Residual Subluxation Following Medial Approach Open Reduction in Congenital Dislocation of the Hip

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History

A 17-month-old female presented for evaluation of a limp noted soon after she began walking at age 14 months. Physical findings suggested a congenital dislocation of the left hip, and radiographs confirmed this diagnosis (Fig. 1). The patient was placed in skeletal traction, and three weeks later a closed reduction under anarthropic control was performed (Fig. 2). Interpreted as an inadequate closed reduction, an open reduction via a medial (Ludloff) approach was performed. Postoperatively, the patient was placed in a hip spica cast for eight weeks, followed by an abduction splint worn full time.

Subsequent follow up revealed lateral subluxation of the left femoral head (Fig. 3). Therefore, eight months following the initial open reduction, the patient underwent a subtrochanteric varus derotational osteotomy of the left femur (Fig. 4). The patient did well clinically following this procedure, although radiographic evidence of persistent lateral subluxation of the left femoral head remained (Fig. 4, 5).

The patient was followed at regular intervals, and was noted to be asymptomatic seven years postoperatively despite radiographic evidence of acetabular dysplasia and persistent subluxation (Fig. 6). At age 11, the patient began complaining of left hip pain with vigorous activity, which progressed over the next two years to become disabling (Fig. 7). Clinically, an uncompensated Trendelenburg gait, full passive range of motion of the left hip, and equal leg lengths, were noted at this time. However, because of the relentless progression of her symptoms, the patient underwent proximal femoral varus and innominate osteotomies (Fig. 8).

Discussion

This case presents the long-term result of a congenital dislocation of the hip (CDH) in which concentric, stable reduction in the weight bearing position was never attained. Although initially avoiding the most serious complication in the treatment of CDH—the development of severe avascular necrosis (AVN)—it clearly illustrates how the result, regardless of the management of CDH, is unsuccessful if stable concentric reduction is not produced.

There is general consensus that after 6 months of age the deformity in CDH is fixed, and closed reduction can only be successful after a period of traction, to allow positioning of the hip for closed reduction in the acetabulum through stretching of soft tissue impediments. This simultaneously decreases the possible sources of AVN. With increasing age above 18 months, the likelihood of a successful closed reduction is reduced, and the prognosis for a successful outcome diminishes despite pre-manipulation traction. This has stimulated several surgeons to employ immediate surgical reduction with femoral shortening to decompress the soft tissues and avoid avascular necrosis.

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months of age, an attempted closed reduction after traction for three weeks was an appropriate application of present knowledge concerning CDH treatment. Although skeletal traction is generally not favored, as skin traction has been found to be perfectly adequate, the only real drawbacks of using skeletal traction are the local pin-tract problems which might arise in a vigorous, twisting toddler, and the probable need for some type of anesthesia to place the femoral pin safely in the bone avoiding the distal femoral physis.

Assessment of the adequacy of a closed reduction is best obtained by an arthrogram, although controversy exists as to what represents an adequate reduction. Race and Herring reported acceptable results when a "reduction" was obtained with a medial contrast pool of 7 mm or less and with the hip placed in a reduced position without undue force or extreme positioning. This patient’s arthrogram was interpreted to show excessive medial pooling of contrast, in addition to or because of a flattened, obstructing limbus (Fig. 2), and hence immediate open reduction followed this assessment, under the same anesthetic.

The real controversy surrounding management of this patient's arthrographic pathology rests in the choice of medial approach open reduction. Two surgical approaches for open reduction are commonly employed—the medial and the anterior approaches.

The medial approach has the proposed advantage of being a less complex, although not necessarily more easily performed, procedure which allows correction of the constriction of the interosseous capsule by releasing the psoas tendon and the transverse acetabular ligament. These obstructions to reduction can, therefore, be removed, though no other immediate stability is imparted by the procedure. The disadvantages reported using the medial approach include a higher incidence of AVN, through interference with the posterior branch of the medial circumflex artery, and inability to deal with an inverted limbus or to perform a concurrent capsulorrhaphy. These latter surgical restrictions are probably the source of the persistent subluxation seen radiographically following medial approach open reduction, which may or may not respond to prolonged abduction casting or bracing. The anterior approach, while necessitating more surgical dissection, allows for surgical inversion of an infolded limbus, and a more thorough exploration of the joint, by virtue of forcing the surgeon to follow the ligamentum teres to the depth of the true acetabulum and inferomedially to the transverse acetabular ligament. The ability to excise redundant capsule and imbricate the remainder to stabilize the hip in an extended, weight bearing position, remains the major advantage of anterior approach. Although it should probably be considered more of a surgeon's preference than an absolute indication, the presence of an infolded limbus and wide medial contrast pooling suggesting obstruction to reduction, in a patient already of walking age, would indicate an anterior approach in the majority of cases, so that the limbus can be inverted, and capsulorrhaphy performed, to impart immediate stability in a weight bearing position.

