Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 8s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

A Systematic Review on Neonatal Screening and Orthopaedic Management of Developmental Dysplasia of The Hip Through a Synthesis of Diagnostic Yield and Pavlik Harness Outcomes

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Cite this paper as: Prateek Rastogi, Shubham Anant, Sankalp Agarwal, Ishdeep Singh Oberoi, Prashant Tiwari, (2025) A Systematic Review on Neonatal Screening and Orthopaedic Management of Developmental Dysplasia of The Hip Through a Synthesis of Diagnostic Yield and Pavlik Harness Outcomes. *Journal of Neonatal Surgery*, 14 (8s), 968-979.

ABSTRACT

Background: Developmental dysplasia of the hip (DDH) is a common paediatric orthopaedic condition which affects 1–2 per 1,000 newborns with dislocation; and up to 60 per 1,000 for milder forms detected by ultrasonography. Early identification in the neonatal period allows for conservative treatment - most commonly with the Pavlik harness and reduces the risk of long-term complications such as gait abnormalities and early osteoarthritis.

Objectives: This review evaluates the diagnostic yield of neonatal clinical screening and selective ultrasonography for DDH; and assesses the outcomes of Pavlik harness treatment. Primary metrics include sensitivity, specificity and positive predictive value (PPV) of screening. Additional metrics include treatment success rates, duration, predictors and complications such as avascular necrosis (AVN).

Methodology: A systematic review was conducted using PubMed, Google Scholar and Cochrane databases for studies published between 1990 and 2025. Inclusion criteria targeted primary studies on neonatal DDH diagnosis and Pavlik harness outcomes. Of 342 initially identified records - 295 were screened and nine studies were included following predefined criteria. These comprised three retrospective case series, two prospective cohorts, two retrospective cohorts, one diagnostic test study and one randomized controlled trial.

Results: Clinical screening sensitivity ranged from 18.5% (Choudry & Paton, 2018) to 62% (Mace & Paton, 2015), while specificity consistently exceeded 99%. Sonography improved diagnostic accuracy and influenced management in up to 32% of cases (Ashby & Roposch, 2015). A quality improvement screening bundle (Shen et al., 2023) raised early diagnosis rates from 0.48 to 3.5 per 1,000 and eliminated the need for surgery. Pavlik harness success rates ranged from 46% in older infants (Pollet et al., 2010) to 97.2% in early-treated hips (Gahleitner et al., 2024) - with AVN rates as low as 0% in most successful cohorts.

Conclusion: Ultrasonography significantly enhances diagnostic precision for DDH when paired with clinical screening. The Pavlik harness remains a highly effective and safe intervention - when initiated early in appropriately selected patients. Structured screening protocols and interdisciplinary collaboration between neonatology and orthopaedics are vital to improving outcomes and to reduce the prevalent burden of late-presenting DDH.

Keywords: *Developmental Dysplasia of the Hip (DDH); Neonatal Screening; Pavlik Harness; Ultrasonography; Ortolani Sign; Barlow Test; Avascular Necrosis; Infant Hip Dislocation; Orthopaedic Outcomes; Early Diagnosis.*

1. INTRODUCTION

Developmental dysplasia of the hip (DDH) presents a spectrum of hip joint abnormalities.[1–3] These abnormalities range from acetabular dysplasia to frank dislocation - with an incidence of 1–2 per 1,000 live births for dislocated hips and up to 40–60 per 1,000 for milder forms detected by sonography.[4,5] As a paediatric orthopaedic condition with lifelong implications - DDH

requires early identification to enable conservative management and reduce surgical intervention.[4,6,7] The natural history of untreated DDH includes gait abnormalities, hip pain, and early-onset osteoarthritis.[3,8]Left untreated, DDH often culminates in total hip arthroplasty in adulthood.[9–12] Timely neonatal screening is considered critical and typically accomplished using a combination of clinical tests - namely the Ortolani and Barlow manoeuvres and age-guided imaging to detect cases warranting early orthopaedic referral and intervention.[13]

