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From Aches to Answers: Understanding and Managing Hip Joint Issues in Kids

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Abstract.

Introduction: Joint pain is a prevalent concern among pediatricians, orthopedists, and general practitioners, affecting up to 50% of children during childhood. The hip joint is particularly vulnerable, with degenerative diseases of the hip joints (DDHJ) being the leading cause of pediatric orthopedic visits. Various conditions, such as developmental dysplasia of the hip (DDH), Legg-Calve-Perthes Disease (LCPD), and slipped capital femoral epiphysis (SCFE), contribute to the spectrum of hip joint disorders in children.

Material and methods: We have gathered the available materials and scientific reports, analyzing and summarizing them in a single study.

Aim of study: This study aims to explore the etiology, diagnosis, and management of hip joint pain in children, focusing on DDH, LCPD, SCFE, and other related conditions. By examining the risk factors, clinical presentations, and current treatment strategies, the study seeks to enhance the understanding and early detection of these disorders, ultimately improving patient outcomes.

Conclusion: Hip joint pain in children encompasses a broad differential diagnosis, ranging from self-limiting conditions like transient synovitis to serious disorders such as septic arthritis and JIA. Early identification and appropriate management of conditions like DDH, LCPD, and SCFE are crucial in preventing long-term complications. While physical activity is generally safe, intense exercise may increase the risk of musculoskeletal pain. A multidisciplinary approach, supported by further research, is essential for effective pain management and treatment optimization in pediatric patients.

Keywords. Developmental dysplasia of the hip; hip joint pain; musculoskeletal pain; musculoskeletal diseases in children.

The main syndrome- pain.

Joint pain is a frequent symptom encountered by pediatricians, orthopedists, and general practitioners in children and adolescents. Musculoskeletal pain affects an estimated 25% to 50% of children throughout childhood [4] and among the various joints, the hip joint is often the most affected, with an annual incidence rate of 148.1 per 100,000 children [1]. The differential diagnosis for hip pain in children is extensive, encompassing conditions that may not primarily involve the musculoskeletal system. While many cases are benign and resolve on their own, there are instances where a rare diagnosis could lead to significant long-term morbidity or even mortality, if not identified early and managed properly [1,3]. Degenerative diseases of the hip joints (DDHJ) are the most common reason for visits to a pediatric orthopedist [2]. Based on the widely accepted classification degenerative diseases of the hip joints (DDHJ) in children encompass the following [2,5]:

1) Diseases with a genetic/congenital predisposition- hip dysplasia.
2) Diseases acquired during the growth period- Legg-Calve-Perthes Disease.
3) Diseases of a traumatic nature- slipped capital femoral epiphysis (SCFE).

Developmental dysplasia of the hip.

Developmental dysplasia of the hip (DDH) is among the most prevalent musculoskeletal disorders in newborns [6]. Based on US statistics, the incidence of developmental dysplasia of the hip is about 10 per 1,000 live births, with approximately 1 in 1,000 newborns presenting with a dislocated hip at birth [7]. In addition, hip dysplasia is the leading cause of hip arthritis in women under 40 and accounts for 5% to 10% of all total hip replacements in the United States [8].

The risk factors for developmental dysplasia of the hip include being female, breech position, family history, certain swaddling practices, limited space in the womb, and being born post-term. [7]. Al of those should lead to a clinical screening, which includes two primary tests performed in the first days of a newborn's life: the Ortolani test and the Barlow test [7,8] [Figure 1,2]. To understand the rationale for performing these tests, it is important to review the pathogenesis of the disease.

Proper development of the femoral head and acetabulum requires that the femoral head be securely positioned in the hip socket. If the head is loose or either structure is underdeveloped, the hip joint may become misaligned and misshapen. Looseness is often termed instability or

subluxation, while structural deformities are referred to as dysplasia; however, some view instability itself as dysplasia. Subluxation can be static, with the head partially uncovered without stress, or dynamic, where the hip partially dislocates under stress [2,8]. The Ortolani maneuver is the main test for detecting hip dysplasia in newborns. It involves the examiner gently moving the hip to push a dislocated or partially dislocated femoral head back into the socket. On the other hand, the Barlow maneuver checks for hip looseness by gently moving the hip to see if a properly positioned femoral head becomes dislocated or partially dislocated. While both tests are used together in assessing an infant's hip, the Ortolani maneuver is considered more significant. Mild instability and variations in hip shape at birth are sometimes viewed as abnormal and the physical examination is supplemented with an ultrasound [8,9,11]. The key factors to assess are the coverage of the femoral head by the acetabulum, which should be at least 50%, and the depth of the bony acetabulum, measured by the alpha angle. An alpha angle greater than 60° is considered normal [7,9]. Some authors suggest the benefits of introducing routine hip ultrasound screening, as it is linked to earlier diagnosis, earlier treatment, and improved outcomes [9,11].

