Developmental Dysplasia of the Hip (DDH): Early Diagnosis and Management

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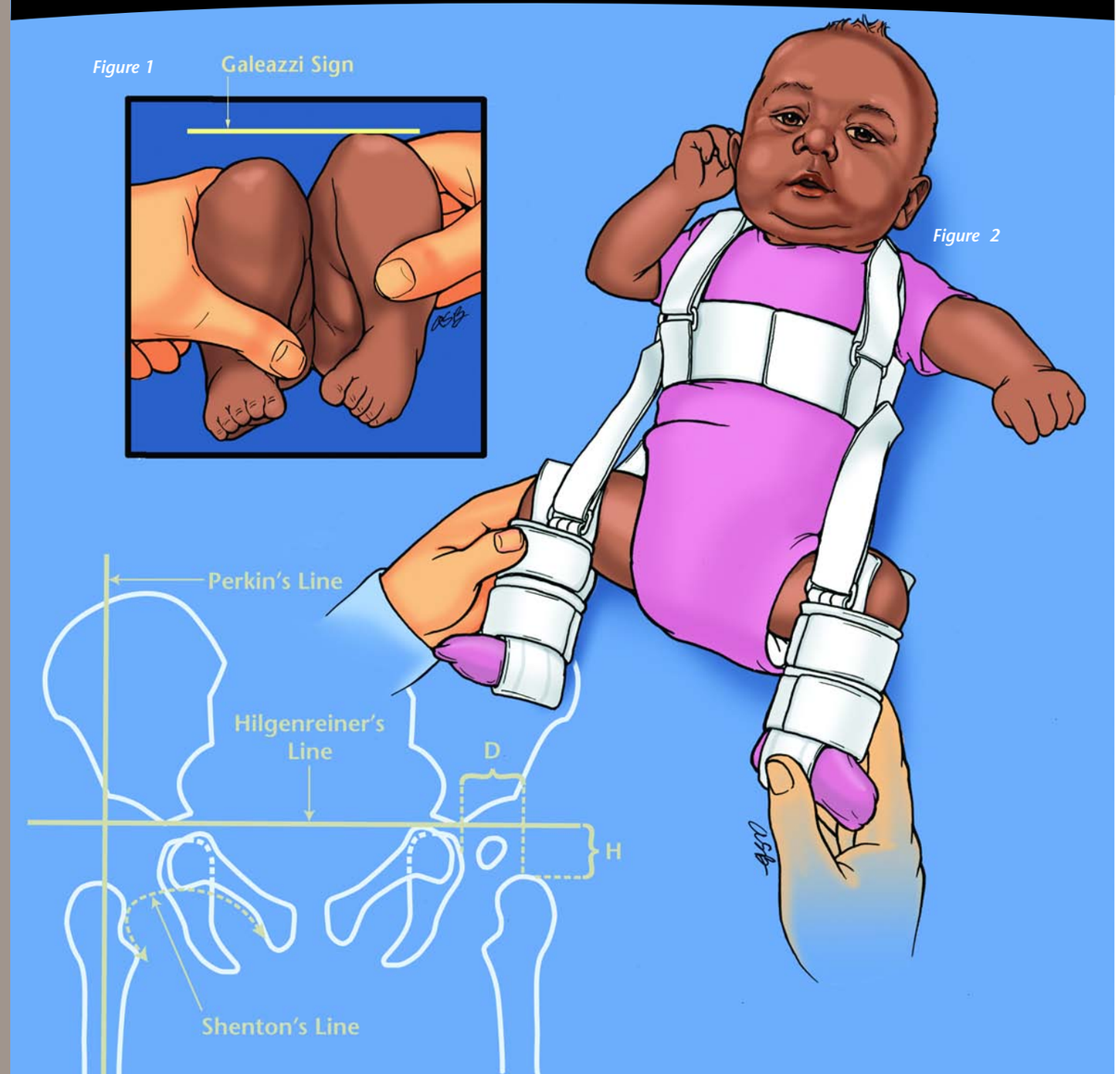


Developmental dysplasia of the hip (DDH) is a condition which defines any abnormality of a child's proximal femur or acetabulum. Most commonly this refers to neonatal hip instability, but also may describe a stable hip with an underdeveloped or shallow acetabulum. A full spectrum of disease may be seen—from the newborn with an irreducible dislocated hip, to the adolescent with hip pain secondary to a mild "uncovering" of the femoral head. Natural history studies suggest a significant relationship between DDH and early onset degenerative hip disease. Thus, early diagnosis and management are extremely important in order to help prevent early onset arthritis and pain in the older patient.