In spite of optimal management of CDH in the young child, careful follow up is necessary to identify persistent subluxation of the femoral head, persistent acetabular dysplasia, and late ischemic changes. Persistent subluxation due to inadequate reduction contributes to acetabular dysplasia by preventing the normal acetabular response to concentric reduction in the young patient. Every effort at obtaining a concentric reduction should
be made at the earliest possible time in the life of the patient to maximize the potential for acetabular development. If serial follow up reveals little or no progress in acetabular development, the need for a surgical procedure aimed at provoking such development should be considered. Progressive or persistent subluxation is an ominous sign and is an indication for further treatment.

Consistent with this approach, upper femoral varus derotation osteotomy was performed at age 26 months, eight months after open reduction when subluxation not responding to abduction bracing was identified. Although Salter has emphasized innominate osteotomy from a belief that stimulation of acetabular development was limited after 18 months of age, there is ample evidence that upper femoral osteotomy, especially performed before the age of 4, will uniformly correct acetabular dysplasia if AVN has not been produced. Unfortunately, as the preoperative abduction-internal rotation radiograph (Fig. 3B) suggests, this hip could not be concentrically reduced in the acetabulum. Hence, the expected restoration of normal acetabular development was not realized, as subsequent follow up demonstrated (Fig. 4, 5, 6). Arthrography at the time of upper femoral osteotomy would probably have revealed the non-concentricity of the reduction more explicitly, and the necessity for anterior open reduction. Since the prerequisite for upper femoral osteotomy—concentric reduction on abduction-internal rotation positioning—was not present, the expected result—stimulation of normal acetabular development—could not be predicted.

An additional sequela to this patient's treatment, not apparent until age 9 years, 8 months, was a caput valgum deformity indicative of lateral arrest of the upper femoral physis (Fig. 6, 7). This type II pattern of AVN produces gradual recurrent subluxation of the femoral head, usually with recurrent acetabular dysplasia. Vascular insult to the posterior superior branches of the medial circumflex system is proposed as the etiology. A growth disturbance results in a valgus orientation of the head relative to the femoral neck, producing secondary subluxation of the femoral head, sometimes developing years after an apparent concentric and uncomplicated reduction. Secondary reconstructive procedures such as acetabular redirection, upper femoral osteotomy, and surgical closure of the remaining open physis, should be performed to re-establish congruency. Even though the patient was asymptomatic when this complication revealed itself, reconstructive surgery to deal with predictable further subluxation due to asymmetric physical arrest would have been indicated at that time.

The complex reconstruction (Fig. 8) performed at age 13 when the patient had developed significant symptoms, unfortunately does not assure a good prognosis. Although radiographically subluxation has been improved (Shenton's line has been restored) the CE angle indicates persistent dysplasia, in spite of reconstruction. By the Severin classification this hip would rate no better than a group III result, and hence would be considered a fair result at best, with a guarded prognosis through adulthood. In spite of upper femoral redirection, the femoral head is still occupying a somewhat lateralized position in the true acetabulum, which is not surprising since the femoral head has never been concentrically reduced. Hence, the innominate osteotomy has improved, but has far from normalized the long-standing dysplasia which never improved due to uncorrected subluxation.
Fig. 7: Age 13; severe dysplasia, subluxation, and caput valgum are present.

Fig. 8: AP radiograph following proximal femoral and innominate osteotomies. The CE angle measures 14°, documenting persistent dysplasia in spite of acetabular redirection.

Conclusion

This patient's initial treatment appropriately utilized principles which are well accepted in the treatment of CDH under 18 months of age. In retrospect, the failure to achieve a concentric reduction can probably be traced to the inability to perform a capsulorrhaphy at the time of open reduction via the medial approach. One may infer an inflamed limbus as well, due to the lateral subluxation seen at every stage of this patient's course (Fig. 3-6). The persistent lateral subluxation of the femoral head, indicative of capsular laxity and soft-tissue interposition, prevented a satisfactory response by the acetabulum to an appropriate and efficacious procedure (upper femoral varus derotation osteotomy). Although mild, type II ischemic changes were eventually identified radiographically, this development probably did not further complicate the antecedent major problem, the persistent, uncorrected subluxation which had been present since initial treatment. Although further surgical reconstruction would have been indicated at almost any point following the persistent subluxation which went unremedied by upper femoral osteotomy at age 28 months, the delay in performing such reconstruction until the patient was symptomatic at age 15 may have prevented a more normal restoration of acetabular dysplasia, since the deformity was so long-standing by the time of the eventual definitive reconstruction. Because of that incomplete restoration, this patient's long-term prognosis must be regarded only as fair. Hence, the failure to obtain a concentric, stable reduction at any stage in this patient's course significantly prejudiced the final result, in spite of competent and satisfactory management and application of principles at nearly every stage.

References