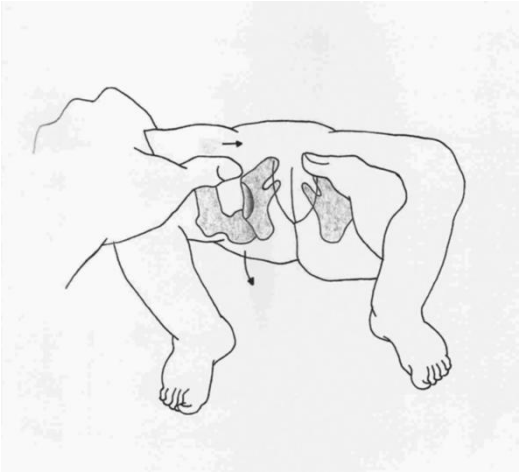

Figure 1. The Barlow maneuver- provocation of hip dislocation.
Link: https://podyplomie.pl/pediatria/12162,jak-sie-wykonuje-badanie-przesiewowe-stawow-biodrowych-u-noworodkow-i-niemowlat?

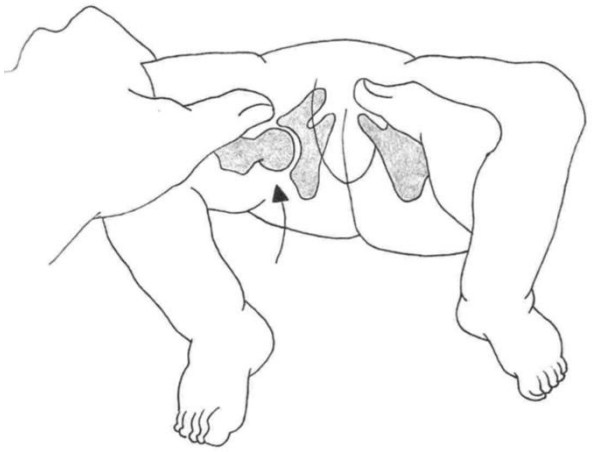

Figure 2. The Ortolani maneuver- provocation of femoral head reposition into the acetabulum during hip abduction.
Link: https://podyplomie.pl/pediatria/12162,jak-sie-wykonuje-badanie-przesiewowe-stawow-biodrowych-u-noworodkow-i-niemowlat?

Legg-Calve-Perthes Disease.

Among degenerative diseases acquired during the growth period, LCPD is the most common [2]. It is a condition where the femoral head loses blood supply, causing limping and pain, particularly after activity [12,13]. The exact cause is unknown but may involve repetitive trauma, developmental delays, or blood flow issues [14,15]. The disease commonly affects

children aged 4-8 and is more prevalent in males [13]. Diagnosis is based on physical exams and imaging, with the Waldenström classification used to stage the disease [16,17]. Treatment focuses on maintaining hip joint alignment through physical therapy, activity restriction, or surgery. Prognosis depends on the extent of femoral head damage and early intervention, with most treatments yielding positive results [18]. Further research is needed to improve understanding and management of LCPD.

Slipped capital femoral epiphysis.

SCFE is one of the most common hip joint disorders among children aged 9 to 15 years [2]. The causes of SCFE are believed to be multiple, including factors like obesity, rapid growth during puberty, and, less commonly, hormonal disorders. About 63% of affected children have a weight at or above the 90th percentile [2,19,20]. Hormonal conditions such as hypothyroidism, hypogonadism, growth hormone treatment, and hypopituitarism are also associated with SCFE. An underlying endocrine disorder should be suspected in children with unusual presentations, such as those who are very young or older than typical, underweight, or have short stature [19]. During a physical examination, the patient may display an antalgic gait or be unable to bear weight in cases of a severe slip. The most indicative sign is restricted internal rotation of the hip. Additionally, obligatory external rotation, known as the Drehmann sign, is observed in the affected hip of SCFE patients when the hip is passively flexed to 90 degrees [19]. As it comes to the treatment, currently, there are no evidence-based recommendations [21]. Some authors suggest that surgical treatment is crucial for SCFE to relieve pain, restore cartilage, and stabilize the femoral neck. Central epiphysiodesis is used for stable SCFE, while active osteotomies, like the Dunn procedure, are preferred for unstable cases despite a higher risk of avascular necrosis [2,19-22].

