

Newborn Care Guidelines for Developmental Dislocation of the Hip

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Abstract: *Developmental dysplasia of the hip (DDH) describes a spectrum of conditions related to the development of the hip in infants and young children. It encompasses abnormal development of the acetabulum and proximal femur and mechanical instability of the hip joint. Newborns often have physiologic laxity of the hip and immaturity of the acetabulum during the first few weeks of life. In most cases, the laxity resolves, and the acetabulum proceeds to develop normally. With assessment of risk factors, serial physical examination of the hips, and appropriate use of imaging studies, most children with pathologic hips can be correctly diagnosed and treated without long-term sequelae. Clinical screening of all neonatal hips is currently accepted as the most economic assessment of hips in many countries, with infants considered at risk of DDH or with hips demonstrating subluxation then undergoing Graf ultrasound examination at 6 weeks of age.*

Keywords: newborn, developmental dislocation, hip, screening

1. Introduction

Developmental dysplasia of the hip (DDH) describes a spectrum of conditions related to the development of the hip in infants and young children. It encompasses abnormal development of the acetabulum and proximal femur and mechanical instability of the hip joint (1-3).

Newborns often have physiologic laxity of the hip and immaturity of the acetabulum during the first few weeks of life. In most cases, the laxity resolves, and the acetabulum proceeds to develop normally. With assessment of risk factors, serial physical examination of the hips, and appropriate use of imaging studies, most children with pathologic hips can be correctly diagnosed and treated without long-term sequelae (4, 5).

Typical DDH, which generally occurs in otherwise healthy infants, will be the focus of this topic review. Hip dysplasia and instability also occur in association with other conditions. Teratologic hip dysplasia occurs in association with various syndromes (eg, Ehlers-Danlos, Down syndrome, arthrogryposis), and neuromuscular hip dysplasia occurs when there is weakness and/or spasticity in some or all of the hip muscle groups (eg, in spina bifida or cerebral palsy). The diagnosis and management of teratologic and neuromuscular hip dysplasia differ from the diagnosis and management of hip dysplasia in otherwise healthy infants (6-8).

Developmental dysplasia of the hip (DDH) describes a spectrum of conditions related to the development of the hip in infants and young children. It encompasses abnormal development of the acetabulum and proximal femur and mechanical instability of the hip joint. Newborns often have physiologic laxity of the hip and immaturity of the acetabulum during the first few weeks of life. In most cases, the laxity resolves, and the acetabulum proceeds to develop normally (9). With assessment of risk factors, serial physical examination of the hips, and appropriate use of imaging

studies, most children with pathologic hips can be correctly diagnosed and treated without long-term sequelae. Typical DDH, which generally occurs in otherwise healthy infants, also occur in association with other conditions. Despite serious long-term consequences for children with late diagnosis of DDH, best practice early screening techniques are debated with considerable variation in routine screening protocols internationally. Clinical screening of all neonatal hips is currently accepted as the most economic assessment of hips in many countries, with infants considered at risk of DDH or with hips demonstrating subluxation then undergoing Graf ultrasound examination at 6 weeks of age (10-12). Graf ultrasound, a morphological assessment of the infant hip, measures the angle of the roof of the acetabulum (alpha angle) and the percentage cover of the femoral head. It classifies hips as: mature, immature, or dislocated. The wide range in the Graf measurements prior to 6 weeks makes it an unreliable screening tool in early infancy.

Clinical screening for DDH relies on detection of hip subluxation or dislocation soon after birth using Barlow or Ortolani methods and is experience-dependent with skilled, trained and experienced operators more reliably performing the procedure. Systematic reviews suggest that routine screening with dynamic ultrasound may be more economically viable as portable ultrasound machines become more affordable and are further incorporated into contemporary clinical practice internationally (13,14). This paper shows a systematic review regarding the prevention and early detection using assessment and surveillance, suitable for general practitioners.

2. Material and Methods

A literature review. Two types of literature were reviewed: guidance and published studies. Nine guidance documents were identified, including: The Cochrane and Campbell Handbooks. Published studies were identified through 'pearl growing', citation chasing, a search of PubMed using the systematic review methods filter, and the authors' topic

knowledge. The relevant sections within each guidance document were then read and re-read, with the aim of determining key methodological stages.

3. Results

The clinical features of DDH depend upon the age of the child and the severity of the abnormality. The spectrum of presentation ranges from instability on the newborn examination, to subtle limited abduction in the infant, to asymmetric gait in the toddler, to activity-related pain in the adolescent, to osteoarthritis in the adult. The earlier DDH is detected, the simpler and more effective the treatment and the better the long-term outcome (15).

