

The Correlation Between Minor or Unrecognized Developmental Deformities and the Development of Osteoarthritis of the Hip

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Abstract

The 20th century brought three major conceptual changes about osteoarthritis of the hip. The first was a dramatic change in the understanding of the etiology of many cases of osteoarthritis of the hip. The second was the establishment of the mechanism by which minor developmental abnormalities lead to arthritis. The third was, for the first time, the possibility that the rate of disease development could be retarded and even possibly prevented from progressing. To understand these conceptual changes, it is essential to define the terms used to describe osteoarthritis of the hip.

Instr Course Lect 2009;58:257-259.

Osteoarthritis of the hip has previously been categorized (erroneously) as primary osteoarthritis and secondary osteoarthritis. Destructive hip changes related to inflammatory disease such as rheumatoid osteoarthritis, psoriatic arthritis, ankylosing spondylitis, and Reiter syndrome; infection; gout; calcium pyrophosphate disease; diffuse idiopathic skeletal hyperostosis; hip joint damage after acetabular or femoral head trauma; and femoral head collapse from osteonecrosis, hemochromatosis, and ochronosis were specifically excluded from consideration. These exclusions are necessary to define the use of the term osteoarthritis in this chapter so that extraneous factors introduced by these other conditions are eliminated from consideration.

Prior Concepts of the Definition of Osteoarthritis

The widely held belief during the first half of the 20th century was that

the definition of osteoarthritis of the hip consisted of two components. The first component, defined as secondary osteoarthritis, consisted of those cases that developed from the presence of easily recognized and moderate to severe deformities of the hip joint secondary to developmental abnormalities. In contrast, those cases in which the contour of the hip joint appeared normal were defined as primary osteoarthritis.

Secondary osteoarthritis was believed to be related to excessive pressure on the hip joint cartilage, secondary to factors such as decreased contact surface area, joint instability, or noncongruent contact surfaces. These factors are likely to lead to cartilaginous breakdown over time. There also appeared to be, in general but not always, a relationship between the severity of the deformation of the joint and the rapidity of the development of the arthritic changes.

These features ascribed to secondary arthritis of the hip have not changed. What has changed is the understanding of so-called primary osteoarthritis of the hip, which affects the understanding of hip etiology.

Identification of Developmental Abnormalities

In the past, the failure to diagnose or appreciate subtle developmental abnormalities led to the belief that “primary” osteoarthritis must be related to some unidentified abnormality of the cartilage itself, that is, a primary cartilaginous disease. However, after 50 years of intense investigation of this hypothesis, there are no consistent data identifying such abnormalities. Although such an identification still remains possible, including the possible genetic link to a propensity to develop osteoarthritis of the hip, the data correlating the subtle (and often underrecognized) abnormalities in the contour of the hip with the subsequent development of osteoarthritis of the hip are strong, coming from diverse sources and multiple investigators. Moreover, it is at least possible and perhaps even likely that one of the pathways in which genetics might influence the development of osteoarthritis of the hip is through genetically related developmental abnormalities. Consider specifically the

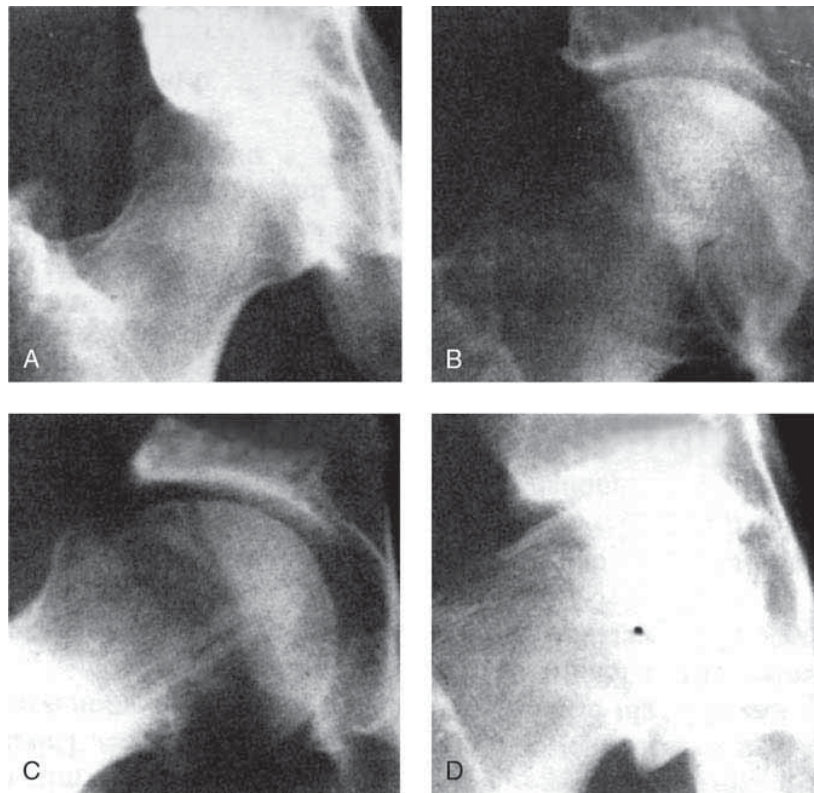


Figure 1 AP radiographs of a normal hip and three forms of abnormalities associated with mild slipped capital femoral epiphyses. **A**, Normal hip. **B**, Flattening. **C**, Bump. **D**, Hook. (Reproduced with permission from Stulberg SD, Cordell LD, Harris WH, Ramsey PL, MacEwen GD: Unrecognized childhood hip disease: A major cause of idiopathic osteoarthritis of the hip, in Amstutz HC (ed): *The Hip: Proceedings of the Third Open Scientific Meeting of the Hip Society*. St. Louis, MO, CV Mosby, 1975, pp 212-228.)

example of developmental dysplasia, which clearly has a genetic link and is important in the new understanding of the role that subtle developmental abnormalities play in predicting osteoarthritis of the hip.

