



# Radiological Outcome in Developmental Dysplasia of the Hip Following Varus Derotation Osteotomy: A Case Series

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## Abstract

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**INTRODUCTION:** Developmental dysplasia of the hip (DDH) includes femoral head subluxation or dislocation and/or acetabular dysplasia. The gold standard treatment for DDH during walking age remains controversial. Treatment modalities that have been proposed to treat DDH after walking age are femoral osteotomy and pelvic osteotomy. The aim of this study was to assess the radiographic results of surgical treatment of DDH after the walking age.

**CASE PRESENTATION:** Four patients were included in this study. All patients presented with DDH in walking age and underwent varus derotational osteotomy. Measurements of acetabular index (AI) and migration percentage were done on pelvic X-ray before and after the procedure to assess the outcome.

**CONCLUSION:** This study showed satisfactory outcomes following femoral osteotomy in ambulatory DDH in terms of migration index and AI. Further study with more samples is needed for higher level of certainty.

## Introduction

Developmental dysplasia of the hip (DDH) includes femoral head subluxation or dislocation and/or acetabular dysplasia [1]. DDH is more commonly affected in female and predominantly affected in the left-side [2], [3]. The treatment of DDH after the walking age group is usually surgical due to the fact that the pathological changes present at this age as severe contracture of the muscles, tendons, and capsule around the hip, increased shallowness of the acetabulum, excessive femoral anteversion, hypertrophied inverted labrum, excessive pulvinar, misdirected acetabulum would make closed reduction very difficult, and forcible that may lead to avascular necrosis of the femoral head or redislocation [4].

The gold standard treatment for DDH during walking age remains controversial. Treatment modalities that have been proposed to treat DDH after walking age are femoral osteotomy and pelvic osteotomy. The goals of open reduction are to: (1) Safely reduce the dislocated hip and to surgically recreate normal anatomy (as closely as possible) and (2) to reorient the

biomechanical relationships such that the development of degenerative hip disease is delayed or prevented [5].

The aim of this study was to assess the radiographic results of surgical treatment of DDH after the walking age.

## Methods

Four patients were included in this study. All patients presented with DDH in walking age and underwent varus derotational osteotomy (VDRO). Measurements of acetabular index (AI) and migration percentage (MP) were done on pelvic X-ray before and after the procedure to assess the outcome.

### Case 1

A 2-year-old female patient with pre-operative radiograph examination showing complete dislocation of the left femoral head with MP 196% and AI 38.41° (Figure 1).

