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Case Report

Treatment of posterior dislocation following surgical ante-version overcorrection with de-rotation osteotomy of proximal femur in a child with developmental dysplasia. Importance of operative planning: a case report

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ABSTRACT

Proximal femoral osteotomy is commonly performed as an adjunct to open reduction in developmental dysplasia of the hip (DDH) in children presenting after walking age. Inadequate operative planning or incorrect execution of bony procedures can lead to instability and redislocation, resulting in significant morbidity. We report a 7-year-old boy with bilateral DDH who presented with painless limp following two previous surgeries performed elsewhere. The right hip developed posterior dislocation following excessive derotation during proximal femoral osteotomy, while the left hip remained stable. Clinical examination and radiographs demonstrated posterior instability of the right hip with acetabular dysplasia and rotational malalignment of the proximal femur. Revision surgery was planned with extensive soft tissue release, correction of femoral retroversion through rotational osteotomy, and Dega pelvic osteotomy to address posterior and lateral acetabular deficiency. The hip was stabilized with capsulorrhaphy and temporary trans-articular Kirschner wire fixation followed by spica immobilization. At 18 months of follow-up, the hip remained stable with satisfactory remodeling of the acetabulum and proximal femur, and no evidence of avascular necrosis. Excessive derotation during femoral osteotomy can result in femoral retroversion and posterior hip dislocation. Accurate intraoperative assessment of femoral version and adherence to a structured surgical protocol are essential to prevent such complications in DDH surgery.

Keywords: Developmental dysplasia of hip, Femoral derotation osteotomy, Posterior dislocation, Revision surgery, Paediatric hip

INTRODUCTION

Developmental dysplasia of the hip (DDH) has a varied incidence, and late presentation after walking age is common in developing countries; the reported incidence of DDH requiring operative intervention in walking-age children ranges from 1 to 2 per 1,000. Late presentation of DDH after walking age is common in India. Since operative intervention is the main stay of treatment in this age group, meticulous operative planning by upcoming pediatric orthopedic surgeons cannot take back stage.[1,2,10,11,13] Lack of adherence to standardized operative protocols can lead to avoidable complications. Primary/ initial surgery provides an excellent opportunity for correction as the tissue planes are preserved. When abnormal soft tissue structure rectification and bony correction is not achieved, this contributes to failure which is immediate or delayed. Complications of open reduction in DDH are due to improper soft tissue release, excessive varusization with proximal femur osteotomy.[2,4,7] Long leg dysplasia after salter osteotomy and acetabular dysplasia secondary to pelvic osteotomy

are frequently cited in literature.[4-7] This case report attempts to throw light on a rare occurrence of re-dislocation secondary to improper bony correction (excessive de-rotation) which in turn lead to improper re-modelling problems requiring revision surgery in a bilateral DDH case.

CASE REPORT

A 7-year-old boy with bilateral developmental dysplasia of the hip presented to our institute with a painless limp of the right lower limb following two previous surgical procedures performed at outside hospitals. At the age of three years, the child underwent open reduction of the left hip at a medical college hospital. Open reduction of the left hip was performed in conjunction with proximal femoral shortening osteotomy; details regarding the extent of soft tissue release were not available. Postoperatively, the child was immobilized in a hip spica cast for six weeks. The right hip was treated with an attempted closed reduction (Figure 1A). After six weeks, the spica cast was removed and the child was allowed to ambulate. Within three months of surgery, the child developed a bilateral painless waddling gait with limp. The child was subsequently evaluated at a multispecialty orthopedic center. Radiographs demonstrated persistent bilateral hip dysplasia (Figure 1B and 1C).

The child subsequently underwent bilateral corrective surgery, which included adductor tenotomy, iliopsoas release, acetabular clearance, and capsulorrhaphy. On the right side, femoral shortening with derotation osteotomy was performed. On the left side, salter innominate osteotomy combined with femoral shortening and derotation osteotomy was carried out. No pelvic osteotomy was performed on the right side.

