Acta Orthopaedica et Traumatologica Turcica xxx (2018) 1–6

Contents lists available at ScienceDirect

Acta Orthopaedica et Traumatologica Turcica

journal homepage: https://www.elsevier.com/locate/aott

# Treatment outcome of dome osteotomy of the pelvis combined with trochanteric advancement for sequelae of Perthes' disease

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ARTICLE INFO

*Article history:*
Received 25 July 2017
Received in revised form
15 February 2018
Accepted 26 February 2018
Available online xxx

*Keywords:*
Dome osteotomy
Trochanteric advancement
Acetabular dysplasia
Perthes' disease
Sequelae

ABSTRACT

*Objective:* Disparity in size between femoral head and acetabulum could promote premature degeneration of the hip joint. The purpose of this study was to report the results of Kawamura's dome osteotomy for acetabular dysplasia due to sequelae of Perthes' disease.
*Patients and Methods:* Fourteen patients (14 hips) operated between 1999 and 2012 were retrospectively reviewed. There were 9 males and 5 females with a mean age of 29 years (range, 15–54 years). Functional and radiological results were reviewed at mean follow-up of 9 years (range, 4–12 years).
*Results:* Pain relief was obtained in 13 of 14 (92.8%) patients postoperatively. Good to excellent functional outcome was obtained in 10 of 14 (71.4%) patients. Mean Harris hip score was improved from 63 to 84 ($p < 0.05$) at the final follow-up. Improvement of limping gait was observed in 10 of 14 (71.4%) patients. Center edge angle improved from mean 24° (11–36°) preoperatively to mean 35° (27–46°) postoperatively ($p < 0.05$), acetabular angle improved from mean 43° (36–49°) preoperatively to mean 37° (32–44°) postoperatively ($p < 0.05$), acetabular head index improved from mean 69% (50–83%) preoperatively to mean 85% (73–100%) postoperatively ($p < 0.05$). Progression of arthrosis stage occurred in 3 of 14 (21%) patients. None of the hip with preoperative Stulberg III, 2 of 9 hips with Stulberg IV and 2 of 2 hips with Stulberg V needed conversion to total hip arthroplasty during the follow-up.
*Conclusion:* Dome osteotomy of the pelvis combined with trochanteric advancement could give a reasonable treatment outcome for acetabular dysplasia due to Perthes' disease at mid to long-term follow-up. Advanced stage of arthrosis, preoperative Stulberg V and no improvement of limping gait after the surgery possibly associated with poor outcome.
*Level of evidence:* Level IV, therapeutic study.


## Introduction

One characteristic of the sequelae of Perthes's disease is the presence of disparity in size between femoral head and acetabulum.[1] This condition can induce pain and promote early degeneration of the joint.[2] Previously, Chiari osteotomy was known as an alternative salvage operation to solve this problem.[3] The original Chiari osteotomy was done by making a flat osteotomy at the superior margin of the acetabulum. The femoral head coverage was then increased by making a medial displacement of the pelvis inferior to the osteotomy.[4] This procedure could increase hip joint function and its longevity.[5]

As a modification to the original Chiari osteotomy, Kawamura[6] has described a dome osteotomy of the pelvis through lateral approach of the hip by making a standard trochanteric osteotomy. This procedure will result in a dome shape bone shelf to cover the femoral head. By making a dome shape pelvic osteotomy, the resulted acetabular roof will match with the sphericity of the femoral head, thus a higher joint contact area is obtained.[7,8] Simultaneous advancement of the greater

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Peer review under responsibility of Turkish Association of Orthopaedics and Traumatology.

https://doi.org/10.1016/j.aott.2018.02.010


Please cite this article in press as: Santoso A, et al., Treatment outcome of dome osteotomy of the pelvis combined with trochanteric advancement for sequelae of Perthes' disease, Acta Orthop Traumatol Turc (2018), https://doi.org/10.1016/j.aott.2018.02.010

trochanter is also possible through this technique. Here we report the treatment outcome of dome osteotomy combined with greater trochanter advancement for sequelae of Perthes' disease.

## Patients and methods

All patients who received dome osteotomy of the pelvis as treatment for sequelae of Perthes' disease between January 1999 and December 2012 were retrospectively reviewed. A total of 15 patients received the procedure within the period. However, one patient was lost to follow-up. Therefore, a total of 14 patients (14 hips) were reviewed in this study. Indication for surgery was progressive hip pain not adequately responding to conservative treatment. There were 9 males and 5 females with a mean age of 29.2 years (range, 15–54 years). The mean of follow-up was 9 years (range, 4–12 years). Two patients had history of Salter innominate osteotomy, one patient had history of femoral varus osteotomy while the other patient had adductor tenotomy and iliopsoas release prior to pelvic dome osteotomy. One patient received femoral valgus osteotomy simultaneously with the procedure of pelvic dome osteotomy (Table 1). All patients received greater trochanter advancement during the procedure.

