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The Use of a Hydroxyapatite Wedge for a Pemberton Osteotomy: A Case Report

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ABSTRACT

This case report describes a nine-year-old girl with bilateral Tönnis type 2 developmental dysplasia of the hip (DDH) that had not been treated previously. A notable feature of this patient was the presence of a simple cystic lesion in the left supraacetabular region. We performed a Pemberton osteotomy and used a hydroxyapatite (HA) wedge in the area of the supraacetabular cyst. Our aim was to evaluate the safety and efficacy of using an HA wedge in DDH cases with accompanying supraacetabular cysts. At the 13-month clinical follow-up, no complications were observed at the hip, including issues with wound healing, non-union, loss of graft position, or infection. Although the hip dislocation was not fully corrected by the final follow-up, no graft-related complications were encountered. In conclusion, based on our experience with this case, we believe that the use of an HA wedge can be both effective and safe in DDH patients with supraacetabular cysts. Additionally, HA wedge use is minimally invasive and may reduce donor site morbidity, as no additional incisions or osteotomies are needed to obtain the graft.

Keywords: Developmental dysplasia of the hip, hydroxyapatite wedge, innominate osteotomies, Pemberton osteotomy.

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INTRODUCTION

Artificial bone grafts are rarely used in innominate osteotomies in children. In this report, we evaluated the short-term outcome of a nine-year-old child with developmental dysplasia of the hip (DDH) and a supraacetabular bone cyst who underwent a Pemberton osteotomy using a hydroxyapatite (HA) wedge. Various graft options have been discussed in the literature. For instance, the use of HA wedges has demonstrated effectiveness in patients undergoing open-wedge high tibial osteotomy.[1] Furthermore, histological studies have demonstrated that the use of HA wedge is a safe method.[2] According to the literature, HA wedges are widely recognized as a valuable graft option in orthopedic surgeries. Our aim in applying this method was to evaluate the safety and efficacy of HA wedge use in DDH cases involving supraacetabular cysts.

CASE REPORT

In June 2008, a nine-year-old girl presented to our clinic with complaints of leg length discrepancy and limping. Physical examination revealed pelvic obliquity and increased lumbar lordosis. Radiographic imaging and limited-section computed tomography was performed. Based on all

evaluations, the patient was diagnosed with bilateral Tönnis type 2 DDH. Due to her status as an immigrant, the patient could not be identified in the National Survey system. She was the first child in the family, and there was no family history of DDH. Imaging also revealed a simple bone cystic lesion in the left supraacetabular area (Fig. 1A-B).

We treated her left hip with a Pemberton osteotomy and used an HA wedge both as a spacer and to fill the cyst. The HA wedge was a biphasic phosphocalcic ceramic composed of 65% phosphocalcic hydroxyapatite [$Ca_{10}(PO_4)_6(OH)_2$] and 35% tricalcium phosphate, with a porosity of 60-80% (Ceraform®; Teknimed Co., Toulouse, France). The wedge was trapezoidal in shape, measuring 10 to 20 mm in width, 12 mm in height, and 7 mm in thickness.

Time to union (defined as the radiographic disappearance of the clear zone around the HA wedge) was evaluated according to Kamegaya's definition.[3] Clinical evaluation was performed using the modified McKay criteria.[4] Since this is a case report, ethics committee approval was not required; however, informed consent was obtained from the patient. No artificial intelligence-supported applications were used in the design of this study.

