidelines from the Standing Medical Advisory Committee, implemented in 1969 and updated in 1986.[17] Clinical examination is the first line of screening, undertaken perinatally and repeated at six weeks. An ultrasound scan (USS) of the hip is performed selectively for those with abnormal clinical findings and those with risk factors. Despite the introduction of screening programmes, a significant number of children still require surgery for DDH.[7,18-21] This suggests either a failure of screening, or a failure of treatment.

In countries such as Austria, Germany, and Mongolia, all infants are screened using USS, with a low rate of late detection of DDH.[3,4,22-27] This, however, has the potential for overtreatment and increased costs.[6,22,28-30] Some bodies, including the U.S. Preventative Services Task Force, do not recommend any screening.[31] The evidence giving rise to these differences is clearly insufficient.[7,9,32-36]

There is further debate and variation of practice in relation to core aspects of the diagnosis and treatment of children with DDH,[7,37-40] notably the type of USS technique which should be used,[41-46] which risk factors should trigger USS, the optimal age at which to perform USS, which type of splint, brace, or harness to use, the optimal time to start treatment, and its duration.[9,14,47-51] Additionally, due to the natural development of an infant's hip with age, there remains debate about which hips require treatment.[9,52-54] Such is the uncertainty that the UK national screening committee have stated that "if proposed now as a new programme, DDH screening would probably not be accepted. However, it is so ingrained in the clinical practice of so many people that it would be almost impossible to stop it unless overwhelming evidence of ineffectiveness could be obtained."[55]

Determining the optimum screening strategy for DDH has thus been identified as a top-ten research priority for clinical effectiveness in children's orthopaedics in the UK.[56] In response, the British Society for Children's Orthopaedic Surgery (BSCOS) undertook a consensus exercise concerning the screening and treatment of DDH before the age of three months.[57] The aim was to establish consensus in order to minimize variations in treatment, and to form a foundation upon which high-quality studies in this area can be based.

Methods

A modified Delphi approach was used to gather broad input from a diverse group of clinicians, while minimizing domination by one or a few 'experts'.[58]

Applications were invited in October 2019 from members and associate members of BSCOS to join the steering group. A group of 20 members including nurses, physiotherapists,