Transient synovitis

Transient synovitis is an acute inflammatory process affecting the synovial membrane of the joints, primarily in children, and typically presents as hip pain. It is a mild, self-limiting condition. Although the exact cause remains unknown, various theories suggest the following risk factors: prior upper respiratory infection, preceding bacterial infection, poststreptococcal toxic synovitis, and previous trauma. The condition most commonly affects children aged 3 to 10 years, with an incidence rate that is twice as high in boys compared to girls. [23] The primary cause of pain is the stretching of the joint capsule due to fluid accumulation in the joint. An ultrasound-guided hip aspiration is both a useful diagnostic tool and a therapeutic procedure. It helps to relieve pain and restore movement while also allowing differentiation from septic arthritis of the hip.[24] A critical aspect is the differential diagnosis with other joint disorders, the Kocher criteria are used for this purpose [25] Treatment primarily involves rest and avoiding stress on the joint. Pain management includes the use of NSAIDs. Symptoms typically resolve completely within 1 to 2 weeks. For patients whose condition does not

improve, further evaluation and possible hospitalization should be considered to explore alternative diagnoses. [23,26]

Juvenile idiopathic arthritis

Juvenile idiopathic arthritis (JIA) is one of the most common rheumatic diseases of unknown etiology in children. It is categorized into systemic and oligoarticular types. The disease can lead to growth delay, osteoporosis, and macrophage activation syndrome (MAS), which is one of the most serious complications and can result in multiorgan failure. [27] Disease-modifying treatment includes methotrexate therapy combined with corticosteroids, sulfasalazine (especially for enthesitis), and leflunomide may also play a secondary role. In patients that are resistant to standard treatment, biological treatment should be applied, such as TNF inhibitors, IL-1 inhibitors.[28,29]

Septic arthritis of hip

Septic arthritis of the hip is a rare but urgent condition that requires immediate diagnosis and treatment.[30] Kocher criteria for quickly assessing patients include: ESR greater than 40, fever above 38.5°C, WBC count exceeding 12,000, and inability to bear weight on the joint. The risk of septic arthritis is 3% if one criterion is met, 40% if two are met, 93% if three are met, and 99% if all four criteria are met. [31]. The most affected patients are younger than two years of age [32]. Immunosupression is often a factor that can increase probability of developing disease. It can lead to destruction of hip and sepsis. Upper respiratory tract infection precedes the illness in 80% of cases. The disease is of bacterial origin, with coccobacillus Kingella kingae being the primary pathogen (70% of cases), about 10% being Staphylococcus [31]. Clinical symptoms are nonspecific, which complicates diagnosis. Imaging techniques such as ultrasound are used for early detection, while MRI is employed in more challenging cases. Treatment typically involves hip aspiration, arthrotomy, and arthroscopy, combined with antibiotic therapy. Rapid intervention is crucial for achieving the best treatment outcomes. [30] The treatment consists of short intravenous antibiotic therapy followed by an oral 3 week therapy. In more severe cases intravenous therapy should last for 4 to 6 weeks. Additionally, for pain management, NSAIDs should be considered.[32,33]

Chronic musculoskeletal pain and physical activity.

Chronic musculoskeletal pain is a significant issue in modern medicine. It is often not precisely diagnosed but has a negative impact on the physical and mental health of children and their families. Chronic pain also represents a substantial financial burden on the economy; according to a study conducted in the UK, the

estimated cost of chronic pain in adolescents was £3.84 billion Chronic pain is most common at age 14, and often begins in one area before spreading, leading to reduced mobility and fitness due to avoidance behaviors. Studies show that 83% of school-aged children experience pain, with 30.8% suffering from pain lasting over six months, primarily musculoskeletal pain (64%). Girls report more pain than boys, and children from low-education, low-income families face a 1.4-fold higher risk of pain.Effective management of childhood pain is challenging due to insufficient evidence on treatment efficacy. Pain management should include multidisciplinary approaches, as current medications such as tricyclic antidepressants, NSAIDs, opioids, and anticonvulsants show variable success. Comprehensive research and systematic reviews are needed to establish effective treatments, and careful management of medication use is essential. [34,35] In healthy children, research suggests that moderate physical activity is not associated with a higher frequency of musculoskeletal pain and injuries. However, intense physical activity is linked to an increased occurrence and severity of pain in children aged 8-12 years. There is a lack of detailed data on this relationship, and further studies should be conducted.[36]

Conclusion.