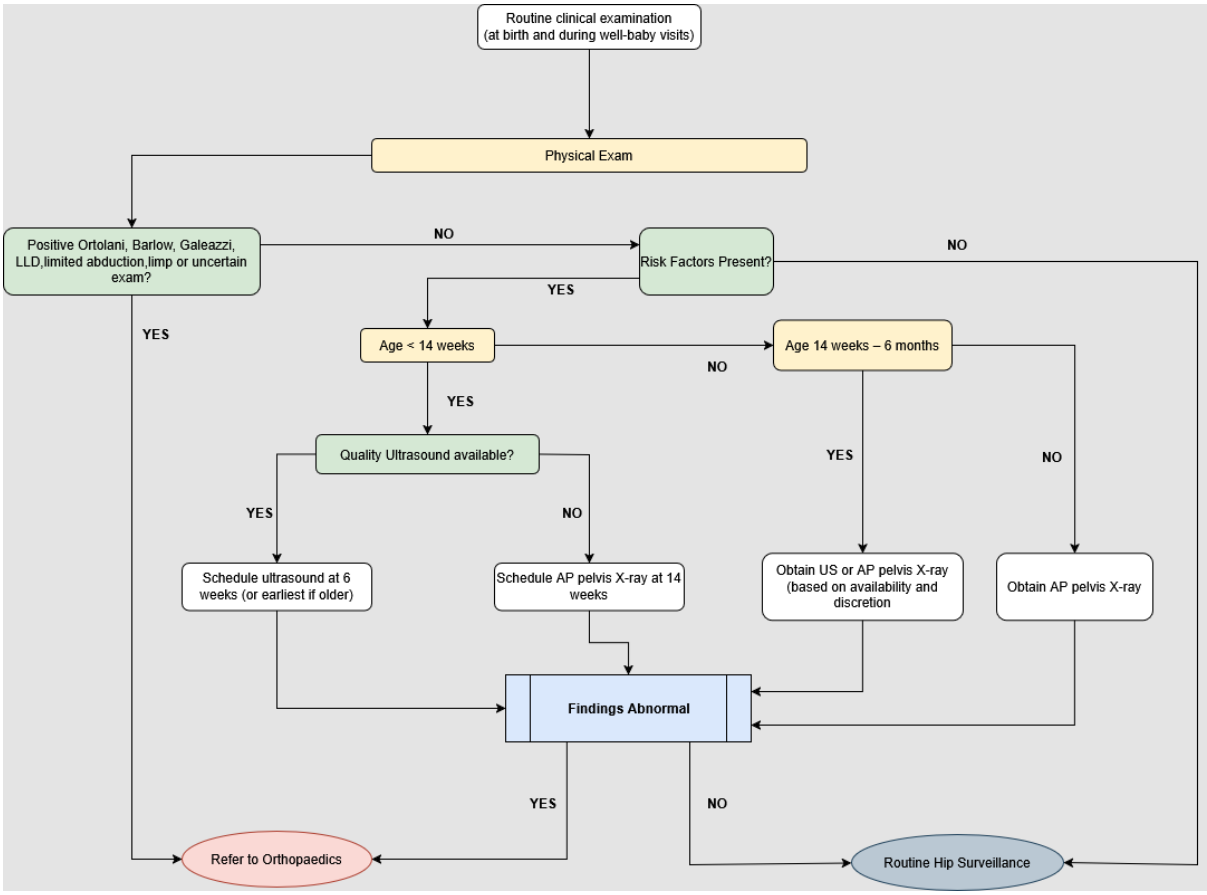
Despite the long-standing use of clinical examination existing evidence highlights its limitations. Studies reviewed by Shehadeh et al. (2022) report poor sensitivity for the Ortolani and Barlow signs, ranging from 7% to 28.3%, although specificity remains high.[14] This indicates the risk of missed diagnoses when clinical screening is used alone in settings without routine imaging. Ultrasonography using the Graf method has become a gold standard in many healthcare systems due to its ability to detect DDH in the early, asymptomatic phase. Yet its widespread adoption remains contested. This is mainly to do with concerns about interobserver variability and overtreatment.[9] Biedermann and Eastwood (2018) argued that universal ultrasound screening can virtually eliminate late presentations and reduce the severity of interventions.[15]

From a policy perspective - global practice varies significantly. Universal ultrasound screening has been embraced in countries like Germany and Austria. Demonstrable reductions in late diagnosis and surgery rates have been observed. In contrast - nations like the UK, US, and India predominantly employ selective screening strategies due to cost and concern over overdiagnosis.[16] The tension between under-diagnosis and over-treatment remains central to ongoing debate. This highlights the need for context-specific and evidence-based protocols that balance clinical benefit with system feasibility.

This review has been written from an orthopaedic standpoint and synthesizes data from nine studies published between 1992 and 2024. Our review includes retrospective case series, prospective cohorts, and a randomized controlled trial - to evaluate the diagnostic yield of neonatal screening and ultrasonography and the efficacy of Pavlik harness treatment in infants with DDH. We sought to offer neonatologists and paediatricians insights into how early detection strategies translated into successful orthopaedic outcomes. The clinical decision-making algorithm (Figure 1) based on the study by Aroojis et al. (2022) illustrates this synthesis and outlines a streamlined and repeatable referral and imaging pathway to guide timely management of DDH across varying clinical settings.[3]

The flowchart (Figure-1) outlines the clinical decision-making pathway for screening and referring infants with suspected developmental dysplasia of the hip (DDH). It begins with routine physical examinations at birth and during well-baby checks. It incorporates clinical signs such as positive Ortolani or Barlow tests, limb length discrepancy or limited abduction. Infants with concerning findings are referred directly to orthopaedics. For those with risk factors but normal exams – E.g., breech presentation, family history of DDH, oligohydramnios, restrictive swaddling or associated musculoskeletal conditions like torticollis or clubfoot - imaging is recommended based on age: ultrasound before 14 weeks or AP pelvis X-ray afterward. Abnormal imaging requires referral; while normal results lead to continued surveillance. This structured approach is widely adopted to ensure timely identification and management of neonatal DDH

Figure 1 - DDH Screening and Referral Pathway



From an orthopaedic perspective, the success of DDH management hinges on the accuracy of neonatal diagnosis and the timely application of the Pavlik harness, yet variability in screening efficacy and treatment outcomes persists.[3] For neonatologists, understanding these orthopaedic outcomes is vital to refine screening protocols and enhance collaboration with orthopaedic specialists. This review, authored from an orthopaedic standpoint, synthesizes evidence from nine studies spanning 1992 to 2024 to evaluate the diagnostic yield of neonatal screening and ultrasonography, and the efficacy of Pavlik harness treatment in infants with DDH. By integrating retrospective case series, prospective cohorts and a randomized controlled trial - we aimed to provide neonatologists with tangible insights into early detection and its influence on orthopaedic success.

