Rotational Acetabular Osteotomy for Habitual Hip Dislocation With Posterior Acetabular Wall Deficiency in Patients With Down Syndrome

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abstract

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Hip dislocation associated with Down syndrome is relatively rare. Hip dislocation can progress to severe subluxation or habitual dislocation if the initial therapy is improperly performed. However, definitive treatment guidelines for conservative and surgical therapy for hip dislocation in patients with Down syndrome have not been established. This article describes a case of a 12-year-old girl with Down syndrome with nontraumatic habitual hip dislocation. Her hip joint was associated with acetabular dysplasia and hypoplasia of the posterior acetabular wall. Although conservative therapy was initially performed, no effects were observed. Rotational acetabular osteotomy and capsular plication were performed to reconstruct the posterior acetabular wall. No postoperative redislocation occurred, and the treatment effects were favorably sustained for 2 years. In Down syndrome, few cases of developmental dysplasia and hypoplasia of the posterior acetabular wall have been reported. In previous reports, these morphological abnormalities were rarely taken into consideration when determining the treatment strategy, and to our knowledge, no other reports demonstrate therapy involving rotational acetabular osteotomy for hip dislocation complicated with Down syndrome. Whether the acetabulum had posterior wall deficiency was thought to be important for conservative and surgical therapies in hip dislocation in patients with Down syndrome. Rotational acetabular osteotomy could be an effective surgical procedure for reconstruction of the acetabulum by posterolateral rotation of the osteotomized acetabulum.

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D own syndrome is a congenital disease caused by the presence of all or part of an extra twenty-first chromosome. Coexisting articular conditions include patellar dislocation, atlantoaxial instability, scoliosis, and hip joint diseases. Shaw and Beals¹ reported that the incidence of coexisting articular conditions is believed to be comparatively low. The incidence of hip joint abnormalities is approximately 6.2%, and joint laxity due to hip dislocation and subluxation accounts for 2.9% of incidences in patients with Down syndrome.¹

Hip dislocation and subluxation occurring in childhood can develop into degenerative hip diseases, habitual dislocations, and high hip dislocations.¹³ Therefore, early diagnosis and treatment are crucial. However, previous studies concluded that neither conservative nor surgical treatments produce consistent results. No consensus exists regarding the optimal treatment strategy. The probability of a comorbid occurrence of developmental dysplasia and Down syndrome is approximately 9%.³ If this kind of bone malformation is observed, performing this treatment becomes more difficult.

This article describes excellent results obtained through rotational acetabular osteotomy to remodel the posterior acetabular wall in a patient with habitual hip dislocation due to developmental dysplasia occurring comorbidly with Down syndrome.

CASE REPORT

The patient was a 12-year-old girl with Down syndrome. Since early childhood, a clicking sound had been noticed in her left hip joint when she moved. However, she had no particular disabilities in activities of daily living. At 12 years of age, the patient developed a mobility disorder in her lower left limb, with no obvious cause. Radiographs confirmed a left-sided posterior dislocation of the hip with developmental dysplasia, with 46° in the left sharp angle (Figure 1). In addition, computed tomography (CT) scan revealed a posterior acetabular wall deficiency (Figure 2). Because the patient did not report severe pain, applying vertical traction for dislocation reduction to the hip joint in a flexed position with no anesthesia was easily performed. After the hip joint was reduced, radiographs showed an acetabulum–head index of 44% and hip joint subluxation with −10° in the center-edge angle. The patient was provided with an abduction brace as a conservative treatment. However, the patient sustained redislocation. Radioscopy determined the angle of the dislocation to be 20° when the hip joint was internally rotated and at 90° of flexion. Consequently, surgical treatment was required because little proof existed that the conservative treatments provided any sustained effects.

Intraoperatively, the gluteus muscle by the greater trochanteric osteotomy was reversed. To remodel the posterior acetabular wall, the osteotomized acetabulum was posterolaterally rotated to perform rotational acetabular osteotomy. Radioscopy revealed sufficient covering of the acetabulum but showed slightly insufficient medial orientation of the femoral head. Therefore, an additional plication suture was performed on the articular capsule, which was lax. Stability was successfully restored to the hip joint postoperatively. The sharp angle was 40°, the center-edge angle was 20°, and the acetabulum–head index was 94% (Figure 3), and the remodeling of the posterior acetabular wall was also considered successful (Figure 4).