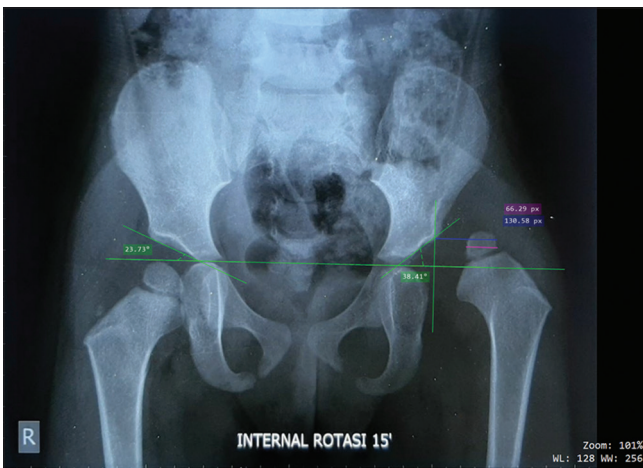


Figure 1: Pre-operative pelvic radiograph measurements

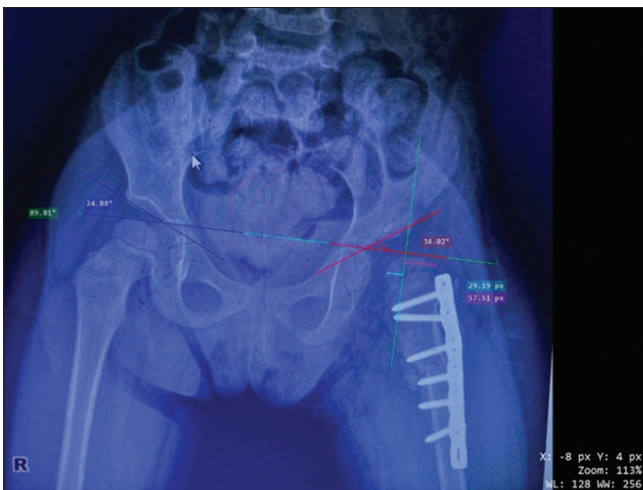


Figure 2: Post-operative pelvic radiograph measurements

The patient underwent VDRO and showed a significant correction of the MP 63.7% and AI 34.02° (Figure 2).

### Case 2

A 9-year-old female patient presented to the orthopedic clinic with bilateral DDH. VDRO was

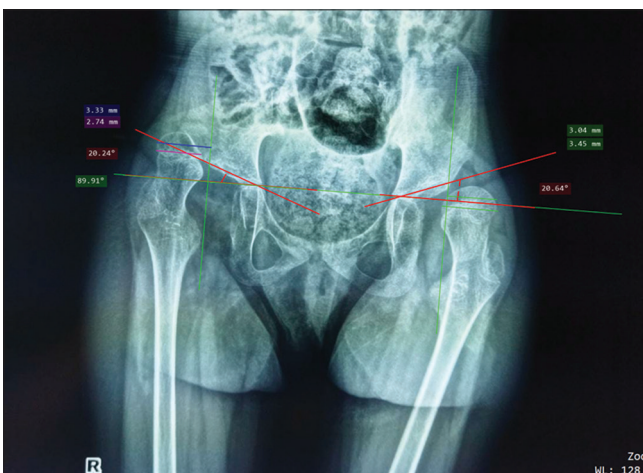


Figure 3: Pre-operative pelvic radiograph in patient 2

done only on the right femur. The pre-operative pelvic radiograph was shown in Figure 3. The AI showed 20.24° and 20.64° in the right and left hip, respectively. The MP showed 122% and 88% in the right and left hip, respectively.

The patient underwent right femoral osteotomy procedure (Figure 4). Post-operative radiograph measurement showed AI 16.33° and MP 21%.

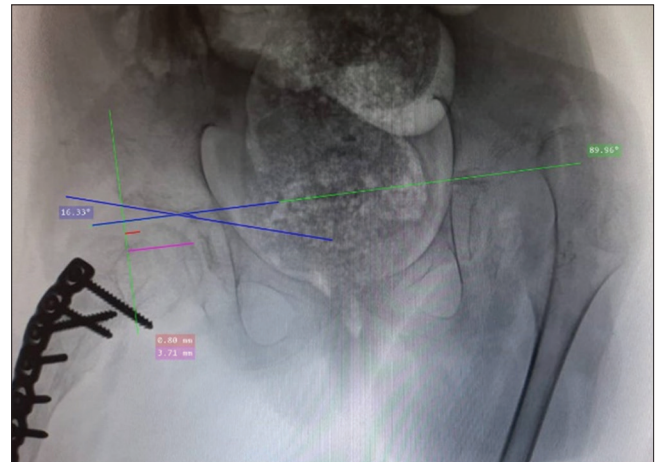


Figure 4: Post-operative radiograph in patient 2

### Case 3

A 5-year-old female patient presented to the orthopedic clinic with bilateral DDH. VDRO was done on both femurs. The pre-operative pelvic radiograph was shown in Figure 5. The AI showed 27.69° and 28.41° in the right and left hip, respectively. The MP showed 161% and 152% in right and left hip, respectively.

