Medium-term results of the Bernese periacetabular osteotomy in the treatment of symptomatic developmental dysplasia of the hip

D. N. Garras, T. T. Crowder, S. A. Olson

From Duke University Medical Center, Durham, USA

We studied the medium-term outcome of the Bernese periacetabular osteotomy in 52 patients (58 hips) with symptomatic developmental dysplasia of the hip and a mean age of 37.6 years (13 to 48).

The operations were performed between 1993 and 2005 by the senior author with a mean follow-up of 66.7 months (13 to 153). There were 42 women (47 hips) and ten men (11 hips). Of these patients, 24 (30 hips) had an osteotomy on the right side and 22 (28 hips) on the left. Six patients had bilateral operations. The clinical outcome was assessed using the modified Merle d’Aubigne scale, and pre- and post-operative radiological evaluation using the modified Tonnis osteoarthritis score, the centre-edge angle, the acetabular index, the status of Shenton’s line, and the cross-over sign.

The mean centre-edge angle and the acetabular index were 14˚ (2˚ to 34˚) and 23.6˚ (0˚ to 40˚) before operation, and 36.6˚ (16˚ to 72˚) and 7.9˚ (0˚ to 28˚) after, respectively (p < 0.001, analysis of variance (ANOVA)). Shenton’s line was intact in 23 hips (39.6%) before operation and in 48 hips (82.8%) after. The cross-over sign was present in 31 hips (53.4%) before and in three hips (5.2%) after operation (p < 0.001, ANOVA). The total Merle d’Aubigne clinical score improved from a mean of 12.6 (9 to 15) to 16.0 (12 to 18) points (p < 0.001, ANOVA). Only four hips required subsequent total hip replacement.

Our results indicate that the Bernese periacetabular osteotomy provides good symptomatic relief for patients with little to no arthritis (Tonnis type 0 or 1) with an underlying deformity that can be corrected to a position of a stable, congruent hip joint.

Dysplasia of the acetabulum is characterised by deficient superior and anterior cover of the femoral head associated with a decreased acetabular depth and laterolisation of the hip joint. These factors are thought to lead to altered joint mechanics by increasing the force applied over a restricted surface area. Incongruity and increased contact pressures eventually cause breakdown of the articular cartilage. Once the patient’s hip becomes symptomatic, untreated dysplasia leads to progressive degenerative osteoarthritis.

Treatment of hip dysplasia is based on the assumption that an improvement in the mechanical situation will arrest or delay the development of osteoarthritis. Many different acetabular osteotomies have been used to re-orientate the abnormally-shaped acetabulum to a normal position with the aim of creating adequate cover of the femoral head and a stable, congruent joint. Obtaining sufficient correction is often difficult. Various deficiencies in these procedures lead to the development of the Bernese periacetabular osteotomy. This was originally described using a modified Smith-Petersen approach but subsequently other exposures have been used. This study aimed to evaluate the medium-term outcome following periacetabular osteotomy for the treatment of dysplasia of the hip.

Patients and Methods

Between July 1993 and March 2005, 52 patients (58 hips) with symptomatic developmental dysplasia of the hip were treated with a periacetabular osteotomy. There were 42 women (47 hips) and ten men (11 hips). Osteotomy was performed on the right hip in 24 patients, the left in 22 and bilaterally in six. The senior author (SAO) performed all the procedures. The osteotomy was carried out as described by Ganz et al. using a modified Smith-Petersen approach. The mean age of the patients at the time of surgery was 37.6 years (13 to 48). They were followed for a mean of 66.7 months (13 to 153) after the osteotomy. None was lost to follow-up.
Clinical assessment was undertaken by the senior author (SAO) before and after operation using the modified Merle d'Aubigne hip score. This grading system measures categories of pain, mobility, and range of movement, each on a 6-point scale. The summation of all the points allocated provided the overall clinical score. A score of 18 points is considered excellent, 15 to 17 good, 13 to 14 fair, and less than 13 a poor result.

Radiological evaluation was performed by all three authors on the pre-operative anteroposterior view of the pelvis and a false profile view of the hip as described by Lequesne and de Seze. We undertook post-operative evaluation on the anteroposterior radiograph of the pelvis. The anterior centre-edge angle and the acetabular index of the weight-bearing zone were measured as an indicator of dysplasia of the hip. The status of Shenton's line and the presence of a cross-over sign of acetabular retroversion were recorded.