Objectives

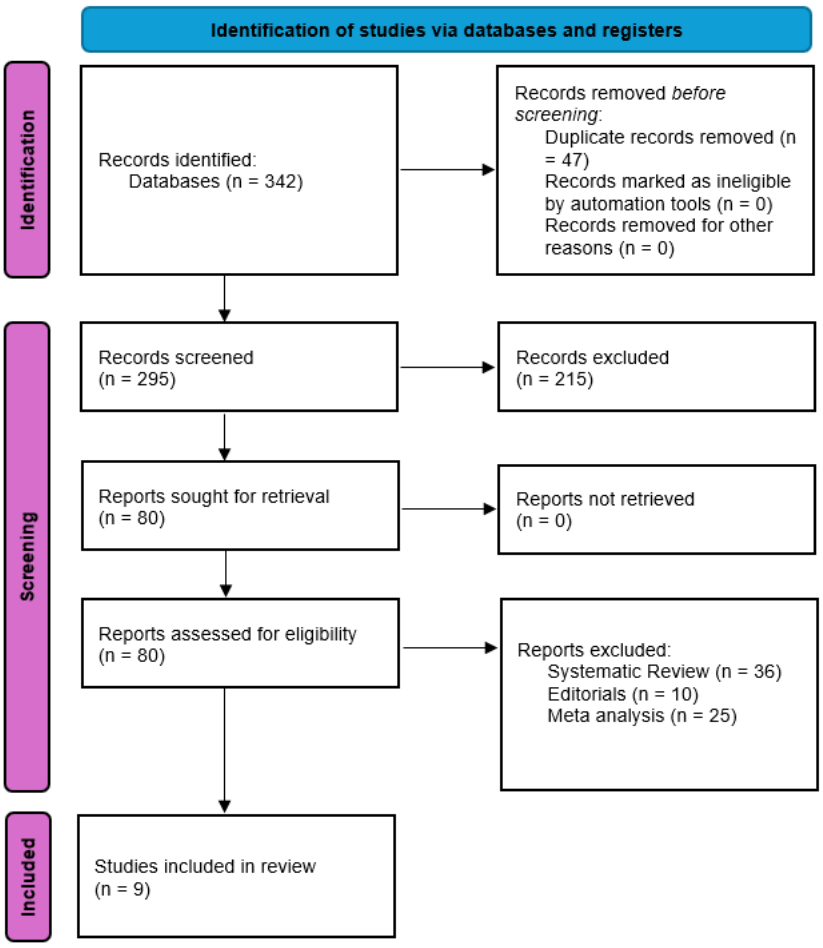
Developmental dysplasia of the hip (DDH) poses a significant challenge in neonatal care, requiring precise diagnosis and effective orthopaedic intervention to prevent long-term morbidity. While neonatal screening and ultrasonography aim to identify DDH early, the Pavlik harness remains the primary conservative treatment, guided by orthopaedic principles. Variability in diagnostic accuracy and treatment outcomes underscores the need for a synthesized evaluation to inform neonatal-orthopaedic collaboration. This review, authored from an orthopaedic perspective, seeks to bridge these domains by assessing key elements of DDH management in neonates.

The primary objective is to evaluate the diagnostic efficacy of neonatal clinical screening and selective ultrasonography in detecting DDH, focusing on sensitivity, specificity, positive predictive value (PPV), and their influence on orthopaedic referral. A secondary objective is to analyze the orthopaedic outcomes of Pavlik harness treatment, examining success rates, predictors of efficacy (e.g., age, Graf type, bilaterality), treatment duration, and complications such as avascular necrosis. By synthesizing evidence from nine primary studies spanning 1992 to 2024, this review aims to elucidate how diagnostic precision in the neonatal period enhances orthopaedic success, particularly with the Pavlik harness. Additionally, it seeks to identify gaps in current practices and provide neonatologists with actionable insights to optimize screening protocols and facilitate timely orthopaedic intervention. Our study intends to strengthen interdisciplinary approaches and ensure early DDH management which is line with both neonatal care priorities and orthopaedic best practices.

2. METHODOLOGY

This review synthesizes evidence on the diagnosis and orthopaedic management of developmental dysplasia of the hip (DDH) in neonates, with a focus on neonatal screening, ultrasonography, and Pavlik harness treatment outcomes. A comprehensive literature search was conducted across multiple databases and included PubMed, Google Scholar and the Cochrane Library - to identify studies published between 1990 to 2025. Search terms included combinations of "developmental dysplasia of the hip" "DDH" "neonatal screening" "ultrasonography" "Pavlik harness" "orthopaedic treatment" and "hip dislocation" with filters applied for human studies and English-language publications.

