

## Supplementary File 4: Primary chart for books' articles

| First editor's name  | Book name (with edition)   | Publication details (date, publisher, place)       | Chapter (with pages) | Descriptive data  |
|----------------------|--|--|----------------------|---|
| Blom <i>et al.</i>   | Apley and Solomon's System of Orthopaedics and Trauma (10 <sup>th</sup> ed..ition) | 2018<br>Taylor and Francis Group<br>Boca Raton, FL | 19 (pp: 531-536)     | The term DDH, coined by Klisic in the late 1980s, has replaced the term CDH to reflect a spectrum of abnormalities in the development of the hip joint, ranging from mild acetabular dysplasia to irreducible dislocation. Broadly, DDH can be classed into four groups on the basis of a combination of clinical and sonographic examination<br>Reduced and stable but dysplastic<br>Reduced but dislocatable<br>Dislocated but reducible<br>Dislocated and irreducible  |
| Aresti <i>et al.</i> | Paediatric Orthopaedics in Clinical Practice                                       | 2016<br>Springer<br>London                         | 6 (pp: 69-90)        | DDH represents a spectrum of disorders, which can affect the acetabulum and proximal femur. These can range from a subtle uncovering of the femoral head within the acetabulum to a complete dislocation of the hip, with degrees of instability between the two extremes. Normal development of the hip requires interaction between the femoral head and the acetabulum. A concentrically reduced, spherical femoral head will allow normal growth of the acetabulum, whereas an unstable hip may lead to progressive dysplasia and complete dislocation of the hip   |
| Benson <i>et al.</i> | Children's Orthopaedics and Fractures (3 <sup>rd</sup> )                           | 2010<br>Springer<br>London                         | 26 (pp: 435-464)     | In 1989, Klisic suggested that the umbrella term "DDH" should replace "CDH" as it embraced the concepts of instability and imperfect formation but had the further advantage of not specifying when the displacement or dysplasia occurred. This may have medicolegal consequences. It is nonetheless accepted that congenital factors contribute to developmental abnormalities. The hip joint during early infancy is vulnerable to displacement. Although the clinical signs of instability may be subtle, they are usually detectable by careful examination. Early recognition and treatment in the neonatal period may prevent progressive subluxation or dislocation. Early treatment encourages the hip joint to grow normally and makes dysplasia less likely. It limits the otherwise inevitable progression to deformation, lost function, and eventual osteoarthritis |
| Broughton            | A Textbook of Pediatric Orthopaedics   | 1997<br>WB Saunders<br>London                      | 16 (pp: 203-2018)    | DDH is term now used for what used to be called CDH. The name change recognizes that not all cases are present or detectable at birth, but some develop over the first few months of life. It also recognizes that there is a spectrum of disorders ranging from hips that are dislocated and cannot be reduced, through hips that can be reduced and hips that can be dislocated but at rest are enlocated to hips which cannot be dislocated, but have some abnormality of development of the acetabulum  |
| Canale <i>et al.</i> | Campbell's Operative Orthopaedics (13 <sup>th</sup> )                              | 2017<br>Elsevier<br>Philadelphia, PA               | 30 (pp: 118-1154)    | Developmental dysplasia of the hip generally includes subluxation (partial dislocation) of the femoral head, acetabular dysplasia, and complete dislocation of the femoral head from the true acetabulum. In a newborn with true congenital dislocation of the hip, the femoral head can be dislocated and reduced into and out of the true acetabulum. In an older child, the femoral head remains dislocated and secondary changes develop in the femoral head and acetabulum   |
| Ebnezar              | Textbook of Orthopedics (4 <sup>th</sup> )   | 2010<br>Jaypee Brothers<br>New Delhi               | 35 (pp: 494-501)     | Definition<br>DDH is defined as partial or complete displacement of the femoral head from the acetabular cavity since birth<br>Stages of DDH<br>There are three stages of DDH: (1) dysplastic stage, (2) dislocatable or subluxation stage, and (3) dislocation stage   |