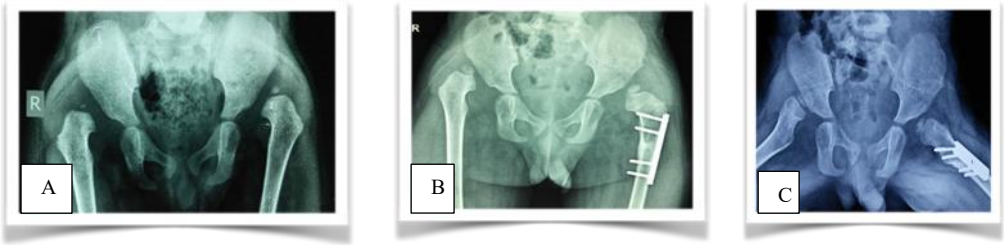

Figure 1: The figure shows pre-operative radiograph (A) with bilateral DDH and post-operative antero-posterior, (B) frog leg lateral x-rays and (C) showing failed open reduction (in another hospital) on left with persistent dislocation of right hip.

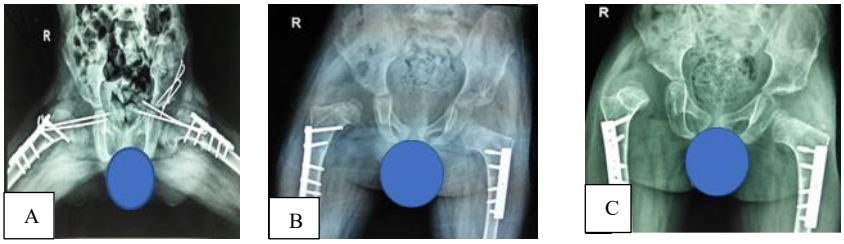

Figure 2: (A) Radiograph shows bilateral open reduction with varus shortening osteotomy of femur and salter innominate osteotomy on the left with trans-articular Kirschner wire stabilization (attempted in another hospital), (B) immediate post-operative radiograph after wire removal shows increased joint space with loss of concentric reduction and (C) radiograph shows dislocated hip on the right side 6 months following surgery. Shenton line is in discontinuity with acetabular index of 40 degrees.

Bilateral trans-articular Kirschner wires were placed, and a hip spica cast was applied for ten weeks (Figure 2A). The postoperative period was uneventful, and the child was reviewed for spica cast and Kirschner wire removal. Radiographs at that stage demonstrated satisfactory containment of the femoral heads. The trans-articular wires were removed, and the child underwent rehabilitation and gait training (Figure 2B). The child's father was told about the concerns of the bilateral surgery and was advised regular follow-ups. Initially, the child demonstrated a normal gait on the left side with a persistent lurch on the right. The father was counseled about remodeling potential after the surgery and was told to follow-up regularly. Subsequent follow-up radiographs demonstrated a congruent left hip and posterior dislocation of the right hip (Figure 2C). After fifteen months of follow-up at the multispecialty hospital, the child presented to our orthopedic unit for further evaluation. After detailed history taking, physical examination and studying of radiographs, these were our findings. At presentation, the child walked with an externally rotated right lower limb associated with an extension lurch. The left hip demonstrated a normal gait cycle. Clinical examination revealed posterior dislocation of the right hip, with reduction possible only in extreme external rotation. Radiographic evaluation demonstrated a

well-contained left hip and an incongruent right hip. Shenton's line on the right side was disrupted, with radiographic evidence of hip dysplasia and subluxation. The acetabular index measured approximately 40°, and a rotational abnormality of the proximal femur was evident (Figure 3A). The upper femoral ossific nucleus development was good, despite two operative insults to the hip.