## Operative technique

All operations were done by the senior author (TRY). Details of the procedure have been reported previously.[9] Briefly, patient was placed in lateral position. A longitudinal skin incision was made centered over the greater trochanter. After skin incision, fascia lata was devided. Then a superomedial directed greater trochanter osteotomy was done. The attachment of abductor muscle and vastus lateral muscle to the greater trochanter was retained. Exposure of outer table of ilium was obtained with the limb positioned in abduction while the greater trochanter musculo-osseus sleeve was reflected anteriorly. A stainmann pin with diameter of 3.5 mm was inserted to the pelvis at upper border of the capsule in superomedial direction with an angle approximately 15° to horizontal line. The position of the Steinmann pin was confirmed with fluoroscopy. A dome osteotomy was done with the guidance of the Steinmann pin position using an oscillating saw. After osteotomy was completed, distal pelvic fragment was displaced medially. The resulted femoral head coverage was confirmed with fluoroscopy. Internal fixation of the pelvis osteotomy was achieved using a Steinmann pin with diameter of 2.4 mm. Then the greater trochanter was reattached using two cancellous screws or stainless steel wire at a distally advanced position. One patient received closed wedge femoral valgus osteotomy simultaneously.

An abduction brace was used postoperatively. Non-weight bearing crutch walking was allowed within one week and continued until approximately three months upon evaluation for radiological bone union. The Steinmann pin was removed at 6–12 weeks. Patients were followed at one month, three months, six months, one year, and every year thereafter postoperatively. Evaluation for improvement of the pain, gait pattern, joint range of movement (ROM), and functional assessment with Harris hip score (HHS)[10] was carried out at each follow-up.

Standard anteroposterior radiographs of the pelvis were taken preoperatively, immediate postoperatively, and at each follow-up. Center edge angle of Wiberg[11], acetabular angle of Sharp[12], and acetabular head index[13] were measured for all radiographs. Joint space at the weight bearing area and the narrowest point were also measured. The angle of pelvic osteotomy, distance and percentage of displacement at the pelvic osteotomy, and distance of greater trochanter advancement were measured for immediate postoperative radiographs (Fig. 1). All radiographic measurement was performed digitaly using Marosis PACS software (Marotech Inc., Seoul, South Korea). With this software, measurement of angles and distances resulted in two decimal points after compensation of magnification. It was then rounded off. Based on modified classification of the Japanese Orthopaedic Association[14], all hips were classified into the following four stages of arthrosis based on anteroposterior pelvic radiographs: prearthrosis (dysplasia only), early arthrosis (slight joint space narrowing and subchondral sclerosis), advanced arthrosis (marked joint space narrowing with or without cyst or sclerosis), and terminal arthrosis (obliteration of joint space). Preoperative radiographic of the hip was also classified based on Stulberg classification.[15]

Statistical analysis was performed using SPSS for Windows version 17.0 software (SPSS Inc, Chicago, IL, USA). Paired student's *t*-test was used to evaluate the significance of data. A $p$ value of less than 0.05 was considered statistically significant.

**Table 1**
Patient's characteristics and preoperative data.

| No | Age (years) | Sex | Side | BMI (kg/m$^2$) | Previous Surgery | Preoperative | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | HHS | Limping gait | Arthrosis Stage | Stulberg Classification |
| 1 | 23 | M | R | 27,1 | Proximal femur varus osteotomy | 47 | Moderate | Early | V |
| 2 | 24 | M | L | 21,6 | – | 73 | Moderate | Pre- | IV |
| 3 | 20 | M | R | 20,1 | – | 76 | Moderate | Early | III |
| 4 | 19 | M | L | 24,2 | – | 71 | Mild | Early | III |
| 5 | 19 | F | L | 19,5 | Salter osteotomy | 48 | Severe | Pre- | IV |
| 6 | 15 | M | R | 23,4 | Adductor tenotomy and psoas release | 73 | Moderate | Advanced | V |
| 7 | 30 | F | L | 27,7 | – | 60 | Mild | Pre- | IV |
| 8 | 40 | F | R | 25,9 | – | 47 | Moderate | Early | IV |
| 9 | 41 | M | L | 24,7 | – | 84 | Mild | Early | IV |
| 10 | 51 | F | R | 20,7 | – | 61 | Mild | Pre- | IV |
| 11[a] | 54 | M | R | 32,5 | – | 45 | Moderate | Early | IV |
| 12 | 34 | F | R | 22,5 | – | 52 | Severe (crutch) | Advanced | III |
| 13 | 20 | M | L | 22,8 | Salter osteotomy | 81 | Moderate | Advanced | IV |
| 14 | 19 | M | R | 32,2 | – | 68 | Mild | Early | IV |

HHS: Harris hip score; BMI: body mass index; M: male; F: female; R: right; L: left.
[a] Received simultaneous proximal femur valgus osteotomy during dome osteotomy.

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