There is no standard definition and no consensus regarding which clinical examination and imaging findings require treatment to permit normal hip development. Current DDH screening practices are criticised for failure to adhere to the general principles of health screening, and there is variability in neonatal hip screening guidelines (16).

Risk factors and prevention of DDH

DDH results from a combination of environmental and genetic factors. Associated gene defects occur in the transforming growth factor beta superfamily, necessary for normal bone and joint development (17).

The highest DDH risk is in female breech babies (absolute risk 120/1000), followed by females with a family history (44/1000), then male breech babies (26/1000). The estimated risk for males with a family history (9.4/1000) is lower than females in general (19/1000). There is ongoing debate as to whether foot abnormalities and oligohydramnios are truly risk factors (18).

Hip development can be affected postnatally. Tight swaddling of lower limbs in extension and adduction is associated with DDH in epidemiological, anatomical and animal studies. High rates of swaddling are seen in patients with DDH diagnosed after three months of age. Conversely, habitually carrying babies with hips flexed and abducted is associated with low DDH incidence. Optimal baby wearing has been proposed as a public health initiative to minimise DDH. The International Hip Dysplasia Institute maintains a list of 'hip-healthy' early childcare products. Reduced prone lying for babies to minimise sudden infant death syndrome and use of disposable rather than bulky cloth nappies have been postulated to contribute to late DDH cases, but this is speculative (19,20).

Rationale for early detection

Early detection for any condition seeks to identify and treat individuals who have developed pathology but not yet sought medical attention. DDH treatment harnesses the ossification potential of the hip to achieve a reduced, stable and mature hip, while attempting to avoid treatment complications including growth disturbance and avascular necrosis. Hip maturation potential is greatest during the first six weeks of life and reaches a plateau by the end of the third month. Brace treatment has a fourfold higher risk of failure when commenced after seven weeks of age. If the femoral head fails to consistently contact the acetabulum,

progressive secondary changes occur, including adductor muscle shortening and mismatch in the morphology of the femoral head and acetabulum. With increasing treatment age, invasive procedures become more likely, including extensive soft tissue releases and osteotomies. Treatment failures and complications are more common (21,22).

As well as maximising the chance of successful treatment with an abduction splint or Pavlik harness, early DDH detection lowers the age at diagnosis for children who develop progressive signs outside the newborn period. The majority of children diagnosed after three months of age self-present when a limp or leg length discrepancy is noticed at walking age. However, abnormal examination findings may be detected earlier when actively sought (23).

Optimal assessment of DDH and the role of the GP

A holistic approach to DDH assessment acknowledges that a combination of risk factor assessment, clinical examination and imaging studies may permit early detection of DDH.

DDH risk factors signal a need to maintain a high index of suspicion for hip pathology. Breech babies with DDH are rarely diagnosed after three months of age, even without ultrasonography screening, presumably because awareness of the increased risk leads to careful examination by skilled examiners. Some guidelines recommend referral of babies with risk factors, including breech birth, family history, torticollis and foot deformities, to specialist hip clinics for assessment and/or recommend ultrasonography screening (24). GPs who see young children should be aware of local guidelines. In literature in 2010, six of 17 children with late-diagnosed DDH were not referred to the paediatric orthopaedic service in the neonatal period, despite meeting referral criteria (25).

Clinical examination remains the most important component of assessment. Rates of late-diagnosed DDH remained very low for decades (2.1% of DDH cases), with an established program of hip clinical examination at birth, on each day during the hospital stay, and at well-baby clinics up to 12 months of age, with ultrasonography reserved only for equivocal clinical examination. Risk factors for late DDH include early hospital discharge and rural birth, possibly reflecting inadequate opportunity for the careful examination of a settled baby by a suitably experienced examiner. There was no documentation of any neonatal hip examination in 47% of children diagnosed with DDH after six months of age in 2010. The GP may be the first practitioner to make an adequate assessment, even if they are not considered the usual clinician responsible for newborn hip examination. Assessment of the abduction range in conjunction with a gentle Ortolani manoeuvre is a safe practice to detect a dislocated hip in a child who may have been unsettled at previous examination attempts. Repeated forceful examinations should be avoided. Low rates of late-diagnosis DDH are seen in babies examined on each day of postnatal hospital admission, supporting the utility of repeated early examinations (26). Clinical examination findings should be documented and communicated specifically, describing the hip as dislocated, dislocatable, subluxatable or stable and documenting the abduction range (27).

