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REVIEW

Hip screening in newborns in the UK: what are the latest guidelines?

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Abstract

The Newborn and Infant Physical Examination screening is a national screening programme which aims to identify infants with congenital abnormalities to minimise the risk of long-term complications. It involves a top to toe examination with special focus on the heart, eyes, testes and hips. The hip component of the Newborn and Infant Physical Examination screen aims to pick up infants with developmental dysplasia of the hips and refer them for appropriate treatment in a timely manner. Guidelines for the hip section of have recently changed. This article reviews these changes, the timings of the follow up and investigations, and the diagnosis and management of developmental dysplasia of the hips.

Key words: Congenital hip dysplasia; Developmental dysplasia of the hips; Newborn and Infant Physical Examination

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Introduction

The Newborn and Infant Physical Examination screening is one of 11 national NHS screening programmes (Public Health England, 2021a). It advises that all infants born in the UK should be screened within 72 hours of birth and again between 6 and 8 weeks of age. The Newborn and Infant Physical Examination involves a top to toe examination, with special focus on the heart, eyes, testes and hips. Its purpose is to identify infants with congenital abnormalities to minimise the risk of long-term complications.

Evaluation of the hips includes documentation of risk factors for developmental dysplasia of the hips and examination of both hips. In the Newborn and Infant Physical Examination, the risk factors for hip dysplasia are:

1. First-degree family history of hip problems as a child
2. Breech presentation at or after 36 weeks' gestation, if the infant is born after 36 weeks' gestation irrespective of presentation at birth (even if the infant has undergone external version before delivery)
3. Breech presentation at the time of birth, if the infant is born between 28 and 35 + 6 weeks' gestation.

Hip examination includes observation of leg length symmetry, the level of both knees when the hips and knees are flexed (Galeazzi test) and the range of hip abduction in flexion. The normal range of hip abduction in flexion is 60–90°. Barlow and Ortolani test manoeuvres are performed on each hip separately to assess hip stability with the infant lying supine. The Barlow test involves flexing the hip to 90° with no abduction. Gentle posterior longitudinal pressure is applied to the distal femur in an attempt to dislocate the hip posteriorly. The Ortolani test involves abduction of both hips while applying gentle anterior pressure to the greater trochanters in an attempt to reduce a dislocated hip. Examination techniques are shown in Figure 1.

Observation of the groin, thigh and buttock skin creases for asymmetry is no longer part of the Newborn and Infant Physical Examination screen. A hip 'click' has also been removed from the Newborn and Infant Physical Examination guidelines and is no longer an indication for further investigation. However, there is controversy regarding this decision. There is conflicting evidence in the literature and several research papers suggest that a hip click can indicate underlying developmental dysplasia of the hips (Humphry et al, 2018; Marson et al, 2019).