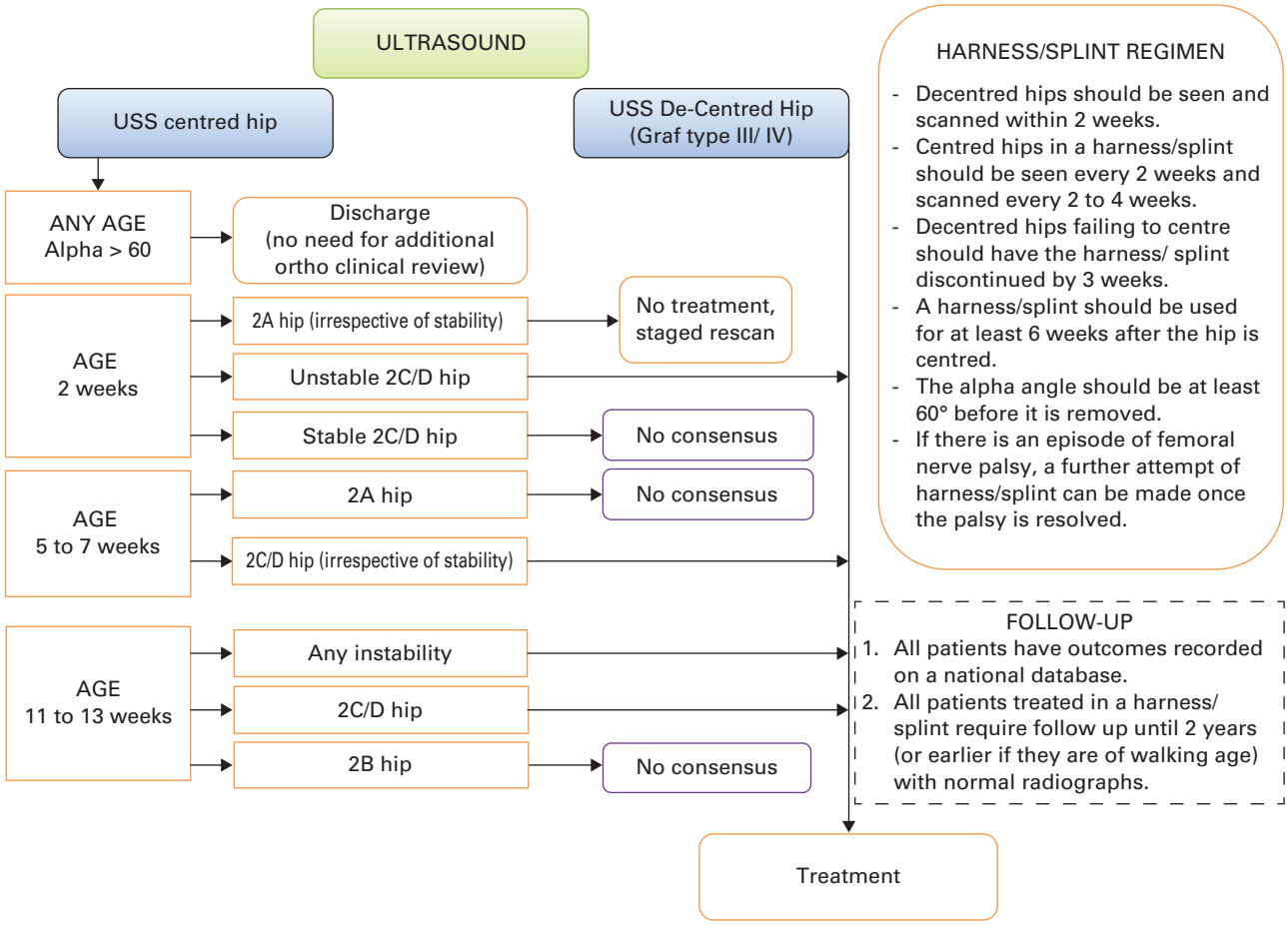

Fig. 1

Consensus flowchart for the management of developmental dysplasia of the hip in children aged under three months. USS, ultrasound scan.

and consultant paediatric orthopaedic surgeons was chosen. All declared an interest in the treatment of DDH in children, and currently undertook this in their routine clinical practice. This represented a diversity of professional occupations, experience, and sex. From within this group a chairperson (MK) was elected.

Due to the COVID-19 pandemic, all meetings were held virtually. Initial meetings involved brainstorming the topic. All members of the group submitted statements and questions in order to highlight areas of potential agreement and/or controversy. These statements were distilled into three areas: 'screening', 'ultrasound', and 'treatment'. Focused meetings were held on each topic separately. At each meeting, proposed statements were discussed and the text was formulated in a manner that was clear in its intent to all members of the group, as is standard practice for research based on the Delphi process. The total number of questions was limited to 60 in order to maximize the rate of completion of the survey. A rigorous process of prioritization of the key questions was performed during several meetings. A literature review was performed relating to each point, to confirm that there was no substantial evidence that would remove the need for the statement.

The Delphi survey therefore consisted of 60 focused statements on the management of DDH in children aged under three months. The statements were subdivided into categories dealing with screening and surveillance (15 questions), the technique of performing a USS (eight questions), initiation of treatment (19 questions), care during treatment with a splint (ten questions), and quality, governance, and research (eight questions).

The survey was sent to all members and associate members of BSCOS, who had opted in to receive such research invitations. It was distributed using the Jisc Online Survey tool (Jisc, UK). On receiving the survey, recipients were initially instructed to continue only if they believed that they had the relevant experience and expertise to participate. The software restricted participation to those who were invited and restricted the response to one per participant. The recipients were asked to grade the statements according to the following categories: strong recommendation for; conditional recommendation for; recommendation for research; conditional recommendation against; or strong recommendation against. Consensus in favour of a statement was reached if > 75% scored the statements as 'Strong recommendation for' or 'Conditional recommendation

for' and < 25% scored it as 'Strong recommendation against' or 'Conditional recommendation against.' Similarly, consensus against a statement was reached if > 75% scored it as 'Strong recommendation against' or 'Conditional recommendation against' and < 25% scored it as 'Strong recommendation for' or 'Conditional recommendation for.'