Figure 2 - PRISMA Flow Chart



The search initially identified **342 studies** based on titles and abstracts. Studies were screened against predefined inclusion criteria: (1) focus on DDH in neonates or infants under 24 months, (2) evaluation of neonatal clinical screening, ultrasonography, or Pavlik harness treatment, and (3) reporting of diagnostic accuracy (e.g., sensitivity, positive predictive value) or treatment outcomes (e.g., success rates, complications). Exclusion criteria were applied iteratively: **215 studies** were eliminated due to non-relevance, as they did not pertain to neonates (e.g., older children or adults) or lacked an orthopaedic focus (e.g., genetic studies without clinical outcomes). Subsequently, **47 studies** were removed as duplicates across databases, identified through identical titles, authors, and DOIs. An additional **72 studies** were excluded because they were reviews, meta-analyses, or editorials lacking original data, as this review prioritized primary research to avoid bias from secondary interpretations.

This process yielded a final set of nine studies for detailed analysis and comprised of retrospective case series (n=3), prospective cohort studies (n=2), a prospective diagnostic test study (n=1), two retrospective cohort study (n=2) and a (RCT) randomized controlled trial (n=1). These studies were selected for their direct relevance to neonatal DDH diagnosis and orthopaedic management with the Pavlik harness. Data was extracted on study design, sample size, diagnostic methods (clinical examination, ultrasonography), treatment specifics (Pavlik harness application, duration) and outcomes (success rates, predictors, complications such as avascular necrosis). Qualitative synthesis was employed to compare findings across

studies to assess both historical and contemporary perspectives on neonatal-orthopaedic collaboration. No formal statistical meta-analysis was performed due to heterogeneity in study designs and outcome measures.

Risk of Bias Assessment for Included Studies

Study	Design	Tool	Bias Domains	Overall RoB
Shen et al. (2024)	Retrospective QI Study	ROBINS-I	Moderate due to selection and detection bias	Moderate
Atalar et al. (2007)	Retrospective Case Series	ROBINS-I	Serious due to no control, selection bias	Serious
Choudry & Paton (2018)	Prospective Diagnostic	QUADAS-2	Moderate – unclear blinding, operator variability	Moderate
Mace & Paton (2015)	Prospective Cohort	ROBINS-I	Low bias in selection and measurement	Low
Pollet et al. (2010)	Retrospective Cohort	ROBINS-I	Serious due to late diagnosis and lack of comparator	Serious
Elbourne et al. (2002)	Randomized Controlled Trial (RCT)	RoB 2	Low in all domains (randomisation, blinding, outcome reporting)	Low
Gahleitner et al. (2024)	Longitudinal Cohort	ROBINS-I	Moderate – loss to follow-up, recall bias	Moderate
Harris et al. (1992)	Retrospective Series	ROBINS-I	Serious – retrospective design, no blinding	Serious
Price et al. (2011)	Prospective Cohort + X-ray Audit	ROBINS-I	Moderate – indirectness of outcomes	Moderate

A formal risk of bias evaluation was performed using study-design appropriate tools. The Cochrane Risk of Bias 2 (RoB 2) tool was used for the included randomized controlled trial (Elbourne et al., 2002), which demonstrated a low risk across all domains including randomization, blinding, and outcome reporting. The ROBINS-I tool was applied to observational studies, including prospective and retrospective cohorts as well as quality improvement and case series designs. Of these, three studies were judged to have some level of risk of bias due to factors such as lack of a comparator group, incomplete follow-up, or retrospective design. The remaining observational studies had moderate to low risk, with Mace & Paton (2015) notably demonstrating low bias through prospective design and clear outcome definitions. The diagnostic accuracy study by Choudry & Paton (2018) was evaluated using the QUADAS-2 framework, which identified moderate risk due to limited blinding and operator variability. Methodological heterogeneity was present and the included studies provided sufficient clarity and relevance to support the systematic review and synthesis.

3. RESULTS

Neonatal Diagnosis: Four studies evaluated the diagnostic yield of neonatal clinical screening and ultrasonography for developmental dysplasia of the hip (DDH), providing critical entry points for orthopaedic management. Mace & Paton (2015) conducted a 15-year prospective study of 201 infants with clinically unstable hips, reporting a clinical screening sensitivity of 62% (95% CI 50.9–74.3), specificity of 99.8% (95% CI 99.7–99.8), and PPV of 24% (95% CI 19.3–33.0). Sonography for Graf type IV hips showed higher sensitivity at 77% (95% CI 66.9–84.6) and a PPV of 49% (95% CI 41.6–68.5), with 36 irreducible dislocations identified (0.57 per 1,000 live births). In contrast, Choudry & Paton (2018), over 4 years with 124 neonates, found a marked decline: clinical sensitivity dropped to 18.5%, specificity remained 99.6%, and PPV fell to 4.0%, while sonographic PPV was 16.1% (20/124 Graf IV hips). Of these, 92 were Graf type I, 12 Graf type II (6 progressing to IV), and 14 Graf type IV at initial assessment.[17,18]

The diagnostic yield includes sensitivity, specificity, PPV, and additional relevant outcomes (e.g., Graf classification, management impact).