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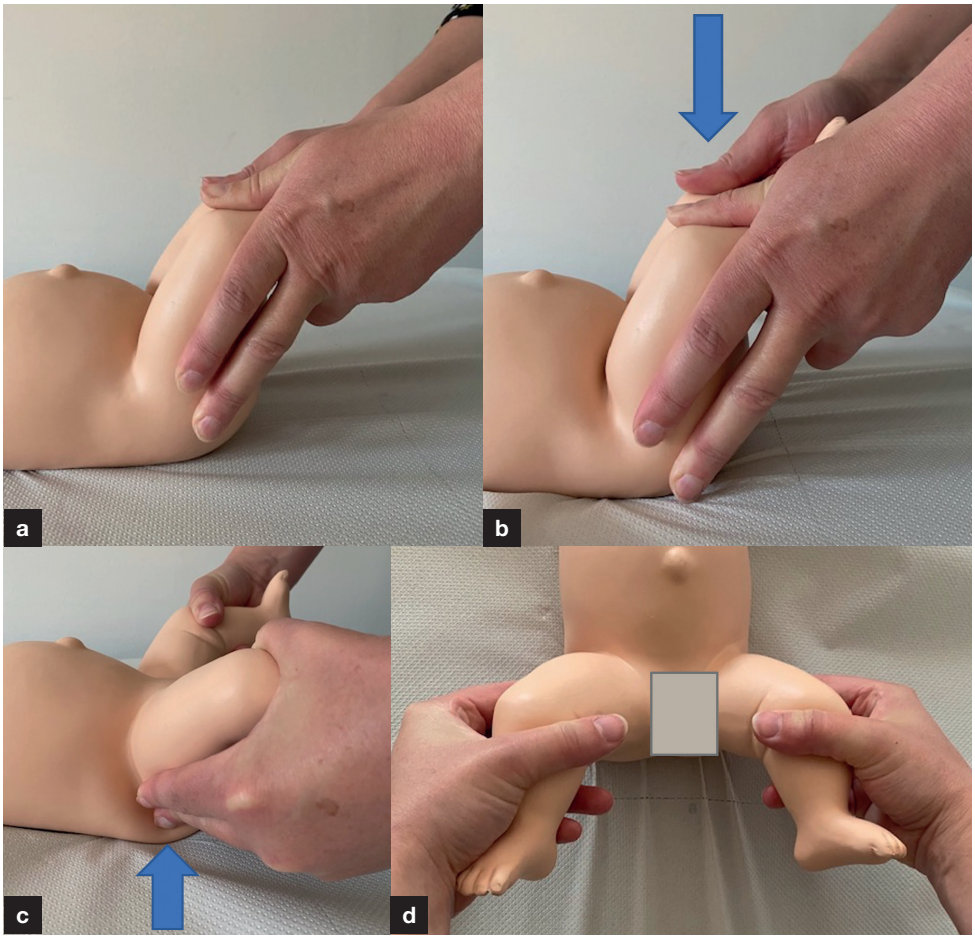

Figure 1. Newborn and Infant Physical Examination hip examination. a. Galeazzi test with both hips and knees flexed. The examiner places both their thumbs on the infant's knees. Both thumbs and hence both knees are at the same level, indicating a negative or normal test. b. Barlow manoeuvre with longitudinal pressure applied to the right distal femur resulting in posterior hip dislocation and a 'clunk' felt. This indicates a positive test. Note the thumbs and knees are now at different levels so this would be a positive or abnormal Galeazzi test. c. Ortolani manoeuvre with abduction of both hips while applying gentle anterior pressure to the greater trochanters. A clunk as the hip relocates anteriorly indicates a positive test. d. Examination of range of hip abduction in flexion. Abduction is equal, indicating a normal test.

Positive clinical findings include a difference in leg length, knees at different levels when hips and knees are bilaterally flexed (positive Galeazzi test), a difference of 20° or more between right and left hip abduction, bilateral loss of 30° or more of abduction and a 'clunk' felt with the Ortolani or Barlow manoeuvres. Positive risk factors and examination findings for developmental dysplasia of the hips are summarised in Table 1.

Changes in the Newborn and Infant Physical Examination guidelines

Before April 2021, the Newborn and Infant Physical Examination guidelines recommended that infants should have a hip ultrasound within 6 weeks of birth if they had a positive risk factor, or within 2 weeks of birth if they had a positive examination finding. All infants who had a positive finding on ultrasound received a paediatric orthopaedic review by 10 weeks of age.