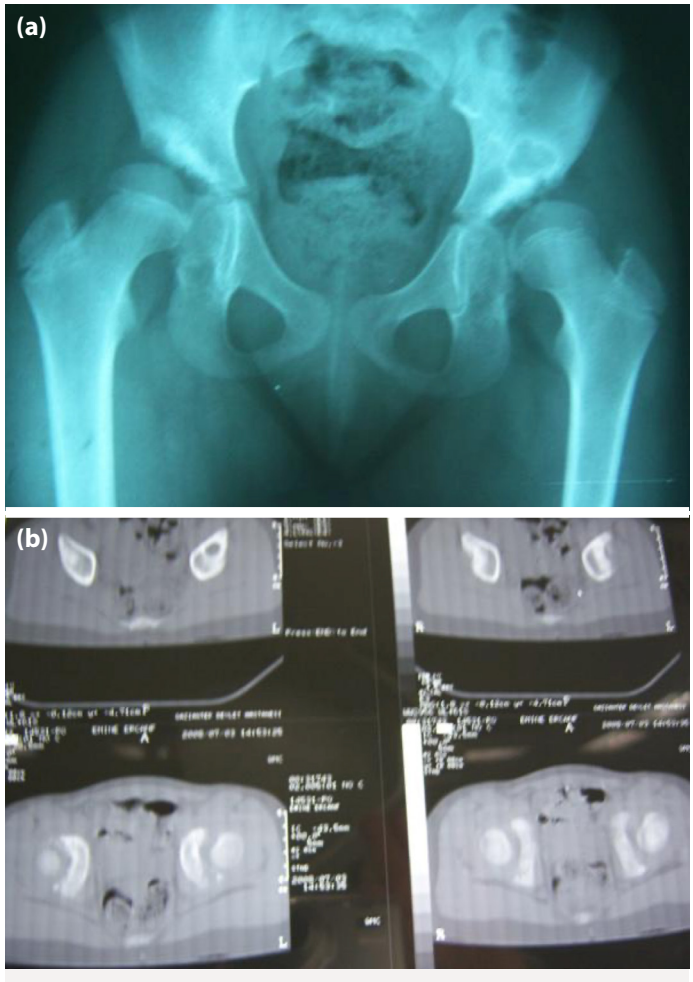

Figure 1. (A-B) Imaging reveals a simple bone cystic lesion in the left supraacetabular area.

Surgical Technique and Treatment

A 6 cm mini transverse (bikini-line) ilioinguinal skin incision was made, without opening the iliac crest apophysis (Fig. 2a-b). A Pemberton-like osteotomy was then performed. After the osteotomy, the cyst contents were cleaned and samples were sent for pathological analysis. The cleaned area of the cyst was cauterized, and an HA wedge was placed to fill the bone defect and correct the acetabulum. K-wires were not used for fixation, as intraoperative stabilization was deemed sufficient (Fig. 3a-b). The pathology results from the cystic area confirmed a diagnosis consistent with a simple cyst. Postoperatively, the patient was immobilized in a hip spica cast for six weeks to support osseous union and soft tissue healing. After cast removal, hip mobilization

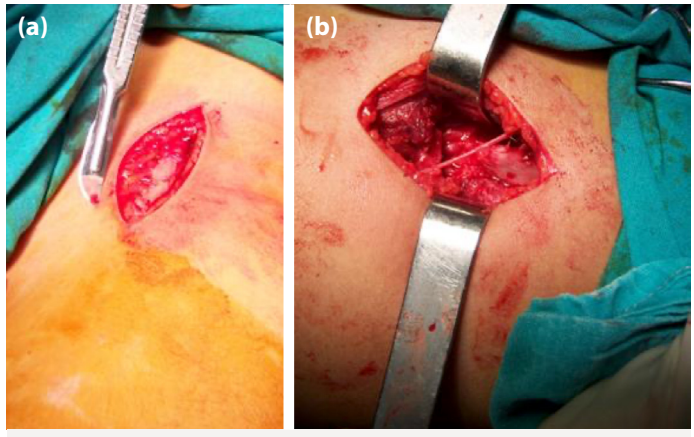

Figure 2. (A-B) The iliac crest apophysis was not opened.

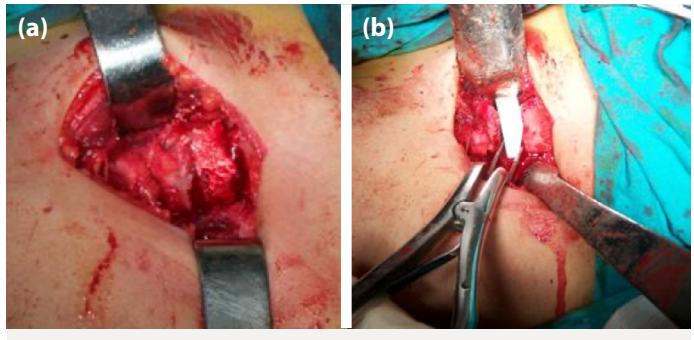

Figure 3. (A-B) Images showing that no K-wires were used during the Pemberton acetabuloplast.

was initiated, and a Ponseti abduction splint was applied for an additional six weeks. Following this period, the patient was allowed full weight-bearing and unrestricted hip range of motion. Complete bone union was achieved by the fifth postoperative month.