Operative management

Operative planning included release of residual soft tissue preventing concentric reduction of the femoral head into the acetabulum.[1,7,10,13] Contracture release resulting from the two previous surgeries was anticipated. Pelvic osteotomy following achievement of concentric reduction was planned. Significant anterior scarring with limited capsular tissue for capsulorrhaphy was expected. A classical extended anterior bikini approach was selected. The child was positioned supine under general anesthesia with a bolster placed beneath the affected hip. Examination under anesthesia confirmed findings consistent with preoperative clinical assessment. Reduction of the hip was achievable only with approximately 60° of hip flexion and extreme external rotation, contrary to the typical reduction pattern of DDH hips requiring internal rotation. The previous anterior incision was extended superiorly and inferiorly to reach normal tissue planes for anatomical reference. Dense scarring with loss of clear tissue planes was encountered. Following release of residual soft tissue contractures, including adductor release and detachment of the iliac apophysis, the hip capsule was exposed superiorly and inferiorly. Care was taken to preserve the thin, scarred capsule for subsequent capsulorrhaphy. The limbus, which was attenuated from prior surgical intervention, was identified and protected. The inferior transverse acetabular ligament, which had not been released during prior surgery, was divided to facilitate concentric reduction into the native acetabulum. The posterior capsule was found to be lax, consistent with prolonged posterior dislocation.

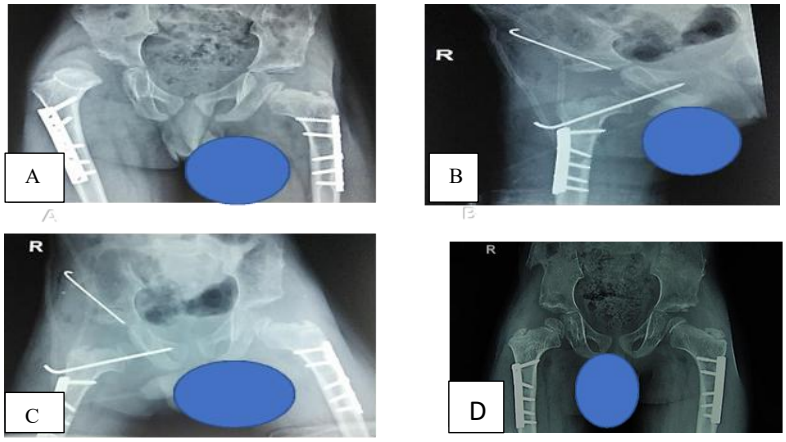

Figure 3: (A) radiograph showing pelvis with both hips after two surgeries on left hip and one surgery on right hip. Dislocation with rotational problem is evident in the right hip, (B) post-operative radiographs showing rotational correction with rotational osteotomy with same implant done in our hospital. Dega pelvic osteotomy to counter the posterior and lateral instability and trans-articular wire to hold the correction and allow soft tissue and bone healing, (C) follow-up radiograph after six months of revision surgery showing stable, congruent hip on the right side with good growth of ossific nucleus and remodeling of acetabulum and proximal femur and (D) the proximal femoral and pelvic osteotomy sites healed uneventfully.

Intraoperative assessment revealed reversal of the expected pathology, with excessive correction of femoral anteversion during prior derotation osteotomy resulting in fixed posterior dislocation requiring extreme external rotation for reduction. Intraoperative assessment demonstrated approximately 20° of femoral retroversion. A lateral approach to the proximal femur was utilized for implant removal and corrective rotational osteotomy to address the posterior dislocation. The proximal femur was carefully re-rotated to allow stable reduction of the hip in approximately 30° of abduction and neutral rotation. Significant posterior capsular laxity resulting from prolonged dislocation was encountered intraoperatively. A Dega pelvic osteotomy was performed to address lateral and posterior acetabular deficiency and compensate for posterior capsular laxity. Following satisfactory assessment of hip stability, capsulorrhaphy was completed. Given the prolonged posterior dislocation and intraoperative instability, the hip was temporarily stabilized using a trans-articular Kirschner wire followed by application of a one-and-a-half hip spica cast (Figure 3B and 3C). The patient was followed up regularly, and the spica cast and Kirschner wire were removed after eight weeks.

Post-removal radiographs demonstrated satisfactory containment of the femoral head. The right hip was followed closely for 18 months, and full weight-bearing ambulation was initiated three months following revision surgery. The proximal femoral and pelvic osteotomy sites healed uneventfully (Figure 3D). The child demonstrated

improved gait with no residual instability at 18 months of follow-up. The patient remained clinically stable at final follow-up.