Pediatric hip pain is a complex and multifaceted issue, often presenting in young athletes and active children. Conditions such as developmental dysplasia of the hip (DDH), Legg-Calve-Perthes Disease (LCPD), and slipped capital femoral epiphysis (SCFE) require timely diagnosis and targeted interventions to prevent long-term complications. While some cases of hip pain may resolve spontaneously, others necessitate a multidisciplinary approach, combining physical therapy, medical management, and in some instances, surgical intervention. Early identification and treatment of hip disorders can help young patients maintain mobility and an active lifestyle, reducing the risk of chronic pain and disability in the future.

Continued research and education are needed to enhance diagnostic accuracy and develop more effective treatment protocols. By raising awareness among healthcare providers, coaches, and parents, we can better support the health and well-being of children, allowing them to stay active and thrive.

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References.

1. Yagdiran, A., Zarghooni, K., Semler, J. O., & Eysel, P. (2020). Hip pain in children. *Deutsches Ärzteblatt international*, *117*(5), 72.
2. Rubashkin, S. A., Sertakova, A. V., Dohov, M. M., & Timaev, M. C. (2018). Degenerative hip disorders in children. *Pediatric Traumatology, Orthopaedics and Reconstructive Surgery*, *6*(3), 78-86.
3. Sen, E. S., Clarke, S. L., & Ramanan, A. V. (2014). The child with joint pain in primary care. *Best practice & research. Clinical rheumatology*, *28*(6), 888–906. https://doi.org/10.1016/j.berh.2015.04.008
4. El-Metwally, A., Salminen, J. J., Auvinen, A., Kautiainen, H., & Mikkelsson, M. (2004). Prognosis of non-specific musculoskeletal pain in preadolescents: a prospective 4-year follow-up study till adolescence. *Pain*, *110*(3), 550–559. https://doi.org/10.1016/j.pain.2004.03.021
5. Karout, L., & Naffaa, L. (2022). Pediatric Hip Disorders: Imaging Guidelines and Recommendations. *Radiologic Clinics of North America*, *60*(1), 149-163.
6. Lyons, D. K., Urban, M. K., & Janicki, J. A. (2023). Developmental Dysplasia of the Hip (DDH). In *Orthopaedics for the Newborn and Young Child: A Practical Clinical Guide* (pp. 89-102). Cham: Springer International Publishing.
7. Nandhagopal T, Tiwari V, De Cicco FL. Developmental Dysplasia of the Hip. [Updated 2024 May 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563157/
8. Shaw, B. A., Segal, L. S., Otsuka, N. Y., Schwend, R. M., Ganley, T. J., Herman, M. J., ... & Smith, B. G. (2016). Evaluation and referral for developmental dysplasia of the hip in infants. *Pediatrics*, *138*(6).
9. Davids, J. R. (2018). Management of neuromuscular hip dysplasia in children with cerebral palsy: lessons and challenges. *Journal of Pediatric Orthopaedics*, *38*, S21-S27.
10. Laborie, L. B., Markestad, T. J., Davidsen, H., Brurås, K. R., Aukland, S. M., Bjørlykke, J. A., ... & Rosendahl, K. (2014). Selective ultrasound screening for developmental hip dysplasia: effect on

