Double-Level Pelvic Osteotomy for Managing Persistent Acetabular Dysplasia

Abdulrahman D. Algarni, MD, SSC (Ortho), ABOS; Fikry Abdelfattah, MD, MSc; Abdulaziz Al-Ahaideb, MBBS, FRCSC; Hamza M. Alrabai, MD, SB-Orth, JMC (Ortho); Shaji John Kachanathu, PT, PhD; Hazem Al-Khawashki, MD, FRCS; Mamoun Kremli, MBBS, FRCS

Abstract: Pemberton’s osteotomy has been recognized as a standard technique for the treatment of acetabular dysplasia. The aim of this article is to describe the surgical technique of a double-level pelvic osteotomy. To the authors’ knowledge, this technique has never been reported. The osteotomy was performed in a case of severe pan-acetabular dysplasia where a single, classic Pemberton’s osteotomy was not sufficient to provide adequate coverage. The described osteotomy provided sufficient acetabular coverage and overcame the persistent acetabular dysplasia. [Orthopedics. 2016; 39(4):e806-e809.]

In 1965, Paul Pemberton described his pericapsular pelvic osteotomy.1 Since then, it has been widely adopted for the treatment of acetabular dysplasia.2-6 Pemberton’s osteotomy is characterized by a redirection of the acetabular roof, hinging on the triradiate cartilage after an incomplete iliac osteotomy. The shape of the acetabuloplasty is modified by rotating the acetabular fragment caudally and anteriorly to improve the anterior and lateral coverage of the femoral head. Pemberton1 pointed out in his original article that congenital dislocation or subluxation of the hip is accompanied by a significant defect in the anterior portion of the acetabulum and that the treatment for such dysplasia should include correction of this defect.

In this article, the authors describe the surgical technique of a double-level pelvic osteotomy performed by the senior author (M.K.) to overcome the persistent acetabular dysplasia. To the authors’ knowledge, this technique has never been reported.

Surgical Technique

An 8-year-old girl known to have Fanconi’s syndrome with multiple congenital anomalies presented to the senior author (M.K.) after failed attempts of open reduction for a right congenital hip dislocation. Clinical evaluation revealed a shortened limb gait on the affected side and an exaggerated internal rotation indicating an excessive femoral anteversion. Indeed, the femoral head could be seen and felt anteriorly in the groin. Initial radiographs showed subluxated hip and acetabular dysplasia. The patient subsequently underwent open reduction, capsulorraphy, Pemberton’s osteotomy, and femoral derotation osteotomy. Unfortunately, the hip subluxation and femoral anteversion gradually recurred and the femoral head could still be felt in the groin on external rotation, indicating a significant anterior acetabular dysplasia (Figure 1). A radiograph and a 3-dimensional computed tomography scan are shown in Figure 1.

In this case, there were lateral, anterior, and posterior acetabular deficiencies. An acetabuloplasty that could improve the lateral coverage and, to a larger extent, provide a lot of anterior coverage without increasing the posterior acetabular deficiency was needed. On the basis of these findings, the senior author (M.K.) decided to proceed with a double-level pelvic acetabuloplasty to overcome
the persistent significant anterior and lateral acetabular dysplasia. The patient underwent repeated open reduction, double-level pelvic osteotomy, and femoral derotation-shortening osteotomy.

The rationale for the double-level pelvic osteotomy is that the superior-level Pemberton’s osteotomy could provide the necessary lateral coverage and some of the required anterior coverage, while the inferior-level osteotomy could provide adequate anterior coverage by directing the correction more anteriorly.

The superior-level Pemberton’s osteotomy is initially performed in the classic way—at the highest level possible just below the anterior superior iliac spine to give an adequate space for the second osteotomy. The direction of this osteotomy posterior to the acetabulum is inclined forward and laterally to achieve both anterior and lateral coverage. When completing the osteotomy, the acetabulum is pulled anteriorly and laterally, hinging on the triradiate cartilage, and a harvested autograft—in this case a femoral autograft—is then inserted at the osteotomy site to prevent rebound of the acetabulum to its original position. The second or inferior-level osteotomy is performed below and is directed in the frontal plane where the inner table cut conforms exactly to the one in the outer table—hinging on the triradiate cartilage and, to a lesser extent, on the thick posterior part of the acetabular dome—allowing the anterior part of the roof of the acetabulum to be displaced directly downward to achieve a more anterior coverage (Figures 2-3). A harvested iliac autograft is then inserted anteriorly at the osteotomy site, and both osteotomies are supplementary fixed with K-wires to prevent graft dislodgment. The senior author (M.K.), however, does not usually use fixation for a single Pemberton’s osteotomy.

