Symposium

Re-dislocation After Primary Open Reduction in DDH- Management and Early Results

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Abstract

Operative intervention is frequently required in children with developmental dysplasia of hip(DDH) who are >18 months old.The major early and delayed complications following operative intervention are redislocation, avascular necrosis, residual dysplasia and instability.

Re-dislocation following primary successful reduction is a devastating complication. The revision surgery is usually prolonged with more blood loss, risk of further complications and long term immobilisation in a spica cast. The revision surgery is technically demanding and require a lot of preoperative planning. There also remains a possibility of never achieving the reduction of femoral head. The authors present their experience of four cases of DDH which were successfully reduced by open reduction at index procedure but later re-dislocated and required secondary surgery.

Careful preoperative planning with CT scan is a must,correcting the abnormal femoral version and providing the femoral head the coverage where exactly it is required is needed. The children after secondary procedure must always be kept under closed supervision till maturity.

Keywords: DDH; Re-dislocation; Open reduction.

Introduction

The aim of treatment in Developmental dysplasia of the hip (DDH) is to achieve a concentric and stable reduction of the femoral head. A concentric reduction when achieved at an early age helps in remodelling of the acetabulum and normal development of the hip. Reduction of the hip can be achieved by closed means in children less than 18 months of age. Failure to achieve closed reduction with a stable hip necessitates an open surgical procedure. The primary surgical procedure may be an open reduction alone or with a combination of pelvic and/ or femoral osteotomy.

Open primary surgical procedure is often successful in achieving a stable concentric reduction. The major early and delayed complications following operative intervention are redislocation, avascular necrosis (AVN), residual dysplasia and instability.

The rate of re-dislocation is approximately 8% [1,2]. Revision DDH surgery is technically demanding and requires careful pre-operative planning. Intraoperatively, normal anatomical landmarks and soft-tissue planes are obliterated from previous surgery. There is the possibility of never achieving concentric reduction of the femoral head. Revision DDH surgery is associated with high rates of osteonecrosis of the femoral head, stiffness and persistent dysplasia [1-3].

We present our experience of four cases of DDH which re-dislocated after initial open reduction.

Case 1

A three-year-old girl presented with a dislocated left hip joint. Radiological examination revealed high acetabular index (AI) on the left side (45 degree) compared to the right hip (29 degrees) (Fig. 1). Femoral anteversion was found to be increased on the left side (50 degrees). Surgical management by open reduction, Dega acetabuloplasty with femoral derotation and shortening performed. Intraoperatively concentric and stable reduction was achieved. Post-operative acetabular index was 32 degree (Fig. 2). The spica was removed after 3 months. On subsequent follow-up at 4 months, X-ray revealed re-dislocation of femoral head and there was erosion of capital femoral epiphysis (Fig. 3). There was decreased abduction on clinical examination. CT scan of hip with 3-D reconstruction revealed postero-superior deficiency of acetabulum and femoral version of zero degrees (Fig. 4a,4b,4c). Revision surgery with open reduction and correction of femoral version with posterior acetabular coverage was planned. Findings were confirmed intra-operatively, femoral anteversion of 20 degree was achieved and there was no further need of femoral shortening. The reduction was found to be unstable at less than 30 degree of abduction and head dislocated posterior-superiorly on attempted adduction. A periacetabular osteotomy was started just posterior to the anterior inferior iliac spine (AIIS) keeping the anterior margin intact and completed by cutting into the sciatic notch. A graft from the iliac crest was inserted posteriorly to provide deficient femoral head coverage. A capsulorrhaphy was performed and a hip spica was applied for 3 months in all cases in the series. Postoperative appearances at 3 months and 1 year are shown in Fig. 5 and Fig. 6 respectively.