management and late detected cases. A prospective survey during 1991–2006. *Pediatric radiology*, *44*, 410-424.
11. Clarke, N. M., Taylor, C. C., & Judd, J. (2016). Diagnosis and management of developmental hip dysplasia. *Paediatrics and Child Health*, *26*(6), 252-256.
12. Rampal V, Clément JL, Solla F. Legg-Calvé-Perthes Disease: Classifications and prognostic Factors.; 2017. https://doi.org/10.11138/ccmbm/2017.14.1.074
13. Pavone V, Chisari E, Vescio A, Lizzio C, Sessa G, Testa G. Aetiology of Legg-Calvé-Perthes disease: A systematic review. World J Orthop. 2019;10(3):145-165. https://doi.org/10.5312/wjo.v10.i3.145
14. Nelitz M, Lippacher S, Krauspe R, Reichel H. Perthes Disease Current Principles of Diagnosis and Treatment. Dtsch Arztebl. 2009;106(31-32):517-523. https://doi.org/10.3238/arztebl.2009.0517
15. Spasovski V, Srzentić Dražilov S, Nikčević G, et al. Molecular Biomarkers in Perthes Disease: A Review. Diagnostics. 2023;13(3). https://doi.org/10.3390/diagnostics13030471
16. Yagdiran A, Zarghooni K, Semler JO, Eysel P. Hip pain in children. Dtsch Arztebl Int. 2020;117(5):72-82. https://doi.org/10.3238/arztebl.2020.0072
17. Jamil K, Walker T, Onikul E, Munns CF, Little DG. A comparison of subtraction MRI with the standard contrast-enhanced imaging in perthes' disease. J Child Orthop. 2019;13(1):82-88. https://doi.org/10.1302/1863-2548.13.180136
18. Caldaci A, Testa G, Dell'Agli E, et al. Mid–Long-Term Outcomes of Surgical Treatment of Legg-Calvè-Perthes Disease: A Systematic Review. Children. 2022;9(8). https://doi.org/10.3390/children9081121
19. Peck, D. M., Voss, L. M., & Voss, T. T. (2017). Slipped capital femoral epiphysis: diagnosis and management. *American Family Physician*, *95*(12), 779-784.
20. Perry, D. C., Metcalfe, D., Lane, S., & Turner, S. (2018). Childhood obesity and slipped capital femoral epiphysis. *Pediatrics*, *142*(5).
21. Aprato, A., Conti, A., Bertolo, F., & Massè, A. (2019). Slipped capital femoral epiphysis: current management strategies. *Orthopedic Research and Reviews*, 47-54.
22. Thawrani, D. P., Feldman, D. S., & Sala, D. A. (2016). Current practice in the management of slipped capital femoral epiphysis. *Journal of Pediatric Orthopaedics*, *36*(3), e27-e37.
23. Whitelaw CC, Varacallo M. Transient Synovitis. In: StatPearls. Treasure Island (FL): StatPearls Publishing; March 1, 2024.
24. Liberman B, Herman A, Schindler A, Sherr-Lurie N, Ganel A, Givon U. The value of hip aspiration in pediatric transient synovitis. J Pediatr Orthop. 2013;33(2):124-127. doi:10.1097/BPO.0b013e31827268b8
25. Ryan DD. Differentiating Transient Synovitis of the Hip from More Urgent Conditions. Pediatr Ann. 2016;45(6):e209-e213. doi:10.3928/00904481-20160427-01
26. Steen EA, Phillips SA. Transient synovitis associated with leuprolide depot (Lupron). Endocrinol Diabetes Metab Case Rep. 2024;2024(3):24-0031. Published 2024 Aug 16. doi:10.1530/EDM-24-0031
27. Barut K, Adrovic A, Şahin S, Kasapçopur Ö. Juvenile Idiopathic Arthritis. Balkan Med J. 2017;34(2):90-101. doi:10.4274/balkanmedj.2017.0111
28. Viswanathan V, Murray KJ. Management of Children with Juvenile Idiopathic Arthritis. Indian J Pediatr. 2016;83(1):63-70. doi:10.1007/s12098-015-1966-1
29. Barut K, Adrovic A, Sahin S, et al. Prognosis, complications and treatment response in systemic juvenile idiopathic arthritis patients: A single-center experience. Int J Rheum Dis. 2019;22(9):1661-1669. doi:10.1111/1756-185X.13649

30. Nannini A, Giorgino R, Bianco Prevot L, et al. Septic arthritis in the pediatric hip joint: a systematic review of diagnosis, management, and outcomes. Front Pediatr. 2023;11:1311862. Published 2023 Dec 21. doi:10.3389/fped.2023.1311862
31. Habusta SF, Mabrouk A, Gregush RE. Septic Arthritis of the Pediatric Hip. In: StatPearls. Treasure Island (FL): StatPearls Publishing; August 14, 2023.
32. Cohen E, Katz T, Rahamim E, et al. Septic arthritis in children: Updated epidemiologic, microbiologic, clinical and therapeutic correlations. Pediatr Neonatol. 2020;61(3):325-330. doi:10.1016/j.pedneo.2020.02.006
33. Castellazzi L, Mantero M, Esposito S. Update on the Management of Pediatric Acute Osteomyelitis and Septic Arthritis. Int J Mol Sci. 2016;17(6):855. Published 2016 Jun 1. doi:10.3390/ijms17060855
34. Clinch J, Eccleston C. Chronic musculoskeletal pain in children: assessment and management. Rheumatology (Oxford). 2009;48(5):466-474. doi:10.1093/rheumatology/kep001
35. Bergman S. Management of musculoskeletal pain. Best Pract Res Clin Rheumatol. 2007;21(1):153-166. doi:10.1016/j.berh.2006.10.001
36. de Aguiar Greca JP, Korff T, Ryan J. Associations Between Children's Physical Activity, Pain and Injuries. Percept Mot Skills. 2021;128(5):1959-1974. doi:10.1177/00315125211028455