Table 1: Diagnostic Yield of Neonatal Screening and Ultrasonography for DDH

Study Author et al. (Year)	Study Type	Focus	Screening Sensitivity	Screening Specificity	Screening PPV	Sonographic Impact	Radiologic Abnormalities	Splinting Reduction	Additional Outcomes
Mace & Paton (2015)[18]	Prospective Cohort Study	Clinical screening and sonography in 201 infants	Clinical: 62% (95% CI 50.9–74.3); Sonographic: 77% (95% CI 66.9–84.6)	99.8% (95% CI 99.7–99.8)	Clinical: 24% (95% CI 19.3–33.0); Sonographic: 49% (95% CI 41.6–68.5)	N/A	N/A	N/A	36 irreducible dislocations (0.57/1,000 live births)
Choudry & Paton (2018)[17]	Prospective Cohort Study	Clinical screening and sonography in 124 neonates	Clinical: 18.5%	99.6%	Clinical: 4.0%; Sonographic: 16.1% (20/124 Graf IV)	N/A	N/A	N/A	Graf outcomes: 92 type I, 12 type II (6 progressed to IV), 14 type IV
Ashby & Roposch (2015)[1]	Prospective Diagnostic Test Study	Sonography's diagnostic impact in 66 hips	N/A	N/A	N/A	Confidence gain 19.4%; Diagnosis changed 52%; Management altered 32%	N/A	N/A	None
Elbourne et al. (2002)[19]	Randomized Controlled Trial	Ultrasonography vs. clinical assessment in 629 infants	N/A	N/A	N/A	N/A	21/314 vs. 21/315 (RR 1.00, 95% CI 0.56–1.80)	RR 0.78 (95% CI 0.65–0.94, p=0.01)	None
Shen et al. (2023)[20]	Retrospective Cohort Study	Screening bundle impact in 5,663 newborns	Diagnosis rate: 0.48/1,000 (pre) vs. 3.5/1,000 (post); Early diagnosis: 50% (pre) vs. 69% (post); Screening uptake: 0.78% (pre) vs. 33.4% (post); Mean screening age: 101.6 vs. 39 days						

Ashby & Roposch (2015) assessed sonography's diagnostic impact in 66 hips, reporting a 19.4% gain in diagnostic confidence and a change in diagnosis in 52% of cases, with management altered in 32% (e.g., initiating or avoiding treatment).[1] Elbourne et al. (2002), in a randomized controlled trial (RCT) of 629 infants, compared ultrasonography plus clinical assessment (n=314) to clinical assessment alone (n=315). By age 2, 21 infants in each group had radiologic abnormalities (RR 1.00, 95% CI 0.56–1.80), but ultrasonography reduced abduction splinting rates (RR 0.78, 95% CI 0.65–0.94, p=0.01), suggesting refined treatment decisions without increased pathology.[19]

The retrospective cohort study by Shen et al. (2023) evaluated the impact of a quality improvement screening bundle for developmental dysplasia of the hip (DDH) implemented in May 2022 at a level III children's hospital in Taiwan.[20] Comparing 2,843 newborns screened pre-bundle (May 2021–April 2022) with 2,820 post-bundle (May 2022–April 2023), the diagnosis rate increased from 0.48/1,000 to 3.5/1,000, with the early diagnosis rate (<6 months) rising from 50% to 69%. Screening sonography uptake surged from 0.78% (22/2,843) to 33.4% (942/2,820, p<0.001), with the mean age at ultrasound decreasing from 101.6 ± 52.6 days to 39 ± 36.4 days (p<0.001). Pavlik harness use rose from 0.04% (1/2,843) to 0.28% (8/2,820, p<0.001), while surgical interventions dropped from 0.04% (1/2,843) to 0% (p<0.001), demonstrating enhanced early

detection and conservative management efficacy post-bundle.[20]

Orthopaedic Management with the Pavlik Harness: The Pavlik harness, a cornerstone of conservative DDH treatment, leverages controlled flexion and abduction to reduce hip instability in neonates and infants. This subsection evaluates its efficacy, drawing on five primary studies and supplementary data from two others, encompassing 1,005 hips. Key outcomes include success rates, treatment duration, predictors of efficacy, and complications such as avascular necrosis (AVN), critical for orthopaedic decision-making and neonatal care collaboration. Table 2 synthesizes these findings, highlighting how orthopaedic management optimizes outcomes following neonatal diagnosis, with implications for treatment protocols and referral pathways.

Table 2: Outcomes of Pavlik Harness Treatment for DDH

Study Author et al. (Year)	Study Type	Focus	Success Rate	Treatment Duration	Predictors of Success	Complications	Failure Indicators	Additional Outcomes
Gahleitner et al. (2024)[21]	Retrospective Cohort Study	Long-term outcomes in 203 hips (152 patients)	97.2% (197/203 hips)	8-12 weeks (mean)	N/A	Residual dysplasia 2.81% (5/178); AVN 0%	N/A	Follow-up 20.46 years mean
Harris et al. (1992)[22]	Retrospective Case Series	Pavlik harness in 720 hips (550 infants)	86% initial (619/720); 81% by age 2 (584/720)	N/A	N/A	Residual dysplasia 9% initial, 5% by age 2; AVN 0.7% (5/720)	No reduction after 2-4 weeks	None
Pollet et al. (2010)[23]	Retrospective Case Series	Pavlik harness in 26 hips (24 infants, 6-24 months)	46% (12/26 hips)	14 weeks (mean, range 4-28)	Graf type 3 (60%) vs. 4 (0%, p=0.035)	AVN 0% in successes; 11.5% (3/14) in failures	No reduction after 6 weeks	Age at start 9 months mean
Atalar et al. (2007)[24]	Retrospective Case Series	Pavlik harness in 31 hips (25 infants, <6 months)	58% (18/31 hips)	8 weeks (median, range 5-11)	Age <7 weeks (p=0.038); Graf IIc/IId/III vs. IV (p=0.008); Unilateral vs. bilateral (p=0.032)	AVN 0% in successes	No reduction by 3 weeks	None
Choudry & Paton (2018)[17]	Prospective Cohort Study	Screening and treatment in 124 neonates	65% (13/20 Graf IV hips)	N/A	N/A	N/A	35% (7/20) required surgery (1 closed, 6 open)	Graf IV focus; broader study context
Elbourne et al. (2002)[19]	Randomized Controlled Trial	Ultrasonography vs. clinical assessment in 629 infants	N/A	N/A	N/A	N/A	N/A	Splinting reduced (RR 0.78, 95% CI 0.65–0.94, p=0.01); not Pavlik-specific