The incidence of DDH is controversial and depends largely on geographic and racial variation. Prior to clinical or ultrasound hip screening, arbitrary estimates of 1 to 1.5/1000 births were suggested. With screening techniques, up to a 7 to 15 percent incidence in white neonates has been reported. A slightly higher incidence is seen in Canada, the United States, and in North American Indians. In contrast, few cases are seen in African American, Chinese, or Korean children.

Etiology is multifactorial: mechanical, hormonal, genetic, and other various risk factors may all play a role. Intrauterine positioning or crowding may increase the risk for DDH, with frank breech presentation having an estimated 20 percent risk, independent of vaginal or cesarean delivery. Complete or footling breech presentation may only increase normal risk by 2 percent. Neonatal hip posture may also play a role. Infants held with extended and adducted hips while swaddled or wrapped are at increased risk of DDH. In addition, an abduction contracture of one hip may predispose the contralateral side to instability. Maternal hormones can induce significant ligamentous laxity, perhaps explaining the higher incidence in females.

First born infants carry the highest risk, although genetic studies suggest that approximately 5 percent of siblings of children with DDH also will develop pathology, more in females (10 percent) than males (1 percent). Similarly, twin studies suggest a 34 percent chance that if one identical twin has DDH, the other will as well (3 percent in fraternal twins). Other risk factors include: torticollis (8 to 20 percent incidence), clubfoot or calcaneovalgus feet (up to 25 percent), metatarsus adductus (10 percent), and other associated syndromes or disorders such as Down syndrome, congenital knee dislocation, arthrogryposis, myelomeningocele and Larson's syndrome. The important point to remember is that all factors may contribute. For example, a first born female with a positive family history and breech presentation carries a very high risk for DDH.

Early diagnosis is important to prevent the long term effects of untreated hip dysplasia. Ideally, DDH is detected by routine history and physical exam in the neonatal period. Questions to the parents regarding family history, intrauterine or breech positioning, number of previous children, and other problems associated with pregnancy such as oligohydramnios can be important risk factors to identify. Clinical screening is the gold standard for diagnosis with dynamic hip examinations carried out at birth and at subsequent pediatrician visits throughout childhood. The Ortolani test and Barlow maneuver should be done at each exam, performed when the child is restful, sleeping, or somewhat cooperative if possible. During the Ortolani test, the examiner's hands are placed over the child's knees with his/her thumbs on the medial thigh and the fingers placing a gentle upward stress on the lateral thigh and greater trochanter area. With slow abduction and slight internal rotation, a dislocated and reducible hip will reduce with a described palpable "clunk" (*see Figure 3*). The Barlow maneuver is done by guiding the hips into mild adduction and applying a slight forward pressure with the thumb. If the hip is unstable, the femoral head will slip over the posterior rim of the acetabulum, again producing a palpable sen-

Figure 3: Ortoloni Test

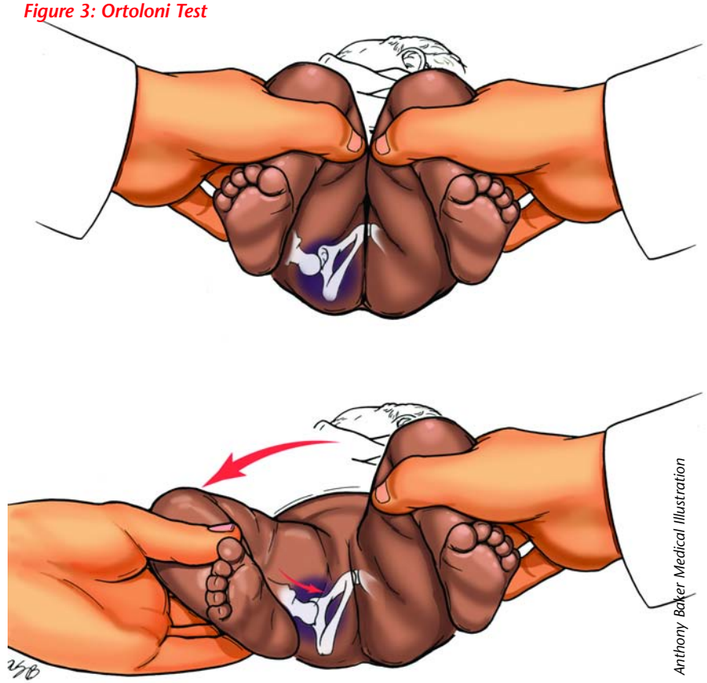
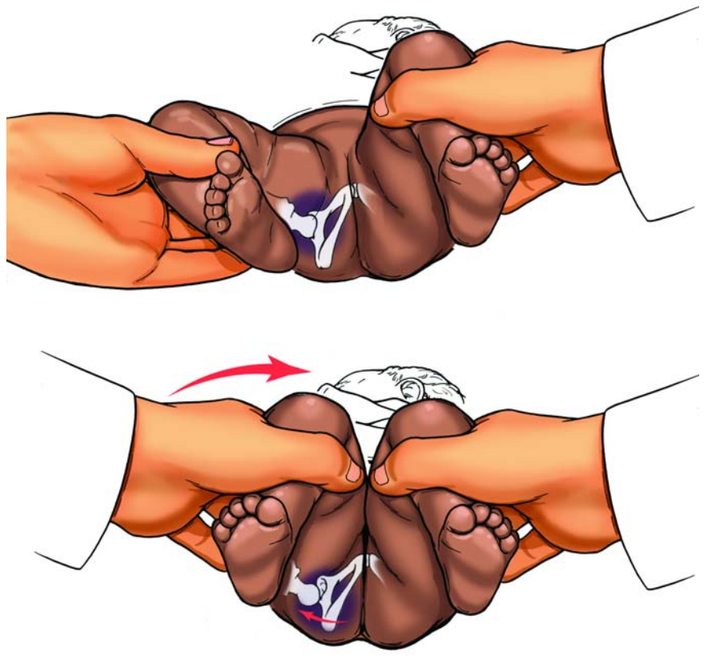


