



Complete Summary

GUIDELINE TITLE

Clinical practice guideline: early detection of developmental dysplasia of the hip.

BIBLIOGRAPHIC SOURCE(S)

American Academy of Pediatrics (AAP). Clinical practice guideline: early detection of developmental dysplasia of the hip. Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip. American Academy of Pediatrics. Pediatrics 2000 Apr; 105(4 Pt 1):896-905. [44 references]

COMPLETE SUMMARY CONTENT

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INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT

CATEGORIES

IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

Developmental dysplasia of the hip

GUIDELINE CATEGORY

Evaluation
Screening

CLINICAL SPECIALTY

Family Practice
Orthopedic Surgery
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Physical Therapists

Physician Assistants
Physicians

GUIDELINE OBJECTIVE(S)

To reduce the number of dislocated hips detected later in infancy and childhood.

TARGET POPULATION

Healthy newborns up to 18 months of age, excluding those with neuromuscular disorders, myelodysplasia, or arthrogyrosis.

INTERVENTIONS AND PRACTICES CONSIDERED

1. Physical examination, including the Ortolani test and the Barlow test.
2. Imaging, including radiographs and ultrasonography.

MAJOR OUTCOMES CONSIDERED

- Developmental dysplasia of the hip
- Avascular necrosis of the hip

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

For the literature through May 1995, the following sources were searched: Books in Print, CAT-LINE, Current Contents, EMBASE, Federal Research in Progress, Health Care Standards, Health Device Alerts, Health Planning and Administration, Health Services/Technology Assessment, International Health Technology Assessment, and Medline. Medline and EMBASE were searched through June 1996. The search terms used in all databases included the following: hip dislocation, congenital; hip dysplasia; congenital hip dislocation; developmental dysplasia; ultrasonography/adverse effects; and osteonecrosis. Hand searches of leading orthopaedic journals were performed for the issues from June 1996 to March 1997. The bibliographies of journals accepted for use in formulating the practice parameter also were perused.

NUMBER OF SOURCE DOCUMENTS

624 articles were identified; of which 118 were accepted for data abstraction.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Subjective Review
Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Evidence quality was assessed on a custom subjective scale, based primarily on the fit of the evidence to the decision model.

The scoring process (see below) was based on the developers decision model and involved traditional epidemiologic concerns, like outcome definition and bias of ascertainment, as well as influence-diagram-based concerns, such as how well the data fit into the model.

Cohort definition: Does the cohort represented by the denominator in the study match a node in the guideline developer's influence diagram? Does the cohort represented by the numerator match a node in our influence-diagram? The closer the match, the more confident the guideline developer is that the reported data provide good evidence of the conditional probability implied by the arrow between the corresponding nodes in the influence diagram.

Path: Does the implied path from denominator to numerator lead through 1 or more nodes of the influence diagram? The longer the path, the more likely that uncontrolled biases entered into the study, making the developer less confident about accepting the raw data as a conditional probability in the model.

Assignment and comparison: Was there a control group? How was assignment made to experimental or control arms? A randomized, controlled study provides the best quality evidence.

Follow-up: Were patients with positive and negative initial findings followed up? The best studies should have data on both.

Outcome definition: Did the language of the outcome definitions (physical examination, orthopaedic examination, ultrasonography, and radiography) match the developers, and, in particular, were physical examination findings divided into 3 categories or 2? The closer the definition to ours, the more the developer could pool the data. Studies with only 2 categories do not help to distinguish clicks from "clunks."

Ascertainment: When the denominator represented more than 1 node, to what degree was the denominator a mix of nodes? The smaller the contamination, the more confident the developers were that the raw data represented a desired conditional probability.

Results: Did the results fill an entire table or were data missing? This is related to the follow-up category but is more general.