The initial suggestion that relatively mild developmental abnormalities might presage the later development of hip osteoarthritis arose from a study by Murray¹ reporting that many patients with what was called a “tilt deformity” subsequently developed osteoarthritis of the hip. Although the tilt deformity most often was the result of unrecognized slipped capital femoral epiphysis, other

conditions such as Legg-Calvé-Perthes disease, spondyloepiphyseal dysplasia, and multiple epiphyseal dysplasia also can lead to this deformity. One of the limitations of Murray’s work was the absence of any radiographic view except AP films.

The relationship between these less obvious hip configurational abnormalities (Figure 1) and the subsequent hip osteoarthritis has been strengthened by studies of follow-up data from cases of known childhood hip diseases and retrospective studies of hip osteoarthritis cases in which prior radiographs have been analyzed.

Study Observations

According to representative longitudinal follow-up studies,²⁻¹⁰ the relationship between abnormal development and later osteoarthritis is clear, but an assessment of those subsets of patients with minor or subtle deformities helps define the relationship between subtle changes and osteoarthritis. For example, cases have been documented in which, because of a slipped capital femoral epiphysis on one hip, the other hip was pinned in situ before any slip occurred. In such instances, despite the prophylactic pinning, a “bump” or outgrowth at the lateral edge of the epiphyseal plate occurred. Long-term follow-up has shown the development of osteoarthritis of that hip.

In a retrospective study of patients receiving total hip replacement in whom earlier radiographs showed the contour of the hip after the epiphysis had closed but before arthritic changes developed, 79% of patients had abnormal contours.⁶ Moreover, there was also a gender correlation between the type of deformity leading to the arthritis, in which the dominant deformity in males was the tilt deformity and the dominant deformity in females was acetabular dysplasia. It also was confirmed that many of the patients with acetabular dysplasia also had some degree of femoral contour abnormalities.

Similar observations were made by Solomon and associates in studies of both whites and blacks in South Africa.²⁻⁵ Although their findings closely parallel those of Murray,¹ Stulberg and Harris (unpublished data presented at the open scientific session of the Hip Society, St. Louis, MO, 1974), Stulberg and associates,⁶ and Harris and associates,⁷⁻⁹ several unique and valuable addi-

tional observations were raised. They found a substantial difference in the incidence of adult osteoarthritis between the races, with adult osteoarthritis occurring less often in black patients than in white patients.^{3,5} The finding that black patients also had a reduced incidence of developmental hip abnormalities in childhood and adolescence reinforced the concept of developmental abnormalities leading to osteoarthritis. This relationship was further strengthened in the study of subsets of the black population in which, in contrast to the general black population, there was a high incidence of childhood and adolescent deformity formation. Central to the correlation between developmental abnormalities and adult hip osteoarthritis was Solomon's observations that in these select subsets of the black population with a high incidence of developmental abnormalities, there was also a high incidence of adult osteoarthritis of the hip.⁵

Summary

The study observations challenge the long-standing traditional concept of primary osteoarthritis. Although a relationship between marked developmental deformities

and osteoarthritis of the hip has existed for decades (secondary osteoarthritis of the hip), the key distinction in the current understanding lies in the special concept that more subtle deformities also produce osteoarthritis of the hip. Such a hypothesis, therefore, proposes that most, if not all, osteoarthritis of the hip is secondary and specifically often secondary to subtle but definite and commonly overlooked, ignored, or not recognized dysplasia or pistol grip deformities. Thus, the prior distinction of primary osteoarthritis versus secondary osteoarthritis disappears. This concept attributes most instances of osteoarthritis of the hip to a predominantly mechanical etiology and seriously challenges the prior belief that the osteoarthritis that develops in these instances with mostly normal anatomic contours develops because of an abnormality in the cartilage itself.

References

1. Murray RO: The aetiology of primary osteoarthritis of the hip. *Br J Radiol* 1965;38:810-824.
2. Solomon L, Beighton P: Osteoarthritis of the hip and its relationship to pre-existing in an African population. *J Bone Joint Surg Br* 1973;55:216-217.

3. Solomon L: Patterns of osteoarthritis of the hip. *J Bone Joint Surg Br* 1976; 58:176-183.
4. Solomon L, Schnitzler CM, Bro-wett JP: Osteoarthritis of the hip: The patient behind the disease. *Ann Rheum Dis* 1982;41:118-125.
5. Solomon L: Geographical and anatomical patterns of osteoarthritis. *Br J Rheumatol* 1984;23:177-180.
6. Stulberg SD, Cordell LD, Harris WH, Ramsey PL, MacEwen GD: Unrecognized childhood hip disease: A major cause of idiopathic osteoarthritis of the hip, in Amstutz HC (ed): *The Hip: Proceedings of the Third Open Scientific Meeting of the Hip Society*, St. Louis, MO, CV Mosby, 1975, pp 212-228.
7. Harris WH, Bourne RB, Oh I: Intra-articular acetabular labrum: A possible etiological factor in certain cases of osteoarthritis of the hip. *J Bone Joint Surg Am* 1979;61:510-514.
8. Harris WH: Primary osteoarthritis of the hip: A vanishing diagnosis. *J Rheumatol* 1983;suppl 9:64.
9. Harris WH: Etiology of osteoarthritis of the hip. *Clin Orthop Relat Res* 1986; 213:20-33.
10. Weinstein SL: Natural history and treatment outcome of childhood hip disorders. *Clin Orthop Relat Res* 1997; 344:227-242.