Feedback from the membership feedback was sought during the first round related to all questions and the broader process. After this meeting, the steering group refined some statements to avoid ambiguity. All statements that did not reach consensus from the first round (either in favour or against) were taken forward to the second round, during which the scores relating to each statement at the first round were provided to the participants, and the statements for rescoring. A final meeting was convened for discussion and development of the consensus document, which was related to a rigorous literature review.

Results

There were 128 responses to the first round from 236 invitations (54%) and 132 responses to the second round from 240 invitations (55%). This is a comparable response to the BSCOS clubfoot consensus project.[59] A total of 20 and 21 participants, respectively, declined to complete the survey due to their belief that they did not have the necessary experience and expertise. Thus, the survey was completed by 108 participants in the first round and 111 in the second round. Of these, 11 (10%) were allied healthcare practitioners and the remainder were paediatric orthopaedic surgeons (90%).

Consensus was reached for 30 of 60 statements in the first round, and for a further 12 in the second round. The statements from the first round and their scores are shown in Supplementary Table i. The refined statements from the second round and their scores are shown in Supplementary Table ii.

Based on the results of the Delphi exercise, a consensus statement was produced (Table I). In order to aid the impact of these statements in practice, this has been distilled into a flowchart focused on the recommendations for the treatment of DDH in children aged under three months (Figure 1). Aspects that did not reach consensus are highlighted in Figure 1 and detailed in Table II.

Discussion

The Delphi process on the management of DDH in children aged under three months revealed some agreement, in an area of medicine with a long history of debate and varied practice. Consensus was reached in 42 of 60 statements proposed by clinicians, with clarity given to the perceived optimal methods of screening and treatment for DDH. It is important to note that none of the areas of consensus are based on high-quality evidence and require focused research. Nevertheless, in the context of uncertainty, consensus is a useful basis on which guidelines can be standardized and a foundation from which evidence can be formulated.

A key difference in this study, compared with most international guidelines,[14-17,31-34] was that consensus recommended a universal USS strategy. This is in line with some European practice,[1,3,23] and a previous European DDH consensus group which reported in 2019.[25] Undoubtedly the reason behind this outcome is the high number of children in whom the diagnosis of DDH continues to be missed in the UK, and therefore present late and require surgical treatment. Most respondents were surgeons who deal with these missed cases. A further key outcome is the appetite for high-quality research to address the uncertainties. The evidence base in children's orthopaedics has been strengthened by recent successful national cohort studies and randomized controlled trials.[60–62] The enthusiasm of the clinical community, combined with new tools that allow the extensive collection of outcome data such as Smart4NIPE, could enable large studies to be efficiently undertaken throughout the UK. It is clear that while interventions for screening need to be tested, elements of the treatment pathway such as how, when, and who to treat, appear the highest priorities. Only by understanding the fundamental aspects of the condition and effective forms of treatments can we begin to understand the place of screening.[63]

This consensus exercise has limitations. While the Delphi approach allows the the opinion of experts to be formulated with all contributing equally, it cannot replace rigorous scientific evidence. There may be instances in which consensus does not reproduce, or even opposes, the evidence, owing to misinformation or competing interests among the experts from whom opinion is sought. There is a broader team of healthcare workers who deliver elements of the screening pathway including midwives, radiographers, paediatricians, nurses, GPs, and radiologists, who were not involved in the consensus exercise. Broader engagement is planned in future studies, including patient and public involvement. While only half of the members of BSCOS participated, there is no reason to believe that responders were different to non-responders, and responders appeared broadly to represent the make-up of the BSCOS membership. While all respondents actively manage children with DDH in their routine clinical practice, this expertise is self-declared. The study is UK-focused, which could affect the generalizability if extrapolated outside of the NHS.

It is clear that decisions about screening programmes and treatment protocols for children with DDH should be based on the best possible evidence. In the absence of high-quality evidence in the management of these children, areas of consensus are the most robust means upon which to guide policy and practice. This document is therefore a framework for current clinical practice and the foundation on which to build future high-quality clinical trials in the management of children with DDH.

Take home message

- Huge variation exists in the practice of screening for developmental dysplasia of the hip in infants, with limited evidence and with little certainty about any stage in the pathway.
- This study has established areas of broad consensus and is a framework to guide clinical practice.
- Robust high-quality randomized controlled trials are necessary for all elements of the screening and treatment pathway.

Supplementary material

Tables displaying a descriptive analysis of statements included in the Delphi survey Rounds 1 and 2.

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