The new Newborn and Infant Physical Examination guidelines (Public Health England, 2021a,b) have changed the recommended timing of hip ultrasound and orthopaedic assessment. All infants born at ≥34 + 0 weeks' gestation with a positive Newborn and Infant Physical Examination hip screen (positive risk factor or clinical finding) should have a hip ultrasound at 4–6 weeks of age. There is no longer a difference in timing of hip ultrasound between infants with a risk factor and positive examination finding for developmental

Table 1. Newborn and Infant Physical Examination risk factors and positive examination findings		
Risk factors	First degree family relative with hip problems as a child	
	Breech presentation	At birth if born after 28 weeks' gestation
		At any time from 36 weeks' gestation onwards (even if turned before birth)
Examination	Overall leg length discrepancy	A difference between the level of knees when the hips and knees are flexed (positive Galeazzi test)
	Limited hip abduction	20° or more difference between hip abduction between legs
		Bilateral loss of 30° abduction or more
	A clinically unstable hip with	A 'clunk' with the Ortolani manoeuvre as the dislocated hip reduces
		A 'clunk' with the Barlow test as a reduced hip dislocates

dysplasia of the hips. For screen-positive infants born before 34 + 0 weeks' gestation, a hip ultrasound should be performed at 38 + 0 to 40 + 0 weeks' gestational age.

Babies with a normal hip ultrasound can be discharged. If the ultrasound is abnormal, the infant should be reviewed by an orthopaedic specialist by:

- 6 weeks of age for infants born ≥34 weeks (34 + 0) gestation
- 40 + 0 weeks' gestational age for infants born <34 + 0 gestation.

The new guidelines for hip assessment are summarised in Figure 2.

The new Newborn and Infant Physical Examination guidelines also recommend a 'one-stop shop' where ultrasound and orthopaedic assessment is undertaken on the same day. If this is not possible, the ultrasound should be performed soon after 4 weeks of age to allow for an orthopaedic assessment by the age of 6 weeks.

Evidence suggests that over 70% of underdeveloped hips at birth resolve to normal hips by 4 weeks of age without treatment (Marks et al, 1994). Therefore, waiting until infants are 4 weeks of age before performing the first ultrasound minimises the need for repeat hip ultrasounds as well as reducing parental anxiety.

Developmental dysplasia of the hip

Developmental dysplasia of the hip is a disorder of the joint between the femoral head and acetabulum. It covers a spectrum of disease from mild dysplasia to a dislocated hip that cannot be reduced. It was originally termed congenital dislocation of the hip, but the condition was renamed to reflect that the development of the hip joint is dependent on the dynamic relationship between femoral head and acetabulum and continues to evolve postnatally. The cause of developmental dysplasia of the hips is multifactorial, with a combination of genetic, mechanical, intra-utero and postnatal factors contributing.

Epidemiology

Developmental dysplasia of the hip has a variable incidence. Approximately 0.1% of newborns are born with a dislocated hip and 1% with hip dysplasia (Loder and Skopelja, 2011) or a positive examination finding on screening (Homer et al, 2000). Ethnicity

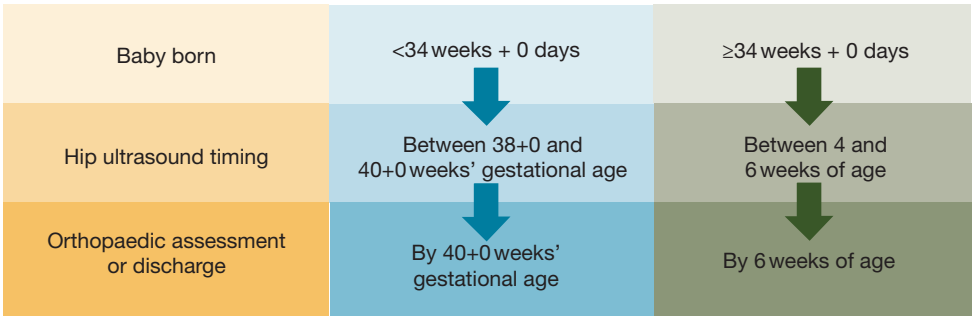

Figure 2. Pathway for newborns identified at risk of developmental dysplasia of the hips.

influences the incidence of developmental dysplasia of the hips and in one systematic review, it ranged from rates as low as 0.06% in black African populations up to 7.6% in native Americans (Loder and Skopelja, 2011).