Figure 1: Case 1,pre-op Xray showing DDH left side

Figure 2: Case 1,immediate post-op Xray

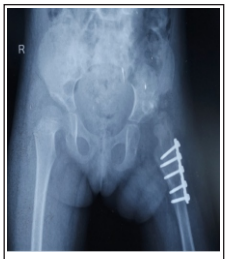

Figure 3: Case 1,redislocation at four month follow-up

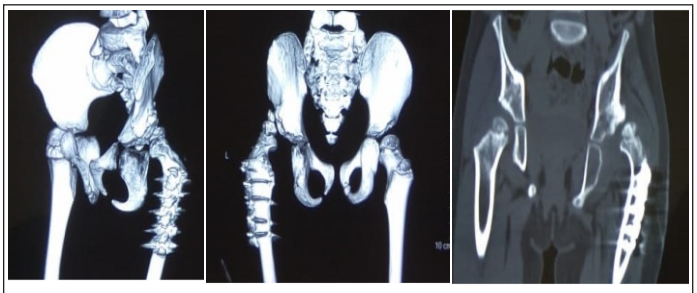

Figure 4: 4a,b,c-Case 1,CT images showing posterior uncoverage

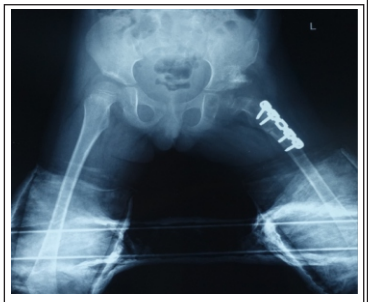

Figure 5: Case 1,three months following revision surgery

Figure 6: Case 1 at one year follow-up

Case 2

A three-year-old girl presented with bilateral DDH. The acetabular index was 40 degrees bilaterally. Femoral anteversion was also increased (Right 45 degrees, left 40

Figure 7: Case 2,Xray showing re-dislocation at 5 month follow-up

Figure 9: Case 2 at 18 months following revision surgery

Figure 8: 8a,b,c-Case 2,CT assessment before revision surgery

degrees). Open reduction of the Right hip was performed followed by Dega osteotomy and femoral shortening with derotation. Concentric and stable reduction was achieved. Post-operative acetabular index was 23 degrees. Hip spica was applied for 3 months. At 5 months, x-ray revealed re-dislocation and superior migration of femoral head (Fig. 7). CT scan of the hip with 3-D reconstruction revealed posterior deficiency of acetabulum with variation of acetabular index on different coronal cuts (Fig. 8a, 8b and 8c). It was 23 degree on anterior cuts and increased to 44 degree on posterior coronal cuts. During revision, the reduction was found to be unstable at less than 40 degree of abduction and 30 degree of flexion; the head dislocated posterior-superiorly on attempted adduction. A modified San Diego osteotomy was performed with the graft placed posteriorly to achieve posterior coverage and a stable and concentric reduction was achieved. On final follow-up at 1.5 year, the hip was stable without any signs of AVN. (Fig. 9)

Case 3

A three-year-old female presented Right DDH. Radiological examination revealed high acetabular index on the right side (50 degrees) as compared to left (18 degrees). Femoral anteversion was also found to be increased on right side (45 degrees). A concentric and stable reduction was achieved by open reduction with Dega osteotomy. Post-operative acetabular index of 30 degrees was achieved. At 7 months, -ray revealed subluxation and lateral migration with increased medial space on right side (Fig. 10). CT scan of hip revealed no acetabular deficiency. Pre-operative fluoroscopy imaging revealed femoral anteversion of 50 degree. This was considered as a cause of failure of primary surgery. Revision surgery was planned. Intra-operatively, it was noted that right hip was stable and deep seated in acetabulum on internal rotation of about 30 degree and abduction. It was found that attempted adduction lead to lateral subluxation of femoral head. Varus derotation osteotomy of right femur was therefore performed. A stable and concentric reduction was achieved (Fig. 11).

Case 4

A 2.5-year-old female presented with bilateral DDH. Radiological examination revealed high acetabular index on both the sides (Right 41 degrees, Left 35 degrees). Surgical management by open reduction was done with femoral shortening on left side. Intraoperatively concentric and stable reduction was achieved. Patient was managed by standard post-operative protocol and spica was removed after 3 months. On subsequent follow-up at 8 months, X-ray revealed dislocation of femoral head with superior migration (Fig. 12). C.T scan of hip with 3-D reconstruction revealed no acetabular deficiency. During the revision surgery, it was noted that femoral head was large and saddle shaped. On attempted reduction, there was a volumetric mismatch between a small acetabulum and large femoral head. The procedure was abandoned. The parents were counselled that further head reduction osteotomy or salvage surgery may be needed in the future.