Postoperatively, the patient was provided with a hip spica cast for 2 weeks and then an abduction brace for 3 months. Two years postoperatively, the patient reported no hip instability, and the hip was stable on physical examination. The range of motion (ROM) of the hips was symmetrical, and no dislocations occurred when the left hip joint was at 50° of internal rotation and 90° of flexion. She has been able to maintain a squatting posture (Figure 5). The degree of functionality according to the Harris Hip Score was 94/100 in the left hip.

DISCUSSION

In general, the causes of hip dislocations occurring comorbidly with Down syndrome are considered soft tissue problems (eg, joint laxity and an excessive ROM),¹⁵ as well as bone formation problems (eg, femoral neck malformation and developmental dysplasia).⁵⁶ According to Shaw and Beals,¹ the hip joints in patients with Down syndrome are generally char-
acterized by a deep, horizontal acetabular roof and increased anteversion. However, the joint laxity and increase in ROM increase the risks of subluxation and dislocation. Furthermore, patients with developmental dysplasia can be predisposed to dislocations.

It has been reported that the therapeutic approaches for hip dislocation with Down syndrome include conservative treatments (eg, using a hip spica cast) and operative treatments (eg, pelvic osteotomy, femoral osteotomy, and capsular plication), but no definitive treatment guidelines have been established. Bennet et al² reported the outcomes of conservative treatment using a hip spica cast in 5 patients (5 hip joints). One patient had a stabilized limb, 1 had subluxation, and 3 had further dislocations. Conversely, Greene⁹ reported favorable results of conservative treatment in all 3 patients (3 hip joints). Bennet et al² analyzed the outcomes of surgical treatment (ie, pelvic osteotomy [particularly Chiari pelvic osteotomy], femoral derotation osteotomy, and a capsular plication performed singularly or in combination) in 14 patients (22 hip joints). Redislocations occurred in 7 patients, and 2 subluxations occurred. Aprin et al¹⁰ reported that 4 of 10 hip joints (6 patients) sustained redislocation after Salter pelvic osteotomy, femoral varus osteotomy, and capsular plication performed singularly or in combination. These results demonstrated that neither conservative nor surgical treatments have provided consistent outcomes.

Woolf and Gross¹¹ performed Salter pelvic osteotomy, femoral varus osteotomy, and capsular plication in patients with Down syndrome with habitual dislocations due to developmental dysplasia and analyzed the data of patients sustaining postoperative redislocations. Computed tomography scan revealed that the covering on the lateral side of acetabulum was in good condition, but the posterior wall remained hypoplastic. They suggested that this may be the cause of redislocation and that the hip joint can be effectively stabilized by remodeling the posterior acetabular wall through modified Pemberton osteotomy to cover the posterior acetabular wall.

No patients with developmental dysplasia receiving conservative treatments reported by Greene⁹ showed favorable results. Among the patients receiving surgical treatments reported by Aprin et al¹⁰ 3 of 4 hips with unsuccessful outcomes had developmental dysplasia, whereas 5 of 6 hips with successful outcomes had a normal acetabulum. Whether posterior acetabular wall deficiency is complicated by developmental dysplasia in these cases was not described, but this cannot be ruled out because redislocation was observed postoperatively for developmental dysplasia. Therefore, 1 reason why neither conservative nor surgical treatments produced consistent results was because sufficient considerations had not been given to the presence of developmental dysplasia or posterior acetabular wall deficiency. Based on the above findings, the bony stability of the posterior acetabular wall was important for patients with developmental dysplasia and posterior acetabular wall deficiency. Rotational acetabular osteotomy covering the anterolateral side of acetabulum as reported by Ninomiya and Tagawa¹² is a successful procedure for acetabular dysplasia. However, we thought that the rotational acetabular osteotomy that remodeled the posterior acetabular wall by rotating the acetabulum posterolaterally would produce good results in patients with Down syndrome and developmental dysplasia. Our patient had no further dislocation or subluxation.

In a previous report, acetabular dysplasia in patients with Down syndrome was treated by modified Bernese periacetabular osteotomy.¹³ These patients had pain or progressive hip subluxation, but no preoperative hip dislocation. To our knowledge, this is the first article in which a favorable outcome of surgical treatment by rotational acetabular osteotomy was obtained in a hip dislocation in a patient with Down syndrome.

When patients with Down syndrome had structurally stable hip joints with no developmental dysplasia or posterior wall hypoplasia, favorable results were achieved using various conservative or surgical treatments, such as Chiari pelvic osteotomy, Salter pelvic osteotomy, femoral osteotomy, and capsular plication. However, when patients had structurally unstable hip joints, remodeling the posterior acetabular wall by rotational acetabular osteotomy was the best treatment option.

**REFERENCES**