Clinical examination in babies up to eight weeks of age is with carefully performed Ortolani and Barlow tests in a settled baby. An Ortolani-positive hip is dislocated at rest but reducible and requires prompt referral for treatment. Early referral of a Barlow-positive hip (resting in joint but dislocatable) minimises treatment delays for a hip that fails to stabilise. Although uncommon in the young child, a hip may be dislocated at rest and irreducible (negative for both Ortolani and Barlow tests). Inability to abduct both hips in a young baby so that the lateral surface of the knees contacts the examination surface may suggest an irreducible dislocation. An urgent ultrasound (not delaying to six weeks of age) can confirm the femoral head position relative to the acetabulum if this is suspected (28).

Unilateral decreased hip abduction in babies older than eight weeks suggests a dislocated or subluxated hip with 78.3% sensitivity. Bilateral reduced abduction is more difficult to assess and is a less specific sign.⁸ Ortolani and Barlow signs are often stated to be unreliable outside the newborn period but still occur. In a prospective study, 44% of hips dislocated at rest in children aged 3–18 months were clinically reducible. Other signs of femoral head malposition include a positive Galeazzi test (relative shortness of the femur with the hips and knees flexed) and leg length discrepancy. Asymmetrical thigh or gluteal skin folds (best assessed with the child prone) are included in many DDH screening guidelines but are only associated with DDH in the presence of other findings such as leg length discrepancy or decreased abduction. A walking-age child with unilateral DDH can present with leg length discrepancy, unilateral toe walking (compensatory for leg length inequality) or a limp. A child with bilateral dislocations presents with a waddling gait and hyperlordosis (29,30).

The use of ultrasonography in DDH assessment is subject to ongoing debate. A 2013 Cochrane review concluded that universal ultrasonography of all newborn hips increased treatment rates without differences in late diagnosis or surgery, contrasting with European studies showing reductions in late detection and surgery compared with the era before ultrasonography screening. A possible explanation lies in rigorous quality control. In Germany, ultrasonography licences are withdrawn from practitioners who fail to meet centrally monitored standards. A range of ultrasonography techniques to identify DDH are used in countries, sometimes in combination, including static measures of femoral head coverage and acetabular morphology as well as assessments of stability. Variability in ultrasonography technique, interpretation and recommendations for treatment can occur, as well as technical errors, including failure to correctly identify anatomical landmarks (31).

The GP may consider medical imaging in patients with an equivocal examination, for selective screening for infants with risk factors or to provide further anatomical information regarding the diagnosis. Ultrasonography is the modality of choice until four months of age. Where there is no specialised paediatric ultrasonography service or doubt regarding adequacy, the threshold for referral to a paediatric orthopaedic surgeon in the presence of risk factors or equivocal physical examination findings may be lower.

Between four and six months of age, X-ray or ultrasonography can be used; after six months of age, X-ray is preferred (32). Increased selective ultrasonography screening for babies with DDH risk factors has been associated with an increase in late-diagnosed DDH in children without traditional risk factors. Selective ultrasonography screening may lead overall to a false sense of security and less vigilance with DDH clinical examination and surveillance in all children. The American Academy of Pediatrics (AAP) recommends routine DDH screening either with ultrasonography at six weeks or X-ray at four months for female breech babies and considers it optional for female babies who have a first-degree relative with DDH and for breech boys. (33)

Surveillance versus screening

Screening usually refers to a short-term, cross-sectional process in a population at risk, whereas surveillance describes a long-term process where screening examinations are repeated at intervals of time. Dislocated hips are diagnosed in children up to five years of age, with the majority of diagnoses above three months of age in walking-age children who self-present. More frequent doctor-initiated assessments can reduce the age at diagnosis. Peaks in diagnosis occur in conjunction with scheduled hip check visits at three and six months, supporting repeated hip examination outside the newborn period. Prescribed ongoing examinations are included in some DDH screening guidelines. The AAP recommends hip examination at well-baby checks at two to four days and by one, two, four, six, nine and 12 months of age. The principle of multiple assessments until walking age is more important than the exact timing of the examinations (34).

There are advantages to supplementing DDH screening with regular GP DDH assessments. The GP has an ongoing relationship with the child, can identify changes in examination findings and provide preventive health advice, including avoidance of lower limb swaddling. The GP can order medical imaging when indicated and refer promptly for treatment, minimising communication breakdowns and treatment delays that occur with screening programs generally.⁹ Young children visit the GP for a range of reasons, including immunisations and common childhood illnesses, providing opportunities for repeated DDH assessment (35).

4. Conclusion

Early DDH detection and treatment harnesses the maximal growth potential of the infant hip, with increased likelihood of treatment success, fewer invasive procedures and fewer complications. Late diagnosis may occur as a result of screening failures, inappropriate swaddling or progression of pathology; efforts to minimise late cases may be hampered by lack of consensus in screening guidelines. While future developments in our understanding of the genetic component may lead to targeted investigations of individuals who are at risk, currently we must search for hip pathology in all children.

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