Scoring process

Cohort definition

- 3 points: both match the developers nodes
- 2 points: one matches, the other one is close
- 1 point: neither match, but both close
- 0 points: mix or unclear

Path

- 3 points: short path
- 2 points: 1 node
- 1 point: greater than 1 node
- 0 points: unclear path

Assignment and outcomes

- 3 points: random
- 2 points: comparative arm
- 1 point: single arm
- 0 points: haphazard

Follow-up

- 3 points: positives and negatives
- 2 points: all positives
- 1 point: not applicable
- 0 points: some positives

Outcome definition

- 3 points: matches ours
- 2 points: 3 (all) categories
- 1 point: 2 categories
- 0 points: no explicit definition

Ascertainment

3 points: no contamination

2 points: contamination less than 10 percent

1 point: contamination less than or equal to 20 percent

0 points: contamination greater than 20 percent

Results

3 points: fill entire table

2 points: fill partial table

1 point: fill entire row or column

0 points: fill partial row or column

METHODS USED TO ANALYZE THE EVIDENCE

Decision Analysis

Meta-Analysis

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Synthesis of Evidence

There are 3 levels of evidence synthesis.

1. Listing evidence for individual probabilities
2. Summarizing evidence across probabilities
3. Integrating the pooled evidence for individual probabilities into the decision model

A list of evidence for an individual probability (or arc) is called an evidence table and provides the reader a look at the individual pieces of data.

The probabilities are summarized in 3 ways: by averaging, by averaging weighted by sample size (pooled), and by meta-analysis. Bayesian meta-analytic techniques were chosen, which allow the representation of prior belief in the evidence and provide an explicit portrayal of the uncertainty of our conclusions. The framework used was that of a hierarchical Bayesian model, similar to the random effects model in traditional meta-analysis. In this hierarchical model, each study has its own parameter, which, in turn, is sampled from a wider population parameter. Because there are 2 stages (i.e., population to sample and sample to observation), and, therefore, the population parameter of interest is more distant from the data, the computed estimates in the population parameters are, in general, less certain (wider confidence interval) than simply pooling the data across studies. This lower certainty is appropriate in the developmental dysplasia

of the hip content area because the studies vary so widely in their raw estimates because of the range in time and geography over which they were performed.

In the Bayesian model, the observations were assumed to be Poisson distributed, given the study developmental dysplasia of the hip rates. Those rates, in turn, were assumed to be Gamma distributed, given the population rate. The prior belief on that rate was set as Gamma (α , β), with mean α/β , and variance α/β (as defined in the BUGS software [used by the developers]). In this parameterization, α has the semantics closest to that of location, and β has the semantics of certainty: the higher its value, the narrower the distribution and the more certain we are of the estimate. The parameter, α , was modeled as Exponential (1), and β , as Gamma (0.01, 1), with a mean of 0.01. Together, these correspond to a prior belief in the rate of a mean of 100 per 1000, and a standard deviation of 100, representing ignorance of the true rate.

As an example of interpretation, for pediatric newborn screening, the posterior α was 1.46, and the posterior β was 0.17, to give a posterior rate of 8.6/1000, with a variance of 50, or a standard deviation of 7.1. Note that the value of β rose from 0.01 to 0.17, indicating a higher level of certainty.

The Bayesian confidence interval is the narrowest interval that contains 95% of the area under the posterior-belief curve. The confidence interval for the prior curve is 2.53 to 370. The confidence interval for the posterior curve is 0.25 to 27.5, a significant shrinking and increase in certainty but still broad.

The model for the odds ratios is more complicated and based on the Oxford data set and analysis in the BUGS manual.

Thresholds

In the course of discussions about results, the Subcommittee was surveyed about the acceptable risks of developmental dysplasia of the hip for different levels of interventions.

Recommendations

Once the evidence and thresholds were obtained, a decision tree was created from the evidence available and was reviewed by the Subcommittee. In parallel, a consensus guideline (flowchart) was created. The Subcommittee evaluated whether evidence was available for links within the guidelines, as well as their strength of consensus. The decision tree was evaluated to check consistency of the evidence with the conclusions.

"Cost" -Effectiveness Ratios

To integrate the results, we defined cost-effectiveness ratios, in which cost was excess neonatal referrals or excess cases of avascular necrosis of the hip, and effectiveness was a decrease in the number of later cases. The decision tree was used to calculate the expected outcomes for each of pediatric, orthopaedic, and ultrasonographic strategies. Pediatric strategy was used as the baseline, because its neonatal screening rate was the lowest. The cost-effectiveness ratios then

were calculated as the quotient of the difference in cost and the difference in effect.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

In the guideline, evidence is listed as good, fair, or poor based on the methodologist's evaluation of the literature quality. (See the companion document titled "Development dysplasia of the hip practice guideline [Technical Report]." Pediatrics 2000 Apr; 105[4]:E57.)