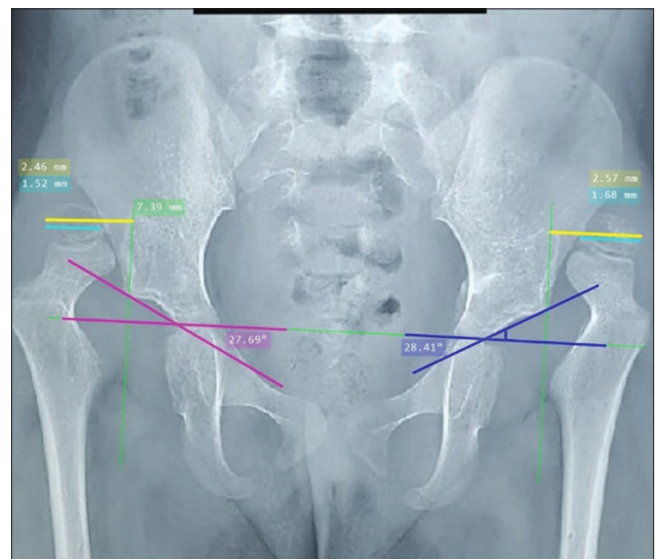


Figure 5: Pre-operative pelvic radiograph in patient 3

The patient underwent bilateral femoral osteotomy procedure (Figure 6). Post-operative radiograph measurement showed AI 28.79 and 28.88 degree with MP 31.3% and 16.3%, in the right and left hip, respectively.



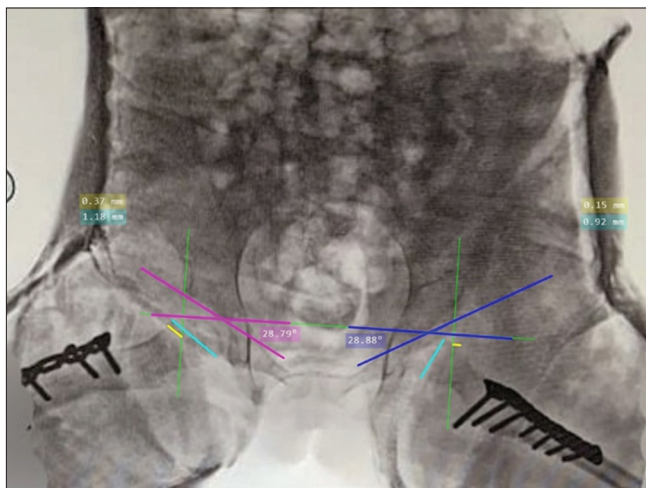


Figure 6: Post-operative radiograph in patient 3

#### Case 4

A 10-year-old female patient presented to the orthopedic clinic with bilateral DDH. VDRO was done on the left femurs. The pre-operative pelvic radiograph was shown in Figure 7. The AI showed  $13.69^\circ$  and  $25.77^\circ$  in the right and left hip, respectively. The MP showed 122% in the left hip.

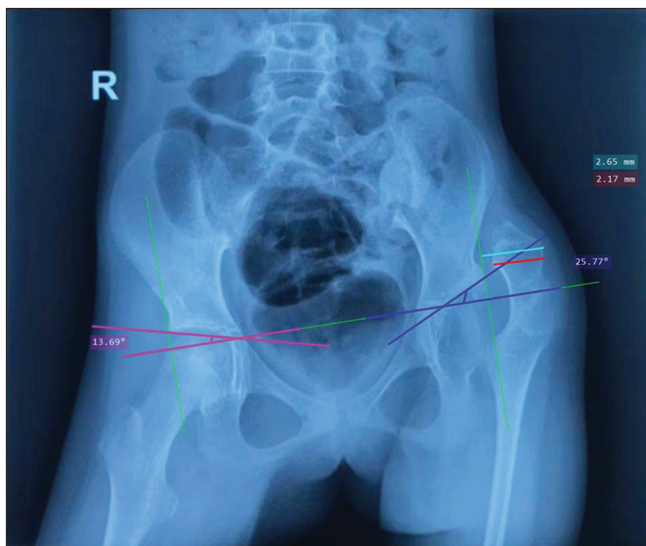


Figure 7: Pre-operative pelvic radiograph in patient 4

The patient underwent left VDRO procedure (Figure 8). Post-operative radiograph measurement showed AI  $25.56^\circ$  with MP 6% in the left hip.