At the 13-month clinical follow-up (Fig. 4), no complications were observed, including wound healing issues, non-union, loss of graft correction, or infection. Functional evaluation using the modified McKay criteria indicated excellent results; however, no significant improvement in hip subluxation or dysplasia was noted. Although the patient was scheduled for subsequent follow-up visits, she did not return, and we were unable to obtain any further information regarding her condition.

DISCUSSION

This case report was presented to evaluate the effectiveness of the graft material used, rather than to address the correction of the patient's deformity. A notable feature of this case is the use of an HA wedge, chosen because autograft options were potentially limited or inadequate due to the presence of a simple bone cyst in the surgical area. To our knowledge, no similar case has been reported in the literature that combines both the use of this specific graft material and the unique characteristics of the case. Therefore, we believe our report may provide a contribution to the existing body of knowledge. Based on the outcome observed in this case, we suggest that the use of an HA wedge may be an effective alternative in similar clinical scenarios.

The Pemberton osteotomy is a commonly used technique for the treatment of DDH.[5] It is a well-established method with proven effectiveness and has been used for many years. Due to its frequent use in our clinical practice, a Pemberton-like osteotomy was performed in this patient. In pelvic osteotomies, a full-thickness tricortical iliac crest autograft, typically harvested from the anterior region of the iliac crest, is commonly regarded as the standard graft material.[6] However, this procedure is sometimes associated with challenges and complications, including partial collapse or displacement of the graft.[6,7] Additionally, separation of the iliac apophysis may lead to growth disturbances in the iliac bone, altering the origin of the abductor muscles.[8-10] The use of an autologous bone graft from the iliac crest also carries significant risks, including donor site blood loss, prolonged operative time, and increased risk of infection.[11] In our case, the presence of a supraacetabular cyst led us to reconsider the standard graft option. Although the iliac crest autograft is the gold standard, we opted to use an HA wedge due to concerns about the ability to adequately fill the defect and to avoid the potential comorbidities associated with autograft harvesting, as noted in the literature.

Figure 4. Follow-up image showing no complications at the final clinical evaluation.

As a result, many researchers have developed and studied different types of allografts and bone graft substitutes to avoid the need for bone graft harvesting.[3,9,10] HA blocks, in particular, have been used to help prevent potential growth disturbances at the iliac donor site and to reduce the extent of the procedure in Salter osteotomies.[3] Amemiya et al.[10] presented three cases with long-term follow-up outcomes. HA is one of the most widely used graft materials and has been applied both experimentally and clinically in bone graft surgeries due to its biocompatibility and excellent osteoconductivity.[12] In a recent study evaluating graft options, Kim et al.[13] demonstrated that the use of an HA wedge is a safe alternative.[13] In our case, complete bone union was achieved within five months, and no graft-related complications were observed during the 13-month follow-up period, suggesting that the graft we used may be a safe and effective option.

However, there are several limitations to our study. First, we were unable to comment on long-term outcomes. Second, due to the unique characteristics of the case, our findings cannot be generalized to all patients with DDH. Lastly, as this is a single case report, its evidentiary value is limited and reflects only our experience with this particular case.

In conclusion, based on our experience with this case, we believe that the use of an HA wedge can be both effective and safe in patients with DDH accompanied by supraacetabular cysts. We believe this case contributes to the literature, as no similar report has been identified to date. We also believe that the use of an HA wedge is minimally invasive and may result in reduced donor site morbidity, as it eliminates the need for additional incisions and osteotomies to harvest graft material. Randomized controlled studies are needed to draw more definitive conclusions.

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Informed Consent: Informed consent was obtained from the patient.

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