Below Figure-3 illustrates the treatment duration of Pavlik harness therapy for developmental dysplasia of the hip (DDH) across three retrospective studies. Gahleitner et al. (2024) reported an average duration of 10 weeks (range 8–12) in 203 hips,

reflecting a standardized approach yielding a 97.2% success rate.[21] Pollet et al. (2010) documented a longer mean of 14 weeks (range 4–28) in 26 hips of older infants (6–24 months), correlating with a lower 46% success rate.[23] Atalar et al. (2007) observed a median of 8 weeks (range 5–11) in 31 hips and achieved 58% success in infants under 6 months.[24]

Figure 3 - Treatment Durations

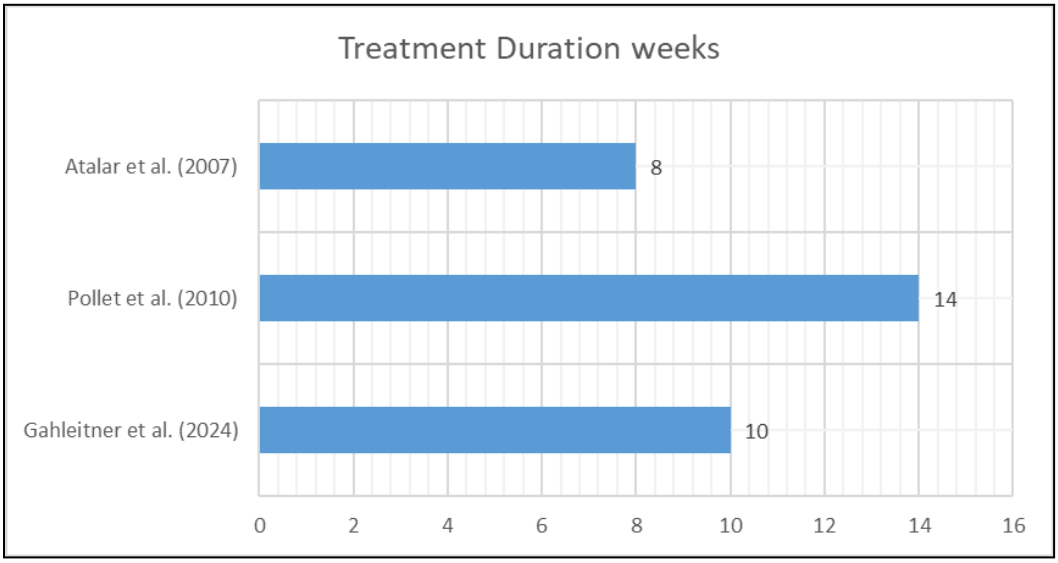
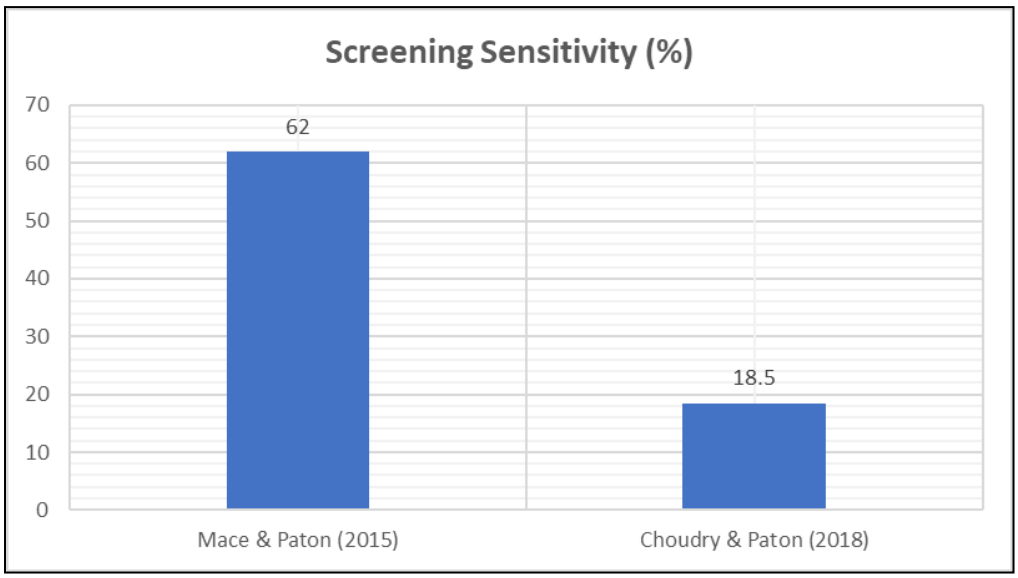


