



A Reduction Technique of Arthroplasty Without Subtrochanteric Femoral Shortening Osteotomy for the Treatment of Developmental High Dislocation of Hip: A Case Series of 28 Hips



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ABSTRACT

In total hip arthroplasty for the treatment of developmental dysplasia of the hip (DDH) with high hip dislocation, it can be technically challenging to locate the true acetabulum and restore limb length without subtrochanteric femoral shortening osteotomy. We explored and described total hip arthroplasty without subtrochanteric femoral shortening osteotomy in 28 hips with Crowe type III and IV dislocation by intravenous injection of rocuronium at 0.9 mg/kg 1 minute before reduction and hip reduction combined with continuous strong traction of the affected limb with patients in a position with hip and knee flexion. All patients did not show dislocation, prosthesis loosening, and other severe complications. It is thus a safe and feasible reduction technique for arthroplasty of Crowe type III or IV dislocation of DDH.

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Total hip arthroplasty (THA) is an effective treatment for developmental high dislocation of hip (DDH) with high hip dislocation in adults. It can restore hip stability, recover hip movement, and correct hip deformities [1–5]. However, this operation is technically challenging, because these patients have poor quality of acetabular bone stock, narrow femoral canals, and highly dislocated proximal femora [6–9]. In addition, arthroplasty of high hip dislocation in adults is prone to injuries of the sciatic nerve and artery [10–12], and hip reduction is very difficult to achieve.

Therefore, many doctors perform the arthroplasty via a subtrochanteric femoral shortening osteotomy or without hip reconstruction in the true acetabulum region in order to avoid neurovascular injury and difficulties in hip reduction. However, the above approaches can lead to complications such as shortened limbs, nonunion after osteotomy, loosened prosthesis, dislocation of hip, and hip pain [13–20].

Consequently, we performed the arthroplasty of high hip dislocation without subtrochanteric femoral shortening osteotomy. We not only reconstructed the center of rotation of the hip, but also achieved excellent clinical effect. THA can be safely achieved by intravenous injection of rocuronium at 0.9 mg/kg (three times of ED95) 1 minute

before reduction and hip reduction combined with continuous strong traction of the affected limb at a position with hip and knee flexion.

Materials and Methods

Clinical Data

Twenty-five patients (28 hips) had Crowe type III and IV dislocation of hip associated with osteoarthritis. Nine patients (9 hips) had Crowe type III DDH, and 16 patients (19 hips) had Crowe type IV DDH (Fig. 1). These patients consisted of 2 men and 23 women, with a mean age at the time of the operation of 33 years (19–58 years). The limb length discrepancies were from 3.0 to 6.5 cm, with a mean of 4.6 cm, and 15 patients (18 hips) showed limb length discrepancies greater than 4 cm. Seven patients have suffered from failed surgeries on the acetabulum or proximal femur in childhood. None of the patients had the deformities of the proximal femur or less than 70° of hip flexion. All patients can achieve the excellent motion of knee and hip except for the length discrepancy of limb.

Preoperative Preparation

All patients underwent physical examination to evaluate hip movement and the length of limb. The limb length discrepancy, offset, and size of prosthesis were measured for each patient using anteroposterior x-ray of the hip. The anterior wall, posterior wall and top wall of the acetabulum and the shape of the proximal femur of each patient were examined by three-dimensional computed tomography (CT) imaging. We also evaluated the general conditions

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Fig. 1. CT scan of a left hip with Crowe IV dislocation of hip and the loss of anterior and upward acetabulum wall.

of patients including the knee, spine, muscle strength, muscle tension, and mental condition.

All patients received general anesthesia and were in lateral positions. Each patient was fixed by the anterior, posterior and perineum fixators (Fig. 2). It is a key to this technique because of the application of strong traction.

Prosthesis Preparation

All prostheses were uncemented prosthetic systems made by Zimmer, USA. The acetabular systems included the Trilogy system (12 hips), the Durom system (7 hips), and the trabecular metal (TM) cup (9 hips). The femoral heads included the large-diameter head (Metasul, metal-on-metal interface) and the 28-mm-diameter ceramic head. The femur prostheses included the Versys system (12 hips), CLS stem (7 hips), and Wagner cone Prosthesis Hip Stem (9 hips).

Exposure and Release

All patients received posterolateral incision of the hip with a length of 8–15 cm, and the incision length was less than 10 cm in Crowe type III. The gluteus maximus was bluntly dissected along the



Fig. 2. Strong fixation of pelvis with posterior, anterior, and perineum fixator for reduction position.

muscle fiber, and the soft tissue scarring and osteophytes around the joint were completely cleared. According to the degree of joint laxity, the gluteus maximus end point, rectus femoris and adductor end point were dissected at the posterior ridge of the greater trochanter. If the degree of joint laxity was still not satisfactory, the tensor fascia lata starting point and the iliopsoas end point could be released. When the femur was towed, the femoral head could not reach the real acetabulum. The tissue should be released continually with palpated tension to avoid the injury of the sciatic nerve. Then the traction accompanying the flexion hip and knee should be considered.

Femur Neck Osteotomy

After released thoroughly, hip flexion could be performed easily. We positioned the lower extremity with an internal rotation of 90° and adduction of 20°, and the femoral neck could be exposed for osteotomy. When shortening was less than 4 cm, the osteotomy line was about 1 cm above the femur; when shortening was more than 4 cm, the osteotomy line was close to the lesser trochanter.

Acetabulum Installing

The rim of the true acetabulum was exposed and the soft tissue was debrided in the true acetabulum. The deficient parts of the acetabulum wall were evaluated. In particular, the upper anterior wall must be intact. After the center of the true acetabulum was confirmed by C-arm fluoroscopy, the cartilage and soft tissue in the bottom of the acetabulum were grinded out concentrically starting from the smallest file. If the wall of the acetabulum was deficient, we repaired the deficient wall with the femoral head that was trimmed of cartilage and bone sclerosis. If the deficient region of the acetabulum wall was more than 30%, the acetabulum prosthesis used was the Trilogy acetabulum (using the interface of ceramic on high cross-linked polyethylene). If the deficient region of the acetabulum wall was less than 30%, the acetabulum prosthesis used was the Durom acetabulum (using metal-on-metal large-diameter head). If the bone stock of the acetabulum was not enough, the acetabulum prosthesis used was the TM acetabulum (using the interface of ceramic on high cross-linking polyethylene).

Femur Prosthesis Installing

All patients received total hip arthroplasty without the shortening osteotomy. The patients were kept in a position with the knee flexed with an internal rotation of 90°, the hip flexed at 60° with an adduction of 20°, and the calf perpendicular to the operative bed. The Jaws hook was used to elevate the proximal femur, and the acetabulum hooks were used to pull the greater and lesser trochanter, in order to expose the femur neck. After the anteverted angle was confirmed, we could open the cavum medullare and enlarge it gradually. If the CLS or Versys prostheses could be used based on the preoperative evaluation with the x-ray and CT scan, the CLS or Versys prostheses were used to enlarge the cavum medullare and then installed. If the CLS or Versys systems could not be used, the Wagner cone prosthesis was used. If it was difficult to implant the smallest prosthesis, we used a steel rope or steel wire to bind the proximal femur in order to avoid splitting fractures.

Muscle Relaxation Medicine

When the acetabulum and femur prostheses had been installed, we advised the anesthetist to use the muscle relaxation medicine before hip reduction. Rocuronium was injected into veins at 1 minute before reduction at 0.9 mg/kg (three times of ED95).

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