#### Discussion

The DDH is one of the most common pediatric disorders. The spectrum of the DDH comprises of neonatal instability, acetabular dysplasia, hip subluxation, and true dislocation of the hip [6], [7]. It is more commonly

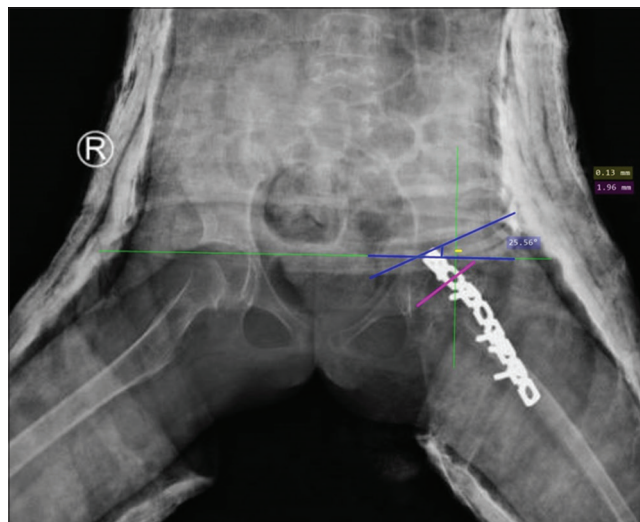


Figure 8: Post-operative radiograph in patient 4

affected unilateral, especially the left-side, in female patient [2], [3]. Several risk factor that causes DDH is breech presentation, familiar history, oligohydramnios, female, and elevated weight in birth [8].

Several pathogenesis theories have been proposed in DDH. Hormonal theory is based on a misbalance between estrogen and progesterone. Estrogens are protective against dislocation while an environment with higher concentrations of progesterone can facilitate dislocation [9]. However, several studies showed that there was no correlation between DDH and serum concentrations of beta-estradiol and relaxine [10], [11], [12]. Mechanical theory sustains that persistent mechanical stimulation can provoke a deformity, especially in periods of high growth. The human fetus accomplishes these criteria, because of its plasticity and rapid rate of growth. The maintained posture with forced hyperflexion of the hip and knee extension associated with breech presentation could lead to hip dysplasia and dislocation [8].

Several clinical signs in DDH are Ortolani, Barlow sign, Galleazi sign, leg length discrepancy, and Klisic sign. Radiographically, increased MP  $>33\%$  is indicated as subluxation. In this study, the radiograph examination showed the increased of AI and MP in all affected hips. These findings indicate the diagnosis of DDH.

These cases showed a DDH in ambulatory age. However, the prevalence of DDH in walking age remains unclear and there will always be children who reach ambulatory age with DDH. Hence, the gold standard of management of DDH in ambulatory age also unclear. It comprises of closed reduction and open reduction and may followed by pelvic and/or femoral osteotomy [13], [14], [15]. However, the aims of surgical procedure in ambulatory age of DDH are maintain reduction without recurrence of subluxation or dislocation as well as without stiffness and avascular necrosis of the femoral head [5], [16].

In these cases, the patients underwent VDRO in ambulatory age. The results showed acceptable result in terms of MP. However, the first case showed increased AI in the left hip while three cases showed normal bilateral AI. The discrepancy between pre- and post-operative AI in second patient was occurred due to the pelvic radiograph that was not in true anteroposterior position.

## Conclusion

This study showed satisfactory outcomes following femoral osteotomy in ambulatory DDH in terms of migration index and AI. Further study with more samples is needed for higher level of certainty.

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