Figure-1 presents the clinical screening sensitivity for detecting developmental dysplasia of the hip (DDH) in neonates across two prospective cohort studies. Mace & Paton (2015) reported a sensitivity of 62%. This indicated moderate efficacy in identifying clinically unstable hips within a cohort of 201 infants.[18]

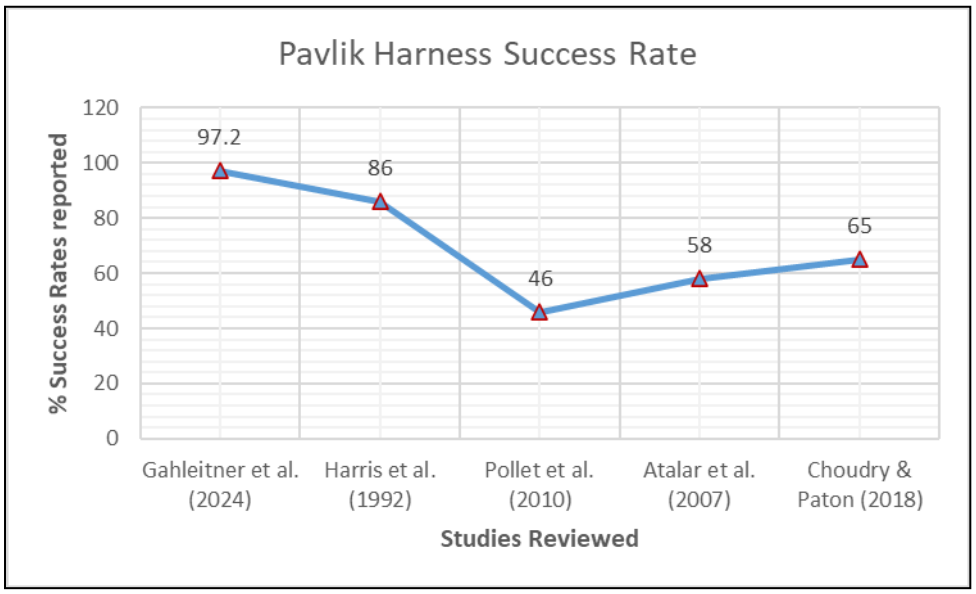
Figure 4 - Screening Sensitivity Comparison



Whereas, Choudry & Paton (2018) documented a lower sensitivity of 18.5% among 124 neonates, suggesting reduced diagnostic accuracy over a later study period. [17]

Figure-2 summarizes the efficacy of Pavlik harness treatment for DDH across five studies, expressed as the percentage of hips successfully reduced. Gahleitner et al. (2024) achieved a 97.2% success rate in 203 hips and indicated exceptional long-term outcomes.[21]

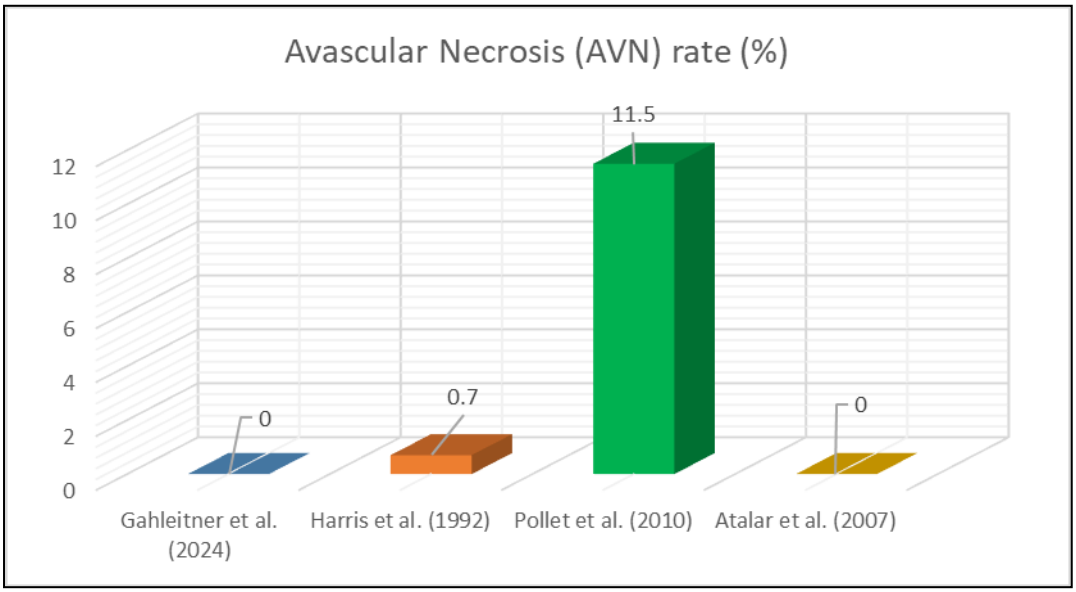
Figure 5 - Success Rates of Pavlik Harness in reviewed studies



Harris et al. (1992) reported an initial success rate of 86% in 720 hips ; while Pollet et al. (2010) recorded 46% in 26 hips - due to an older cohort (6-24 months).[22,23] Atalar et al. (2007) documented 58% success in 31 hips and Choudry & Paton (2018) achieved 65% in 20 Graf IV hips.[17,24] These results highlight the harness's variable effectiveness - influenced by patient and study characteristics.