Risk factors

The Newborn and Infant Physical Examination risk factors for developmental dysplasia of the hips are a first degree family relative with a hip problem as a child (relative risk 4.8) (de Hundt et al, 2012) and breech presentation (relative risk 5.7) (de Hundt et al, 2012). Up to 40% of children with developmental dysplasia of the hips are in the breech position in the third trimester of pregnancy (Loder and Skopelja, 2011). Other known risk factors that are not part of the Newborn and Infant Physical Examination screening protocol are female sex (relative risk 4.6) (Homer et al, 2000) and firstborn infant (relative risk 1.3) (Bower et al, 1987). Approximately 60% of children with developmental dysplasia of the hips are firstborn (Agarwal and Gupta, 2012). Developmental dysplasia of the hips is more common in cultures that swaddle infants, with the hips kept in an extended and adducted position (relative risk 6.1) (Akman et al, 2007), congenital foot deformity (Håberg et al, 2020), reduced space in-utero (large for gestational age and oligohydramnios), and certain syndromes such as arthrogryposis (Szöke et al, 1996).

Imaging

Ultrasound

For newborns or infants identified as being at risk of developmental dysplasia of the hips by Newborn and Infant Physical Examination screening, hip ultrasound is the investigation of choice. Ultrasound is easy to perform, non-invasive and there is no exposure to radiation. The ultrasound examination must be performed by an experienced practitioner. It remains the imaging modality of choice until an infant is 6 months of age. The key measurements on ultrasound are the alpha angle (formed between the bony acetabulum and ilium) and the beta angle (formed between the labrum and ilium). A normal alpha angle is 60° or over and a normal beta angle is 55° or less. Based on these angles, a hip can be categorised according to the Graf (1980) classification which grades hips from I–IV. A Graf grade I hip is normal (alpha angle >60°). An increasing Graf grade indicates increasing severity of hip dysplasia. A Graf grade IV hip is dislocated, with an alpha angle <43° and an inverted acetabular labrum. The Graf classification uses only static images of the hip. There are other ultrasound methods that use dynamic testing to assess hip stability. Figure 3 shows two hip ultrasound images: one normal and one dysplastic.

X-ray

After 6 months of age, the proximal femoral epiphysis starts to ossify, allowing the relationship between the femoral head and acetabulum to be evaluated via X-ray. At this age, X-ray becomes the investigation of choice for developmental dysplasia of the hips. An antero-

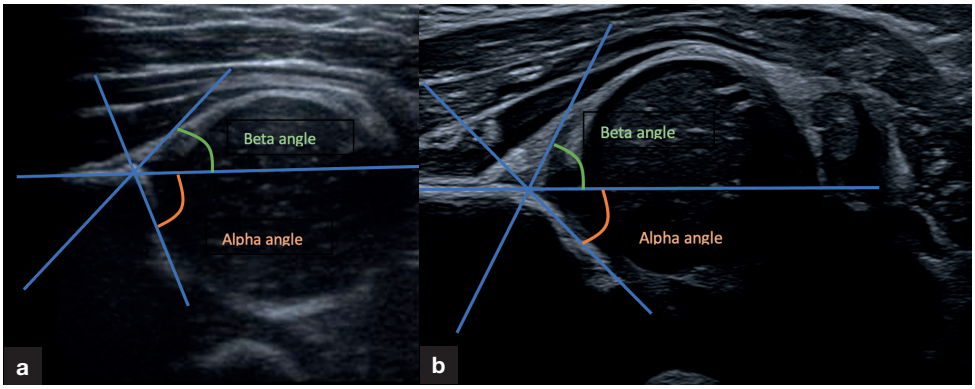

Figure 3. a. Ultrasound image of a normal Graf grade I hip showing an alpha angle of 68° and beta angle of 55°. b. Ultrasound image of an abnormal Graf grade II dysplastic hip showing a reduced alpha angle of 45° and increased beta angle of 70°.