The degree of osteoarthritis was evaluated pre-operatively and at the latest follow-up using a modification of the Tonnis classification (Table I). Grade 0 represented the absence of osteoarthritis; grade I applied to sclerosis of the femoral head or the acetabulum, with mild loss of the apparent joint space and minimum formation of osteophytes; grade II included small cysts in the femoral head or the acetabulum with moderate loss of the joint space; and grade III indicated large cysts in the femoral head or the acetabulum, with moderate or complete loss of the joint space with or without collapse of the femoral head.

Heterotopic ossification was recorded according to the Brooker classification.

The criteria for operation included a minimum of six months of persistent pain affecting the hip, radiological evidence of dysplasia, a functional range of movement (a range of motion that did not inhibit activities of daily living), and closure of the tri-radiate cartilage.

We used one-way analysis of variance (ANOVA) to compare the pre-operative and post-operative clinical and radiological findings. Statistical analyses were performed using a commercial statistical analysis software package, StatView (SAS Inc., Cary, North Carolina). A p-value < 0.05 was considered to be statistically significant.

Results

There was a statistically significant post-operative improvement in the modified Merle d’Aubigne series and in all the radiological indices (Table II).

The severity of pre-operative osteoarthritis according to the modified Tonnis stage was grade I in 27 hips (46.5%), grade II in 24 (41.4%), and grade III in seven (12.1%). Post-operatively, at the last review, the severity of osteoarthritis had improved in 13 hips (22.4%), had deteriorated in seven (12.1%) and remained unchanged in 38 (65.5%). The greatest improvements in the clinical score occurred in patients with the least severe arthritis (Table III).

Overall, the number of hips in the combined Merle d’Aubigne excellent/good category increased from six (10.3%) pre-operatively to 49 (84.5%) at follow-up. Con-
versely, the number of patients in the combined fair/poor category decreased from 52 hips (89.7%) to nine (15.5%) at follow-up.

Complications. Two patients (3.8%) suffered a transient sciatic nerve palsy and nine (17.3%) had dysaesthesiae in the distribution of the lateral femoral cutaneous nerve, all of which had fully resolved by final follow-up. Heterotropic ossification developed in seven hips; Brooker class I in four, class II in two, and class III in one patient. There were four nonunions (6.9%), two involving the posterior column, one involving the pubic root, and one the inferior pubic ramus. One nonunion of a posterior column was symptomatic and required operative treatment. Nine hips underwent subsequent removal of the internal fixation and four progressed to total hip replacement at a mean of three years. There were no post-operative infections.

Discussion
Re-orientation of the dysplastic acetabulum can be effectively performed using the Bernese periacetabular osteotomy. Its attractiveness lies in the ability to achieve nearly unrestricted mobility of the acetabular segment, allowing substantial correction of the deficiency in the coverage through a single approach. Pelvic osteotomies which allow similar correction, such as the Steele triple-innominate osteotomy or the Tonnis procedure, frequently require a second incision to complete the ischial cut. The double osteotomy of Sutherland and Greenfield redirects the acetabulum through distant osteotomies, providing significant distortion of the pelvic ring while gaining less extensive correction of the acetabulum. The Dial osteotomy is able to address deficits of anteromedial cover, but does not allow medialisation of the hip joint. The Salter osteotomy also provides anterolateral cover of the hip, but not medialisation of the acetabulum through direct osteotomy. The Chiari osteotomy is able to achieve significant correction of the acetabulum, and that it is associated with the cross-over sign on the anteroposterior radiograph, has made this condition commonly recognised today.

Correction of acetabular retroversion is now understood as a key element in periacetabular surgery. In our series, a cross-over sign was only observed in three patients post-operatively. There was no statistical significance found (p = 0.28, ANOVA) in improvement in the Merle d’Aubigne score between patients with and without a post-operative cross-over sign due to the small number of patients with post-operative retroversion.

This series of patients treated with periacetabular osteotomy for adult dysplasia of the hip represents the experience of a single surgeon with medium-term follow-up. The results show that the osteotomy provides good symptomatic relief for patients with little to no arthritis (Tonnis type 0 or I) with an underlying deformity that can be corrected to a stable, congruent hip joint.

No benefits in any form have been or will be received by a commercial party related directly or indirectly to the subject of this article.

References