Opinion or consensus is listed as strong if opinion of the expert panel was unanimous or mixed if there were dissenting points of view.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The appropriate committees and sections of the American Academy of Pediatrics (AAP) including the Chapter Review Group, a focus group of office-based pediatricians representing each AAP District, and relevant outside medical organizations reviewed the practice guideline as part of the peer review process.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

The evidence ratings (good, fair, poor) and the consensus ratings (strong or mixed) are defined at the end of the Major Recommendations field.

1. All newborns are to be screened by physical examination. The evidence for this recommendation is good. The expert consensus is strong. Although initial screening by orthopaedists would be optimal, it is doubtful that if widely practiced, such a strategy would give the same good results as those

published from pediatric orthopaedic research centers. It is recommended that screening be done by a properly trained health care provider (e.g., physician, pediatric nurse practitioner, physician assistant, or physical therapist). (Evidence for this recommendation is strong.) A number of studies performed by properly trained nonphysicians report results indistinguishable from those performed by physicians. The examination after discharge from the neonatal intensive care unit should be performed as a newborn examination with appropriate screening. Ultrasonography of all newborns is not recommended. (Evidence is fair; consensus is strong.) Although there is indirect evidence to support the use of ultrasonographic screening of all newborns, it is not advocated because it is operator-dependent, availability is questionable, it increases the rate of treatment, and interobserver variability is high. There are probably some increased costs. We considered a strategy of "no newborn screening." This arm is politically indefensible because screening newborns is inherent in pediatrician's care. The technical report details this limb through decision analysis. Regardless of the screening method used for the newborn, developmental dysplasia of the hip is detected in 1 in 5000 infants at 18 months of age. The evidence and consensus for newborn screening remain strong.

Newborn Physical Examination and Treatment

2. If a positive Ortolani or Barlow sign is found in the newborn examination, the infant should be referred to an orthopaedist. Orthopaedic referral is recommended when the Ortolani sign is unequivocally positive (a clunk). Orthopaedic referral is not recommended for any softly positive finding in the examination (e.g., hip click without dislocation). The precise time frame for the newborn to be evaluated by the orthopaedist cannot be determined from the literature. However, the literature suggests that the majority of "abnormal" physical findings of hip examinations at birth (clicks and clunks) will resolve by 2 weeks; therefore, consultation and possible initiation of treatment are recommended by that time. The data recommending that all those with a positive Ortolani sign be referred to an orthopaedist are limited, but expert panel consensus, nevertheless, was strong, because pediatricians do not have the training to take full responsibility and because true Ortolani clunks are rare and their management is more appropriately performed by the orthopaedist.

If the results of the physical examination at birth are "equivocally" positive (i.e., soft click, mild asymmetry, but neither an Ortolani nor a Barlow sign is present), then a follow-up hip examination by the pediatrician in 2 weeks is recommended. (Evidence is good; consensus is strong.) The available data suggest that most clicks resolve by 2 weeks and that these "benign hip clicks" in the newborn period do not lead to later hip dysplasia. Thus, for an infant with softly positive signs, the pediatrician should reexamine the hips at 2 weeks before making referrals for orthopaedic care or ultrasonography. We recognize the concern of pediatricians about adherence to follow-up care regimens, but this concern regards all aspects of health maintenance and is not a reason to request ultrasonography or other diagnostic study of the newborn hips.

3. If the results of the newborn physical examination are positive (i.e., presence of an Ortolani or a Barlow sign), ordering an ultrasonographic examination of the newborn is not recommended. (Evidence is poor; opinion is strong.) Treatment decisions are not influenced by the results of ultrasonography but are based on the results of the physical examination. The treating physician may use a variety of imaging studies during clinical management. If the results of the newborn physical examination are positive, obtaining a radiograph of the newborn's pelvis and hips is not recommended (evidence is poor; opinion is strong), because they are of limited value and do not influence treatment decisions.

The use of triple diapers when abnormal physical signs are detected during the newborn period is not recommended. (Evidence is poor; opinion is strong.) Triple diaper use is common practice despite the lack of data on the effectiveness of triple diaper use; and, in instances of frank dislocation, the use of triple diapers may delay the initiation of more appropriate treatment (such as with the Pavlik harness). Often, the primary care pediatrician may not have performed the newborn examination in the hospital. The importance of communication cannot be overemphasized, and triple diapers may aid in follow-up as a reminder that a possible abnormal physical examination finding was present in the newborn.