Figure 4: Barlow Maneuver



Anthony Baker Medical Illustration

sation of subluxation or dislocation. (see Figure 4) In infants, the degree of instability can be described as: 1) dislocated and reducible (+ Ortolani), 2) dislocated and irreducible (- Ortolani), 3) dislocatable (+ Barlow), and 4) subluxed (a hip with mild instability or laxity with a – Barlow maneuver).

After 2-3 months of age, the Ortolani test and Barlow maneuvers are less sensitive.

In the infant 3 months or older, several other physical exam findings become more apparent. Unilateral dysplasia may present as asymmetric shortening, identified with the Galeazzi sign, decreased hip abduction, or asymmetric thigh or gluteal folds. (*see Figure 1*). In the walking child, mild hip flexion contractures from bilateral dysplasia may produce hyperlordosis in the lumbar spine and a waddling type gait. Unilateral dislocations may produce a short leg gait in the older child.

Beyond the recommended clinical screening exams, further diagnostic imaging is controversial. Sonography is the most common and useful technique for analyzing the hip joint, especially in children under 6 months of age. Both dynamic and static ultrasound techniques are well described. Most authors agree that infants with identified risk factors for DDH (breech, family history, clubfoot, torticollis) should be routinely screened. With a normal clinical exam, screening ultrasounds should be delayed until at least 6 weeks of age when normal hip maturation improves the specificity of the exam. Screening all infants with ultrasound, although performed outside of the United States, may lead to overtreatment of many infants with ultrasound abnormalities for which there are no true or firm treatment guidelines. For various reasons, including cost, hip sonography is reserved for screening those infants with risk factors or questionable exams, as well as by the treating physician to document reduction of the hip, and to follow the improvement or maturity of a dysplastic hip.

Plain radiographic evaluation is reserved for children 6 months of age or older. Earlier than this, the hip is purely cartilaginous and not visible radiographically. On radiographs, lines can be drawn on the bony surfaces to help localize the femoral head in its relationship to the acetabulum. On an anteroposterior radiograph, Hilgenreiner's line, Perkin's line, and the acetabular index can be drawn and measured. (*see illustration on title page*). The proximal femoral metaphysis should lie medial to Perkin's line, within the inner and lower quadrant of the resulting grid. The normal acetabular index averages around 25 to 27 degrees. In the dysplastic hip joint, the acetabular index is increased. Other radiographic findings include a disruption of Shenton's line, a delay in epiphyseal ossification, and/or a widened or delayed "teardrop" appearance. Plain radiographs and various measurements are most useful in following hip development and maturation throughout childhood and early adolescence. MRI allows excellent anatomic visualization of the immature hip, but is rarely used or indicated.