*Contd...*

**Supplementary File 4: Contd...**

| <b>First editor's name</b> | <b>Book name (with edition)</b>   | <b>Publication details (date, publisher, place)</b>         | <b>Chapter (with pages)</b> | <b>Descriptive data</b>  |
|----------------------------|---|---|-----------------------------|--|
| Hefti                      | Pediatric Orthopedics in Practice (2 <sup>nd</sup> )                    | 2015<br>Springer<br>Berlin                                  | 5 (pp 211-234)              | <p>Definition</p> <p>DDH: Inadequate development of the hip with impaired ossification of the lateral acetabular epiphysis</p> <p>CDH: Displacement of the femoral head from its central position in the acetabulum</p>  |
| Joseph <i>et al.</i>       | Paediatric Orthopaedics: A System of Decision-Making (2 <sup>nd</sup> ) | 2016<br>Tylor and Francis Group<br>Boca Raton, FL           | 24 (pp: 197-211)            | <p>DDH includes a wide spectrum of pathology ranging from mild acetabular dysplasia, which may not present until late adolescence or adulthood, to a fixed, total, irreducible dislocation of the hip diagnosed at birth</p> <p>In the past, DDH was known as congenital dislocation of the hip; however, there is now significant evidence that most hips are not dislocated at birth. It is for this reason that the term DDH is now used. In this chapter, we will not discuss the relatively rare teratologic hip dislocation which occurs early in fetal life, presents as a fixed, high-riding dislocation at birth, and is often associated with syndromes or other congenital malformations or genetic disorders</p>   |
| Morrissy <i>et al.</i>     | Lovell and Winter's Pediatric Orthopaedics (5 <sup>th</sup> )           | 2001<br>Lippincott Williams and Wilkins<br>Philadelphia, PA | 23 (pp: 905-956)            | <p>In the pediatric orthopedic literature, the long-standing terminology of "CDH" has been progressively replaced by the use of "DDH." The former term is attributed to Hippocrates. The term "congenital" implies that a condition existed at birth. The term "developmental" is more encompassing and is taken in the literal sense of organ growth and differentiation, which includes the embryonic, fetal, and infantile periods. This terminology includes all cases that are clearly congenital and those that are developmental, and it incorporates subluxation, dislocation, and dysplasia of the hip. Because this change in terminology has not yet been incorporated into the International Classification of Diseases, the term "CDH," which has existed in the literature for years, will continue to be used in many publications</p> <p>One of the most confusing areas in DDH is the terminology used to discuss the condition. What different investigators mean by "instability," "dysplasia," "subluxation," and "dislocation" varies considerably. In this chapter, the term "DDH" denotes developmental dysplasia of the hip and encompasses all the variations of the condition described. Within this spectrum are two entities: subluxation and dislocation. For the newborn, the term "dysplasia" refers to any hip with a positive Ortolani sign, which is a hip that may be provoked to subluxation (i.e., partial contact between the femoral head and acetabulum), provoked to dislocation (i.e., no contact between the femoral head and the acetabulum), or reduced from either of these positions</p> <p>The distinction between these two entities is often difficult, especially given the subtleties of arthrographic and ultrasonographic classifications. Because further subclassification in the newborn has no influence on treatment, the author prefers to use the term "dysplasia" to encompass these entities and other variations. The term "developmental dislocation" refers here only to complete irreducible dislocations</p> |
| Gosselin <i>et al.</i>     | Global Orthopedics  | 2014<br>Springer<br>New York                                | 38 (pp: 397-403)            | <p>DDH encompasses a spectrum of physical and imaging findings from mild instability to frank dislocation. Looseness within the acetabulum is instability, nonconcentric position is subluxation, and deformity of the femoral head and acetabulum is dysplasia. With maturity, the patient can develop painful, early-onset degenerative arthritis</p>  |