Figure 1: Clinical photograph of anterior hip subluxation on external rotation (arrow) (A). Hip radiograph showing persistent acetabular dysplasia (B). Three-dimensional computed tomography scan showing anterior acetabular dysplasia, anterior femoral head subluxation, and excessive femoral anteversion (C).

Figure 2: Intraoperative clinical photograph showing both osteotomies. The direction of displacement of each osteotomy is shown (white arrows).

Figure 3: The double-level pelvic osteotomy is outlined on a skeletal pelvis model. The acetabular dysplasia (dotted line), the superior cut (black line), and the inferior cut (green line) are shown on the outer table (A) and the inner table (B). The direction of displacement of the superior osteotomy (C) and the inferior osteotomy (D) are shown (white arrows).

An immediate postoperative radiograph is shown in Figure 4A. There was no evidence of hip resubluxation or recurrent excessive femoral anteversion during follow-up. The patient was walking without a limp and had a good
range of motion without anterior subluxation of the femoral head. A radiograph at the most recent 3-year follow-up is shown in Figure 4B.

**DISCUSSION**

Residual acetabular dysplasia is one of the most common complications after treatment for developmental dysplasia of the hip. The goal of treatment is to restore the anatomy to as near normal as possible by the time skeletal maturity is attained. The potential for acetabular development continues for many years; however, after 4 years of age, this potential for restoration of normal anatomy is markedly decreased. Correction of residual acetabular dysplasia theoretically provides a better weight-bearing surface for the femoral head, restores the normal biomechanics of the hip, reduces contact pressures, and may increase the longevity of the hip by preventing degenerative joint disease.

In terms of sufficient coverage, containment, and congruency, different surgical modalities have been advocated for the treatment of acetabular dysplasia: either isolated pelvic osteotomy, or an additional proximal femoral osteotomy. Knowing the appropriate indication, selection, and sequencing of these osteotomies is critical for enhancing patient outcomes. In the current case, although the patient initially underwent combined acetabular and femoral osteotomies, the acetabular dysplasia persisted.

Many pediatric orthopedic surgeons would expect the Pemberton’s osteotomy to achieve a great degree of correction for the acetabular dysplasia without the need for internal fixation. Pemberton’s osteotomy has been the standard technique the senior author (M.K.) has used during the past 20 years. In the current case, there was a need for good lateral coverage as well as good anterior coverage to prevent the anterior subluxation of the femoral head. A single, classic Pemberton’s osteotomy was insufficient to achieve the required improvement of the acetabular coverage on both directions simultaneously. Trying to achieve this through a single Pemberton’s osteotomy alone would not be possible and would risk complete separation of the distal fragment. The double-level pelvic osteotomy described in this article provided good lateral and anterior coverage through the superior Pemberton’s osteotomy and added the much needed anterior coverage through the inferior osteotomy. Using a redirectional type osteotomy like Salter’s in this case would not provide the required improvement in acetabular coverage in both directions and would also risk posterior uncoverage. Triple innominate osteotomy, being a redirectional type of osteotomy, would lead to difficulty in changing the shape and contour of the capacious acetabulum in this case. It is also technically more demanding and necessitates additional incision(s).

In view of the decreased triradiate cartilage flexibility and remodeling potential, some authors have cautioned against the use of the Pemberton’s osteotomy in children older than 7 years. However, others have shown that it is a safe and effective procedure in this age group, especially when combined with a proximal femoral osteotomy. In the current case, the patient was 8 years old and required, in addition to the double-level pelvic osteotomy, a proximal femoral osteotomy.

As with Pemberton’s osteotomy, the authors consider injury to the triradiate cartilage resulting in its premature closure a possible complication following the double-level pelvic osteotomy. Likewise, overcorrection, which would risk femoral head osteonecrosis, is another complication to avoid.

**CONCLUSION**

The double-level pelvic osteotomy might be the solution to persistent anterior acetabular dysplasia. Short-term results of this technique are promising; however, long-term follow-up is advocated.

**REFERENCES**


3. Faciszewski T, Kiefer GN, Coleman SS. Pemberton os-