Once DDH is identified, prompt referral to a pediatric orthopaedist is suggested. The main goal of treatment is to promote an atraumatic relocation of the hip as early as possible, and to maintain the reduction. This, in turn, facilitates normal hip maturation and development. Immature, stable hips (Barlow negative) that progress to normality do not need treatment. These are often the hips identified on screening ultrasounds done prior to 6 weeks of age. In addition, hips that are Barlow positive at birth may become stable within the first 3 weeks of life. Therefore, treatment of such hips may be delayed. Close follow-up and routine physical exams are required, and a later ultrasound to document normal hip stability and development. When the diagnosis of an unstable, Ortolani positive hip is made, early treatment is required. Treatment is based on positioning a reduced hip in flexion and mild abduction to stimulate normal joint development. This is most commonly performed via the Pavlik harness (*see Figure 2*), a dynamic brace which positions the thighs to allow and maintain hip reduction. (*see image*) The hips are flexed to 90 to 110 degrees and allowed approximately 60 to 65 degrees of abduction. Infants are followed bi-weekly for strap adjustment. Progress is monitered and reduction verified with subsequent ultrasound evaluations. Pavlik treatment continues until ultrasound parameters have normalized and the hip stabilized on exam, on average 2 to 3 months later. Complications of Pavlik treatment include: avascular necrosis (up to 15 percent), femoral nerve palsy, skin irritation, and failure of reduction secondary to patient noncompliance or inadequate application. Follow-up thru skeletal maturity is then emphasized—late presentation growth disturbances, avascular necrosis, and residual acetabular dysplasia or deformity can all present later in childhood and early adolescence.

Children who present between 6 months and 2 years old, or those that fail to stabilize or reduce with the Pavlik harness, require general anesthesia, followed by closed or open hip reduction and spica casting. Older children (2 years +) require extensive open reductions with possible femoral and pelvic osteotomies. With each further treatment step, possible complications present. Nonetheless, treatment goals remain the same—obtain and maintain hip reduction without damaging the femoral head.

Early diagnosis and management of developmental hip dysplasia is the key to providing an infant's hip the greatest likelihood of normal development. Identifying risk factors, performing routine physical exams, and appropriately utilizing hip sonography and plain radiographs are all important concepts for today's pediatrician. Once identified, prompt referral for treatment is suggested.

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Case Report

This case report is a one month old female who presented to my office for evaluation of a left hip click. Physical exam demonstrated a positive Ortolani and Barlow maneuver with mild asymmetric gluteal folds. Ultrasound (*Image 1*) shows a dislocated hip with abnormal ultrasound parameters. The child was treated with a Pavlik harness for 2 months full time with a followup ultrasound (*Image 2*) showing a reduced, well covered hip with normal ultrasound parameters. The child was then weaned out of the Pavlik and recently followed up at one year of age with a normal plain radiographic evaluation and physical exam. She will be seen throughout childhood to document normal hip development.

Image 1

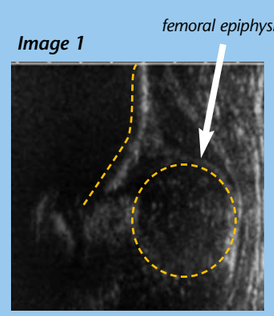
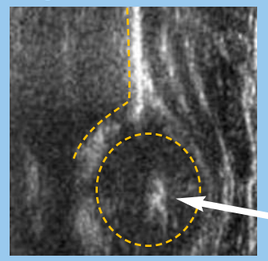


Image 2



Columbus Children's Sports Medicine Keeps the Momentum with New Staff and More Services

Columbus Children's Orthopedic Center is the only facility in the Columbus area to provide a Sports Medicine Program designed specifically to treat pediatric and adolescent patients.

New Physician Joins the Team

Stacy Fischer, MD will join the Children's Sports Medicine staff in September 2005. Dr. Fischer most recently served as a Primary Care Sports Medicine Fellow at Maine Medical Center in Portland, Maine. Dr. Fischer received a master's degree in exercise physiology from the University of Georgia and her medical degree from The Ohio State University. Today, she remains a competitive cyclist, runner and mountain climber.

More Staff Means More Service

In addition to the 11 outstanding physicians, Columbus Children's Sports Medicine recently hired five additional athletic trainers, allowing Children's to continue to expand its services. Columbus Children's is now the sports health provider for area high schools which include Westerville North High School, Westerville Central High School, Reynoldsburg High School and New Albany High School. The program has a variety of educational resources to support central Ohio community schools and athletic programs.

Injury Prevention Program Under Development

With the goals of keeping young athletes healthy and improving athletic performance, Children's Sports Medicine is currently developing a comprehensive injury prevention program. This program focuses on the keys to injury prevention for all athletes: balance, agility, core strengthening, coordination, functional movements and flexibility. For more information about the Columbus Children's Sports Medicine and/or the new injury prevention program or other available resources, call (614) 722-5577, or visit Children's web site at www.columbuschildrens.com and go to Health e-Hints for the Sports Medicine listing.