*Contd...*

**Supplementary File 4: Contd...**

| <b>First editor's name</b> | <b>Book name (with edition)</b>          | <b>Publication details (date, publisher, place)</b> | <b>Chapter (with pages)</b> | <b>Descriptive data</b>   |
|----------------------------|--|---|-----------------------------|---|
| Shapiro                    | Pediatric Orthopaedic Deformities, vol 2 | 2019<br>Springer<br>Cham                            | 1 (pp: 1-182)               | <p>Terminology</p> <p>DDH is a general term referring to a spectrum of deformities, usually diagnosed at neonatal period, in which the structural relationship of the proximal femur to the acetabulum is intermittently or continuously abnormal</p> <p>The spectrum includes subluxable or dislocatable, subluxated, dislocated</p> <p>The DDH is not associated with clinically evident connective tissue, neuromuscular, or other diseases</p> <p>CDH was used previously to describe the entity. The entity now referred to as DDH. Developmental has replaced congenital since (i) it focuses on abnormalities in the development which predisposes to the condition and which worsens in the absence of normal hip positioning and (ii) it is not definite that all dysplastic hips were structurally abnormal and/or detectable at the time of initial postnatal examination</p> <p>Dysplasia is a vague general term referring to a poorly defined disease process. Delayed and thus imperfect development of the acetabulum and the proximal femur are referred to as a dysplastic process</p> <p>Acetabular dysplasia and proximal femoral dysplasia themselves are either primary disorders and/or disorders that occur secondary to growth in the presence of undetected and untreated developmental hip disease</p> <p>DDH therefore encompasses a spectrum of hip abnormality. These include (i) an initial subluxable or dislocatable hip in which the femoral head is located in a normal relation to the acetabulum in certain positions (generally flexion and abduction) but has a partial or complete loss of continuity in other positions; this situation can spontaneously correct itself within few days of birth, or it can progress if untreated to persistent deformity; (ii) a subluxation of the hip which refers to a partial loss of continuity between the femoral head and acetabulum where the abnormal relationship is present throughout the entire range of movement; and (iii) a dislocated hip with complete loss of continuity between joint surfaces at all times regardless of the position of the hip. Some refer to an unstable hip detected clinically on initial screening in the newborn nursery as having "NHI." Terminological distinctions are not merely a semantic issue; imprecise use of terms implies imprecise understanding of the underlying pathoanatomy that can lead to investigations and treatments which are not fully appropriate</p> |

*Contd...*

**Supplementary File 4: Contd...**

| <b>First editor's name</b> | <b>Book name (with edition)</b>                       | <b>Publication details (date, publisher, place)</b> | <b>Chapter (with pages)</b> | <b>Descriptive data</b>   |
|----------------------------|---|---|-----------------------------|---|
| Herring                    | Tachdjian's Pediatric Orthopaedics (5 <sup>th</sup> ) | 2014<br>Elsevier Saunders<br>Philadelphia, PA       | 16 (pp: 483-535)            | <p><b>Definition</b></p> <p>DDH is a spectrum of disorders of development of the hip that presents in different forms at different ages. The common etiology is excessive laxity of the hip capsule with a failure to maintain the femoral head within the acetabulum. The syndrome in the newborn consists of instability of the hip such that the femoral head can be displaced partially (subluxated) or fully (dislocated) from the acetabulum by an examiner. The hip may also rest in a dislocated position and be reducible on examination. Over time, the femoral head becomes fully dislocated and cannot be reduced by changing the position of the hip. In some infants, the clinical examination results are negative, but abnormalities found with the use of ultrasonography and radiographic studies portend later hip dysplasia. The syndrome may manifest later during childhood or adolescence as a dislocated hip or during adolescence as a hip with poorly developed acetabular coverage; the latter is termed dysplasia of the hip.</p> <p>DDH is a disorder that evolves over time. The structures that make up the hip are normal during embryogenesis and gradually become abnormal for a variety of reasons, the chief being the fetal position and presentation at birth (e.g., malposition of the femoral head, abnormal forces acting on the developing hip) and the laxity of the ligamentous structures around the hip joint.</p> <p>The older term congenital dislocation of the hip has gradually been replaced by developmental dysplasia, which was introduced during the 1980s to include infants who were normal at birth but in whom hip dysplasia or dislocation subsequently developed. The American Academy of Pediatrics defines DDH as a condition in which the femoral head has an abnormal relationship to the acetabulum.</p> <p>The abbreviation DDH has been used to denote both dislocation and dysplasia of the hip, and it is used in both senses in this chapter. Dislocation is defined as the complete displacement of a joint, with no contact between the original articular surfaces. Subluxation is defined as the displacement of a joint with some contact remaining between the articular surfaces. Dysplasia refers to the deficient development of the acetabulum. Teratologic dislocation of the hip is a distinct form of hip dislocation that usually occurs with other disorders. The hips of the patients with this condition are dislocated before birth, have a limited range of motion, and are not reducible on examination. Teratologic dislocation of the hip is usually associated with other neuromuscular syndromes, especially those related to muscle paralysis (e.g., myelodysplasia, arthrogryposis). The pathologic process, natural history, and management of teratologic dislocation are discussed separately.</p> |