Discussion

DDH encompasses a variety of conditions ranging from a true congenital hip dislocation to silent dysplasia that presents in the 2nd or 3rd decades of life. An early stable reduction of the femoral head is associated with better long-term outcomes. Children with DDH in the developing countries usually present when they start walking with a painless limp. In a walking age child, treatment is mostly surgical in the form of open reduction with or without femoral or pelvic osteotomies. The most common complications of DDH surgery include AVN of the femoral head, re-dislocation and residual dysplasia. Redislocation following successful index reduction is a serious complication. The revision procedure is technically demanding with an increased risk of complications. Various theories have been put forward in the causation of

Figure 10: Case 3,seven month follow-up showing gross subluxation

Figure 11: Case 3,post-op Xray following revision surgery

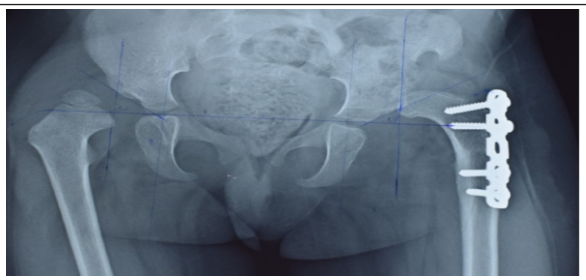

Figure 12: Case 4,Eight month followup following primary surgery showing re-dislocation

redislocation. Frequently the cause of re-dislocation after primary hip surgery for DDH has been reported to be technical errors during the index procedure. Such technical errors may be due to inadequate release of offending soft tissue structures or non-recognition of the true acetabulum. The soft tissues mentioned in literature which can be a cause of re-dislocation are residual stump of ligamentum teres or retained pulvinar, intact transverse acetabular ligament, infolded labrum, tight adductors, inferomedial capsule or inadequately released iliopsoas tendon [2, 4-6]. Lack of care during positioning for spica application during postoperative period has also been reported [7]. Bhaskar et al have shown ossification of epiphysis as a factor in preventing redislocation [8]. We have tried to analyse the various factors in causation of redislocation.

In 2 of our cases, CT scans revealed that posterior acetabular uncovering was the primary cause. It may be because of the fact that reshaping osteotomies like Dega and Pemberton provide good anterior and superior coverage at the cost of posterior coverage. The problem is accentuated by overzealous correction of femoral anteversion leading to a posterior re-dislocation. A large and dysmorphic femoral head has been reported as a cause of re-dislocation [7]. Volumetric mismatch of femoral head and acetabulum often causes difficulty in achieving a stable reduction even during secondary surgery. In Case 4, reduction was not possible and the procedure was abandoned. 3D-CT, 3D printing and MRI scans prior to secondary surgeries can be used to evaluate acetabular shape and femoral version. 3D reconstructed models have also been used to study changes in acetabular volumes after various osteotomies. These investigations may help the surgeon in being better prepared for the revision surgery.

Abnormal femoral version is a common bony cause for late re-dislocation after the index procedure [7]. Under- or over-correction makes the hip prone to re-dislocation. Optimal version of the femur is also essential for a normal gait in the walking child.

In our study one hip had to undergo revised correction of version because it was found to be posteriorly dislocated while another patient had to undergo correction of version which was not addressed in primary procedure.

To address the problem of posterior uncoverage,the authors devised a novel osteotomy in one of the case which can be thought of as reverse Dega's so that anterior part is kept intact and posterior cut is completed in sciatic notch. This provides the surgeon the opportunity to put the graft much more posteriorly. Another thing, which we would like to mention is that correction of femoral anteversion should not be overzealous, so that only that much correction should be done which is required to provide stable reduction.

The surgeon should not jump into secondary surgery without doing careful preoperative clinical and radiological assessment. We feel that CT with 3D reconstruction is an effective modality to assess all components of the problem. We understand that there is definite hazard of radiation but the benefits are much more than this risk. Another important factor which other authors have also emphasised is the experience of the operating surgeon doing the index procedure. We recommend that an operative intervention in a walking child with DDH should be performed by the senior most surgeon in the team.

Acetabular deficiencies or dysplasia's which are poorly understood on plain radiographs may be a cause of redislocation even after perfectly done primary surgery. 3D CT reconstruction to evaluate bony acetabulum along with MRI for cartilaginous labrum might enlarge the horizon of preoperative evaluation of hip joint morphology. These investigations will help in preoperative planning but their inclusion mandates further studies.

Conclusion

Re-dislocation following index surgery in DDH should always be kept as one of the important complication. Careful preoperative planning with CT scan is a must,correcting the abnormal femoral version and providing the femoral head the coverage where exactly it is required is needed. These children after secondary procedure must always be kept under closed supervision till maturity.

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