The Figure below summarizes the incidence of avascular necrosis (AVN) as a complication of Pavlik harness treatment for developmental dysplasia of the hip (DDH) across four studies. Gahleitner et al. (2024) and Atalar et al. (2007) reported an AVN rate of 0% in 203 and 31 hips, respectively/ They indicated minimal risk in their cohorts of neonates and infants under 6 months.[21,24]

Figure 6 - AVN Rates



Harris et al. (1992) observed a low rate of 0.7% (5/720 hips) in a large series of 550 infants.[22] They observed rare occurrences over an extended follow-up. Pollet et al. (2010) documented a higher rate of 11.5% (3/14) among failures in 26 hips of older infants (6–24 months) and highlighted increased risk with delayed treatment.[23]

4. DISCUSSION

Our review highlights the complexity and critical importance of early diagnosis and effective orthopaedic management in developmental dysplasia of the hip (DDH). Despite longstanding reliance on clinical screening and ultrasonography - our synthesis indicated variability in diagnostic accuracy and treatment efficacy - with implications for both neonatal care and orthopaedic intervention strategies.

Clinical screening remains critical in DDH detection; yet its sensitivity is inconsistent. The observed decline in sensitivity from 62% in earlier cohorts (Mace & Paton, 2015) to just 18.5% in later ones (Choudry & Paton, 2018) raises concerns about over-reliance on clinical manoeuvres alone - in the absence of palpable instability.[17,18] Specificity remained high across studies and confirmed the value of a positive clinical finding. Ultrasonography significantly enhanced diagnostic confidence for identifying Graf type IV hips ; but its utility is context-dependent. The diagnostic impact observed by Ashby & Roposch (2015) - where management changed in 32% of cases and the reduction in abduction splinting demonstrated by Elbourne et al. (2002) - helped to refine treatment without increasing long-term pathology.[1,19]

Screening interventions such as the quality improvement bundle analyzed by Shen et al. (2023) offered a promising model. Their study demonstrated not only improved early detection and increased Pavlik harness use - but also a complete elimination of surgical interventions post-implementation. These results suggested that structured screening protocols can close diagnostic gaps and optimize non-operative outcomes. This is in line with both neonatology and orthopaedic goals.[20]

The Pavlik harness is a mainstay in conservative DDH treatment ; yet its success is closely tied to early initiation, patient age and dysplasia severity. Success rates ranged widely across studies - from 97.2% in Gahleitner et al. (2024)[21] to just 46% in older infants in Pollet et al. (2010)[23] – and highlighted the importance of age and Graf classification as predictors of positive outcomes. The absence of avascular necrosis (AVN) in successful treatments further validated its safety when applied judiciously. Higher AVN rates in failed treatments (e.g., Pollet et al., 2010) indicated the risks associated with delayed intervention or persistent instability.[23]

The variability in outcomes also showed broader challenges in standardizing DDH management across institutions. Differences in diagnostic criteria, harness protocols and follow-up timing limit direct comparison. In essence, this review supported a collaborative, interdisciplinary approach to DDH. For neonatologists - orthopaedic thresholds for referral and treatment is crucial. For orthopaedists - neonatal screening limitations can influence shared decision-making. By adopting early detection and timely and evidence-based intervention – it becomes feasible to reduce long-term morbidity and avoid surgery.

This review builds upon and expands the existing literature through a structured synthesis of DDH screening and orthotic treatment outcomes. In contrast to Birkett et al. (2024), who systematically analyzed 18 UK-based studies for compliance with national guidelines but offered limited treatment data, the present review evaluates both diagnostic yield and Pavlik harness effectiveness across 9 studies.[25] Sewell & Eastwood (2011) provided a wide-ranging narrative review of DDH diagnostics and orthosis use but lacked systematic methodology or risk of bias assessment.[26] More recently, Marletta et al. (2025) conducted a comprehensive meta-analysis of 22 studies, reporting a pooled Pavlik harness success rate of 88.8% when initiated before 3 months, compared to just 32% when started after 6 months.[27] Their complication rates—AVN at 0.89% (<3 months) vs. 9.66% (3–6 months) indicated the importance of early treatment. Marletta et al. quantified timing-outcome relationships[27] - while our review complemented this with a broader focus on screening accuracy (clinical sensitivity 18.5–62%) and real-world flowchart applications and supported by formal risk of bias assessment (RoB 2, ROBINS-I, QUADAS-2). Taken together - this review offered practical value for clinical decision-making across the screening-to-treatment continuum.

We recommend that future studies could aim to (A) refine screening algorithms (B) identify biomarkers or clinical predictors of treatment failure and (C) explore the long-term functional outcomes of early conservative treatment.

5. CONCLUSION

Early and accurate diagnosis of neonatal and developmental dysplasia of the hip (DDH) is essential for orthopaedic management and avoid long-term complications. This review observed the limitations of clinical screening alone and strengthened the value of ultrasonography - when combined with structured protocols. The Pavlik harness remained an effective and safe treatment when initiated early - with outcomes influenced by age and dysplasia severity. Collaboration between neonatology and orthopaedics is key to improving early detection and optimizing conservative treatment or surgical interventions

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