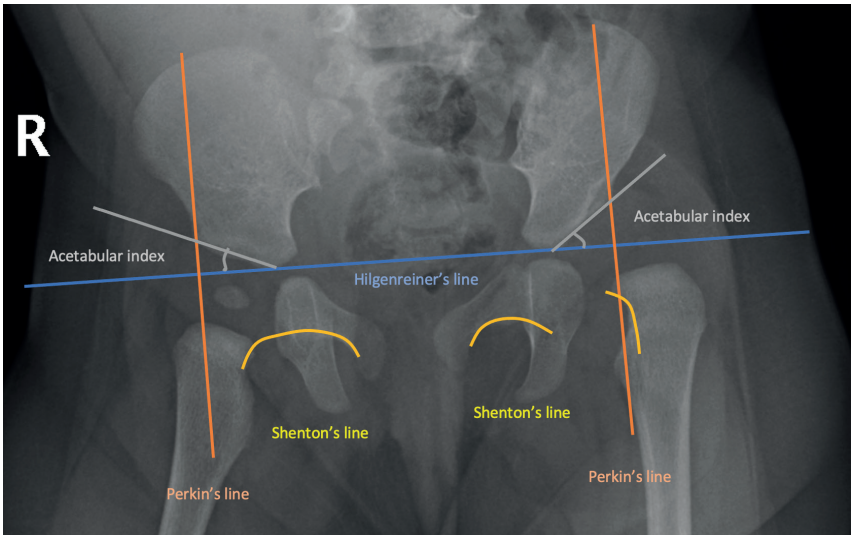

Figure 4. An antero-posterior radiograph of both hips of a 6-month-old infant, showing a normal right hip (with the femoral epiphysis in the inferomedial quadrant and intact Shenton's line) and a dislocated left hip (with the femoral epiphysis in the superolateral quadrant and a disrupted Shenton's line).

posterior view is of most diagnostic value (Figure 4). A horizontal line (Hilgenreiner's line) is drawn between the triradiate cartilages of the acetabulae and two vertical lines are drawn perpendicular to Hilgenreiner's line bordering the superolateral edge of the bony acetabular roof (Perkin's line). The proximal femoral epiphysis should be located in the inferomedial quadrant of these lines. If it lies in another quadrant, the hip is dislocated. A disruption of Shenton's line also suggests dislocation. The acetabular index is an angle measured between Hilgenreiner's line and the tangential line of the ossific margin of the roof of the acetabulum. The acetabular index decreases with age as the hip matures. Normal acetabular index is less than 35° at birth and less than 25° at 1 year of age (Laurenson, 1959).

Management

Below the age of 6 months, developmental dysplasia of the hips is usually managed non-operatively using a brace that holds the hips in an abducted and flexed position. In the UK, the most commonly used device is the Pavlik harness. Hip ultrasound is usually performed 1 week after harness application to check that the hip is in joint. If the hip does not relocate after 1–4 weeks, the harness should be abandoned. The Pavlik harness is usually worn for between 6 and 12 weeks, depending on the speed at which the hip 'normalises'. Pavlik harness treatment is usually monitored with serial hip ultrasounds. The harness can be worn over a vest or directly next to the skin. It is usually worn full-time but some practitioners allow the harness to be removed for up to 1 hour each day. Pavlik harness treatment is successful in approximately 90% of cases (Walton et al, 2010).

If Pavlik harness treatment is unsuccessful, or an infant presents after 6 months of age, a hip arthrogram is usually performed under general anaesthetic, together with an attempted closed reduction of the hip. An adductor tenotomy and psoas tenotomy may be performed at the same time. If the hip can be successfully relocated, a hip spica cast is applied for a total of 12–16 weeks. Owing to growth of the child, the hip spica cast needs to be changed after 6–8 weeks, under a general anaesthetic. The success rate of a closed reduction is 70–90% (Sankar et al, 2019; Zhang et al, 2020). The timing of a closed reduction remains controversial. Some surgeons do not perform closed reductions because of the risk of avascular necrosis to the femoral head, but wait until the infant is older when open reduction can be performed.