*Contd...*

## Supplementary File 4: Contd...

| First editor's name     | Book name (with edition)                 | Publication details (date, publisher, place) | Chapter (with pages) | Descriptive data  |
|-------------------------|--|--|----------------------|---|
| Weinstein <i>et al.</i> | Instructional course lectures, volume 63 | 2014<br>AAOS<br>Illinois, USA                | 27 (pp: 299-305)     | <p>In patients with DDH, most abnormalities are on the acetabular side. Femoral side changes are secondary to anteversion and pressure changes on the head from the acetabulum or ilium associated with subluxation or dislocation</p> <p>The terminology in DDH is somewhat confusing. The term dysplasia is used to describe a child with a positive Ortolani sign (the hip that can be provoked to dislocate or the hip is dislocated and can be relocated in the acetabulum). The term dislocation describes the presence of a negative Ortolani sign in a child who has secondary adaptive changes of shortening, decreased abduction and asymmetry of the folds, and a hip that cannot be reduced</p> <p>If the diagnosis of DDH is missed at birth, the natural history of the disorder can follow one of four scenarios: The hip can become normal, it can go on to subluxation or partial contact, it can go on to complete dislocation, or the hip can remain located but retain dysplastic features</p> <p>Natural history in untreated patients</p> <p>The natural history of untreated complete hip dislocations depends on two factors: bilaterality and the development or lack of development of a false acetabulum</p> <p>In bilateral, untreated, high dislocations without a false acetabulum, patients have good range of motion and no pain. Hyperlordosis and low back pain develop over time. If the complete dislocation articulates with the ilium and there is a false acetabulum, secondary degenerative arthritis will develop in the false acetabulum</p> <p>In the unilateral untreated complete dislocation, the symptoms of pain are associated with the development or lack of development of a false acetabulum. Other associated problems include ipsilateral valgus knee deformity, with attenuation of the medial collateral ligament; lateral knee compartment degenerative changes; significant limb-length inequalities (up to 10 cm); gait disturbances; and secondary scoliosis</p> <p>It is necessary to define terms when discussing the natural history of dysplasia and subluxation in untreated adults. Dysplasia has an anatomic definition, which is inadequate development of the femoral head, the acetabulum, or both</p> <p>The radiographic definition is determined by the presence or absence of an intact Shenton line. Radiographically, a patient with dysplasia has anatomic abnormalities of the femoral head and/or acetabulum (anatomic dysplasia) with an intact Shenton line. Radiographically, a patient with subluxation has anatomic abnormalities of the femoral head and/or acetabulum (anatomic dysplasia) and a disrupted Shenton line</p> <p>The natural history of hip subluxation is clear; degenerative joint disease will develop in all patients, usually in the third to fourth decade of life</p> <p>The natural history of untreated adults with dysplasia is more difficult to predict because the physical signs are usually lacking and patients present with dysplasia only as an incidental finding on radiographs or if they have symptoms. However, there is good evidence that dysplasia, particularly in females, leads to degenerative joint disease in adults</p> |

DDH: Developmental dysplasia of the hip, CDH: Congenital dysplasia of the hip, AAOS: American Academy of Orthopedic Surgeons, NHI: Neonatal hip instability