DISCUSSION

In this case, de-rotation osteotomy done in the outside hospital had failed due to excessive correction leading to abnormal remodeling.[8] Capsulorraphy was inadequate with laxity contributing to the re-dislocation. Literature review suggests inadequate capsulorraphy as a cause of delayed failure. Usually, it presents when the trans-articular K-wire is removed after 6 weeks, usage of weak suture and failure to perform a well opposed capsular repair are also cause of inadequate capsulorrhaphy.[4-7] In contrast, the case scenario described showed femoral retroversion resulting in post-operative dislocation which was primarily from overcorrected de-rotation osteotomy. On table, we noticed retroversion of 20° which was corrected with proximal femur osteotomy. The capsular laxity was predominantly posteriorly which also was corrected secondarily after bony procedure. Shortening Osteotomy and de-rotation Osteotomy is a well-known commonly used procedure in conjunction with open reduction in DDH surgery.[5,6,8] Utmost care must be exercised while taking decision on table. Inadvertent use of excessive/ incorrect de-rotation with combined open reduction and incomplete soft tissue correction can lead to complications which is described here. Trans-articular K-wire holds the hip forcibly in place intra-operatively giving a false impression to the surgeon.[4-7] Rotational mal-correction is evident only when the wire is removed and worsens the situation when remodeling makes the deformity permanent. We recommend to follow a fixed protocol/ algorithm intra-operatively which allows accurate assessment of the pathoanatomy.[1,3,10,13] Excessive ante-version should be assessed only after capsulotomy and clearance of acetabulum.

If the hip can be reduced with ease, excessive ante-version should be assessed when the cartilaginous femoral head is completely contained in the acetabulum. Partial coverage of the femoral head leads to false measurement. Tight reduction or inability to reduce needs shortening osteotomy which can be combined with Derotation1.[10,11,13] Step wise correction of tightness of reduction and ante-version is recommended. Shortening is measured first after proximal femur osteotomy. Overlapping bone gives an approximate assessment of shortening necessary.[1,10,11] Rotational correction is better done after shortening is tackled. The bone ends after shortening are held temporarily with markers to avoid simultaneous mal-rotation. At this point of time, it is advised to reduce the proximal fragment in to the native acetabulum and held with trans-articular wire, so that rotational measurement can be controlled and accurately planned. As per literature, when excessive abduction is necessary or lateral coverage is inadequate, Pelvic osteotomy is advised to achieve maximum stability.[1,10,13] Choice of pelvic osteotomy needed in various situation is well covered in the literature and is beyond the scope of this article. Vast literature contributed by eminent Orthopedic surgeons around the world comes handy in acquiring the skills and provides the confidence necessary in accurate execution of challenging DDH surgeries.

CONCLUSION

Surgical intervention in DDH should focus on all the aspects of patho-anatomy.[1,4,10,11,13] Hence surgery should carry an aim of multi-pronged approach to correct soft tissue contracture, bony pathology and removal of structures preventing concentric reduction to the native acetabulum.[13] Attempt at partial correction / rectification of the complex patho-anatomy of DDH during the learning curve of the Pediatric Ortho surgeon can lead to catastrophic complication which needs extensive revision surgery of growing children leading to considerable morbidity in active playful age group. As per literature, immediate failure after open reduction is attributed to approach related issues and technical errors of open reduction which are largely due to surgical inexperience.[4-7] Technical errors of open reduction are a cause for failure of primary surgery.[4] This is attributed to not following a fixed protocol while executing an open reduction. We would like to reinforce the well accepted fact that the adductors, iliopsoas, the transverse acetabulum ligament, and the inferior capsular needs to be divided. The hypertrophied ligamentum teres and the pulvinar excised, the limbus everted and an adequate capsulorraphy performed.[1-3,10,13] In addition to open reduction combined pelvis Osteotomy can lead to technical difficulties of incorrect displacement especially when capsule is opened. Failure to perform an adequate femoral shortening or failure to correct femoral ante-version results in re-dislocation.[5,6]

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