If a closed hip reduction is unsuccessful or not attempted, or the child presents late with a high dislocation, an open hip reduction is necessary, together with possible femoral and/or acetabular osteotomies (Figure 5). The hip is usually immobilised in a hip spica cast for 6–12 weeks after surgery. Some surgeons wait for the ossific nucleus to be present in the femoral head before attempting an open reduction.

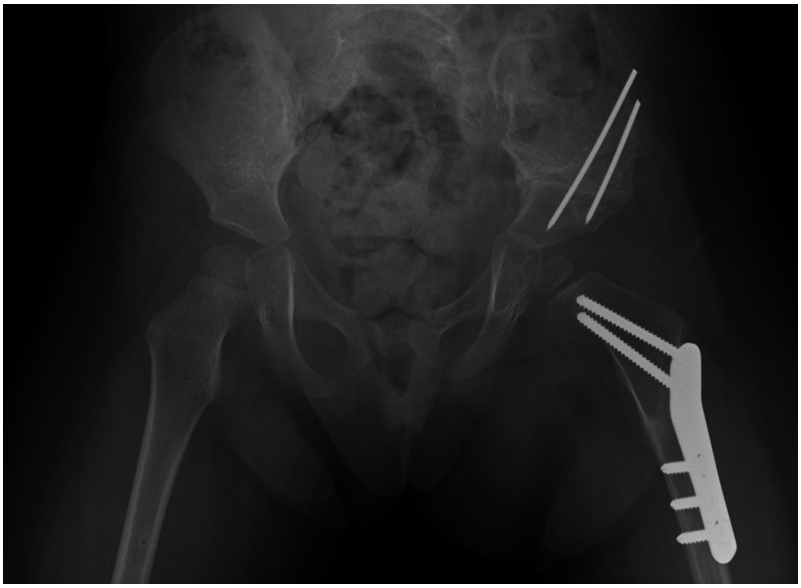

Figure 5. Antero-posterior radiograph of both hips of an 18-month-old girl who had undergone left open hip reduction with femoral and pelvic osteotomies.

Conclusions

The guidelines for the hip section of the Newborn and Infant Physical Examination examination have recently changed. All infants born after 34 weeks' gestation with suspected developmental dysplasia of the hips (because of a risk factor or positive examination finding) should have a hip ultrasound performed between 4 and 6 weeks of age. If the hip ultrasound is normal, the child should be discharged. If the hip ultrasound is abnormal, the child should be reviewed by an orthopaedic specialist by 6 weeks of age. An infant born before 34 weeks' gestation with a positive hip screen should have a hip ultrasound at 38–40 weeks' gestational age. If the hip ultrasound is abnormal, the infant should be reviewed by an orthopaedic specialist by 40 weeks' corrected gestation.

The purpose of the hip section of the Newborn and Infant Physical Examination screening protocol is to detect developmental dysplasia of the hips at the earliest possible opportunity and allow non-surgical treatment with a Pavlik harness. One-stop developmental dysplasia of the hips clinics are likely to become more common, to allow efficient and timely hip ultrasound and orthopaedic evaluation.

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Conflicts of interest

The authors declare that they do not have any conflicts of interest.

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Key points

- The hip section of the Newborn and Infant Physical Examination screen aims to detect infants with developmental dysplasia of the hips.
- Guidelines for the hip section of the Newborn and Infant Physical Examination examination have recently changed and suggested timing of ultrasound and orthopaedic review has now changed.
- Developmental dysplasia of the hips can usually be managed conservatively with a Pavlik harness, if detected early.
- Surgery may be required for infants with hips that are dislocated, do not improve with Pavlik harness therapy, or for patients who present later in life.

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