2-Week Examination

4. If the results of the physical examination are positive (e.g., positive Ortolani or Barlow sign) at 2 weeks, refer to an orthopaedist. (Evidence is strong; consensus is strong.) Referral is urgent but is not an emergency. Consensus is strong that, as in the newborn, the presence of an Ortolani or Barlow sign at 2 weeks warrants referral to an orthopaedist. An Ortolani sign at 2 weeks may be a new finding or a finding that was not apparent at the time of the newborn examination.
5. If at the 2-week examination the Ortolani and Barlow signs are absent but physical findings raise suspicions, consider referral to an orthopaedist or request ultrasonography at age 3 to 4 weeks. Consensus is mixed about the follow-up for softly positive or equivocal findings at 2 weeks of age (e.g., adventitious click, thigh asymmetry, and apparent leg length difference). Because it is necessary to confirm the status of the hip joint, the pediatrician can consider referral to an orthopaedist or for ultrasonography if the constellation of physical findings raises a high level of suspicion. However, if the physical findings are minimal, continuing follow-up by the periodicity schedule with focused hip examinations is also an option, provided risk factors are considered. (See "Recommendations" 7 and 8.)
6. If the results of the physical examination are negative at 2 weeks, follow-up is recommended at the scheduled well-baby periodic examinations. (Evidence is good; consensus is strong.)
7. Risk factors. If the results of the newborn examination are negative (or equivocally positive), risk factors may be considered. Risk factors are a study of thresholds to act. Table 1 in the guideline document gives the risk of finding a positive Ortolani or Barlow sign at the time of the initial newborn screening. If this examination is negative, the absolute risk of there being a true dislocated hip is greatly reduced. Nevertheless, the data in Table 1 in the guideline document may influence the pediatrician to perform

confirmatory evaluations. Action will vary based on the individual clinician. The following recommendations are made (evidence is strong; opinion is strong):

- Girl (newborn risk of 19/1000). When the results of the newborn examination are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age.
 - Infants with a positive family history of developmental dysplasia of the hip (newborn risk for boys of 9.4/1000 and for girls, 44/1000). When the results of the newborn examination in boys are negative or equivocally positive, hips should be reevaluated at 2 weeks of age. If negative, continue according to the periodicity schedule; if positive, refer to an orthopaedist or for ultrasonography at 3 weeks of age. In girls, the absolute risk of 44/1000 may exceed the pediatrician's threshold to act, and imaging with an ultrasonographic examination at 6 weeks of age or a radiograph of the pelvis at 4 months of age is recommended.
 - Breech presentation (newborn risk for boys of 26/1000 and for girls, 120/1000). For negative or equivocally positive newborn examinations, the infant should be reevaluated at regular intervals (according to the periodicity schedule) if the examination results remain negative. Because an absolute risk of 120/1000 (12%) probably exceeds most pediatricians' threshold to act, imaging with an ultrasonographic examination at 6 weeks of age or with a radiograph of the pelvis and hips at 4 months of age is recommended. In addition, because some reports show a high incidence of hip abnormalities detected at an older age in children born breech, this imaging strategy remains an option for all children born breech, not just girls. These hip abnormalities are, for the most part, inadequate development of the acetabulum. Acetabular dysplasia is best found by a radiographic examination at 6 months of age or older. A suggestion of poorly formed acetabula may be observed at 6 weeks of age by ultrasonography, but the best study remains a radiograph performed closer to 6 months of age. Ultrasonographic newborn screening of all breech infants will not eliminate the possibility of later acetabular dysplasia.
8. Periodicity. The hips must be examined at every well-baby visit according to the recommended periodicity schedule for well-baby examinations (2-4 days for newborns discharged in less than 48 hours after delivery, by 1 month, 2 months, 4 months, 6 months, 9 months, and 12 months of age). If at any time during the follow-up period developmental dysplasia of the hip is suspected because of an abnormal physical examination or by a parental complaint of difficulty diapering or abnormal appearing legs, the pediatrician must confirm that the hips are stable, in the sockets, and developing normally. Confirmation can be made by a focused physical examination when the infant is calm and relaxed, by consultation with another primary care pediatrician, by consultation with an orthopaedist, by ultrasonography if the infant is younger than 5 months of age, or by radiography if the infant is older than 4 months of age. (Between 4 and 6 months of age, ultrasonography and radiography seem to be equally effective diagnostic imaging studies.)

Definitions:

In the guideline, evidence is listed as good, fair, or poor based on the methodologist's evaluation of the literature quality. (See the Technical Report companion document.)

Opinion or consensus is listed as strong if opinion of the expert panel was unanimous or mixed if there were dissenting points of view.

CLINICAL ALGORITHM(S)

A clinical algorithm is provided for the screening of developmental hip dysplasia.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

There was a paucity of randomized controlled trials about developmental dysplasia of the hip; most evidence was derived from case series.

1. Newborn screening

a. Pediatric screening

There were 51 studies, providing 57 arms, for pediatric screening, of which 34 studies were used.

b. Orthopaedic screening

Evidence was found in 25 studies. Three studies provided 2 arms each.

c. Ultrasonographic screening

Evidence was found in 17 studies, each providing a single arm.

2. Postneonatal cases

a. After pediatric screening

Evidence was found in 24 studies. One study provided two arms.

b. After Orthopaedic screening

There were only 4 studies.

c. After ultrasonographic screening

Only 1 study was available.

3. Avascular necrosis (AVN) after treatment

a. After early referral

There were 17 studies providing evidence.

b. After later referral

Evidence was obtained from 6 studies.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Minimization of dislocated hips diagnosed at year 1 of age.

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

The recommendations in this statement do not indicate an exclusive course of treatment or serve as a standard of medical care. Variations, taking into account individual circumstances, may be appropriate.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Staying Healthy

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American Academy of Pediatrics (AAP). Clinical practice guideline: early detection of developmental dysplasia of the hip. Committee on Quality Improvement,

Subcommittee on Developmental Dysplasia of the Hip. American Academy of Pediatrics. Pediatrics 2000 Apr; 105(4 Pt 1):896-905. [44 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

2000 Apr

GUIDELINE DEVELOPER(S)

American Academy of Pediatrics - Medical Specialty Society

SOURCE(S) OF FUNDING

American Academy of Pediatrics (AAP)

GUIDELINE COMMITTEE

Committee on Quality Improvement, Subcommittee on Developmental Dysplasia of the Hip.

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Subcommittee on Developmental Dysplasia of the Hip: Michael J. Goldberg, MD, Chairperson; Theodore H. Harcke, MD; Anthony Hirsch, MD; Harold Lehmann, MD, PhD; Dennis R. Roy, MD; Phillip Sunshine, MD; and Carol Dezateux, MB, MPH (consultant).

Committee on Quality Improvement: Charles J. Homer, MD, MPH, Chairperson; Richard D Baltz, MD; Gerald B. Hickson, MD; Paul V. Miles, MD; Thomas B. Newman, MD, MPH; Joan E. Shook, MD; William M. Zurhellen, MD; Betty A. Lowe, MD; Ellen Schwalenstocker, MBA; Michael J. Goldberg, MD; Richard Shiffman, MD; Jan Ellen Berger, MD; and F. Lane France, MD.

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

An update is not in progress at this time.

American Academy of Pediatrics (AAP) Policies are reviewed every 3 years by the authoring body, at which time a recommendation is made that the policy be retired, revised, or reaffirmed without change. Until the Board of Directors

approves a revision or reaffirmation, or retires a statement, the current policy remains in effect.

GUIDELINE AVAILABILITY

Electronic copies: Available from the [American Academy of Pediatrics \(AAP\) Policy Web site](#).

Print copies: Available from AAP, 141 Northwest Point Blvd., P.O. Box 927, Elk Grove Village, IL 60009-0927; www.aap.org.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- Development dysplasia of the hip practice guideline (Technical Report). Pediatrics 2000 Apr; 105(4): E57

Electronic copies: Available from the [American Academy of Pediatrics \(AAP\) Policy Web site](#).

Print copies: Available from AAP, 141 Northwest Point Blvd., P.O. Box 927, Elk Grove Village, IL 60009-0927.

PATIENT RESOURCES

Not available at this time.

NGC STATUS

This summary was completed by ECRI on November 16, 2000. The information was verified by the guideline developer on January 8, 2001.

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