

Salter Osteotomy for Sequelae of Infantile Septic Arthritis of the Hip

Panya Suriyamorn M. D., Toshio Fujii M. D., Akifusa Wada M. D.,
Kazuyuki Takamura M. D., Haruhisa Yanagida M. D.

Department of Orthopaedic Surgery, Fukuoka Children's Hospital

Abstract : Salter osteotomy for treatment of hip subluxation in 5 hips of 5 patients with sequelae of infantile septic arthritis of the hip were retrospectively reviewed clinically and radiographically. All hips had femoral head deformity ; one hip was classified as Choi type II A, another as II B, and the other three as III A sequelae. The average age at surgery was 3.0 years (2.4-3.6 years), and the average follow-up period was 11.7 years (2.6-19.4 years). Concentric reductions were obtained at the same time by either open reduction with joint debridement or by femoral varus osteotomy.

Four patients had satisfactory clinical results according to Hunka's criteria at the time of most recent follow-up. However one patient had unsatisfactory clinical results due to occasional pain. All hips had successful containment of the femoral head, on the most recent follow-up radiograph. This study found that Salter osteotomy was an effective procedure for treatment of hip subluxation that developed as sequelae of infantile septic arthritis of the hip, provided that concentric reduction can be achieved.

INTRODUCTION

Hip subluxation in sequelae of infantile septic arthritis of the hip is a difficult condition for achieving good results by reduction, because the hip usually lacks a spherical femoral head, making concentric reduction difficult to perform to achieve congruency in the joint.⁷⁾ Postoperatively achieving good development and function of the involved hip therefore remain a challenging problem.

Most reports have focused on residual proxi-

mal femoral deformities in severe sequelae of infantile septic arthritis of the hip, and there have been few cases of pelvic osteotomy for hip subluxation^{2)~6)}

The purpose of this study was to review our experience of Salter osteotomy for treating hip subluxation in the sequelae of infantile septic arthritis of the hip.

PATIENTS AND METHODS

Between 1980 and 2002, we have performed Salter osteotomy on 5 hips in 5 patients who had

Study conducted at Fukuoka Children's Hospital, Fukuoka, Japan

Corresponding author : Toshio Fujii, M. D.

Department of Orthopaedic Surgery, Fukuoka Children's Hospital

2-5-1 Tojinmachi, Chuo-ku, Fukuoka, 810-0063, Japan

Tel : 81-92-713-3111 Fax : 81-92-713-3122

E-mail : fujii.t@fukuoka-child.jp

None of the authors received financial support for this study.

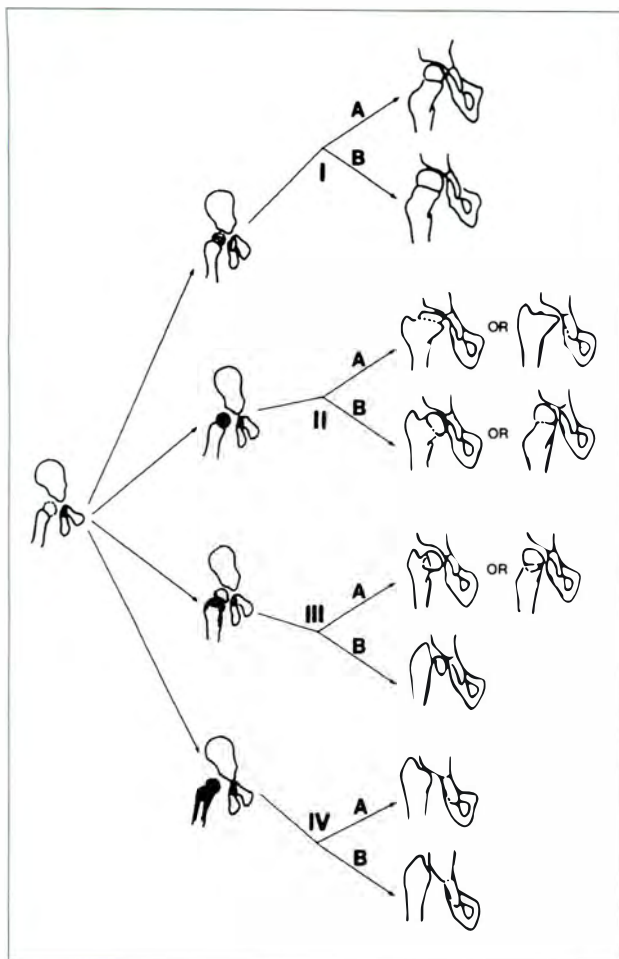


Fig. 2. Case 3(Choi III A)

- a : At 2.9 years old, the radiograph of the left hip showed subluxation and coxa valga deformity.
- b : At immediately postoperatively, after Salter osteotomy and femoral varus osteotomy had been performed.
- c and d : F/U radiograph at 10.1 years old showed residual subcapital coxa valga deformity ; femoral varus osteotomy and distal transfer of the greater trochanter were performed.
- e : At most recent F/U (18.3 years old), she had satisfactory clinical results and good containment of the left hip.

All hips had femoral head deformities and subluxation. These hips were classified by Choi's classification³⁾(Fig. 1) ; one as type II A, another as II B, and the other three as III A sequelae. Concentric reductions such as open reduction with joint debridement or femoral varus osteotomy were obtained at the same time. All cases underwent ilioas and adductor tenotomy. One

Fig. 1. Choi's classification of sequelae of infantile septic arthritis of the hip⁵⁾

- Type I : no residual deformity (Type I A) or mild coxa magna (Type I B)
- Type II : coxa brevia with a deformed head (Type II A) or progressive coxa vara or valga due to asymmetrical, premature physal closure (Type II B)
- Type III : slipping at the femoral neck, resulting in coxa vara or valga with severe anteversion or retroversion (Type III A) or pseudarthrosis of the femoral neck (Type III B)
- Type IV : destruction of the femoral head and neck, with a small medial remnant of the neck (Type IV A) or complete loss of the femoral head and neck and no articulation of the hip (Type IV B)

hip subluxation from sequelae of infantile septic arthritis of the hip. There were three boys and two girls. The average age at surgery was 3.0 years (2.4-3.6 years), and the average follow-up period was 11.7 years (2.6-19.4 years).

Table 1.
Patient Data and Surgical
Procedures

Case	Sex	Side	Choi's classification	Age at surgery (yrs)	Treatment	F/U duration (yrs)
1	M	R	II A	2.4	OR, Salter	2.6
2	M	R	II B	2.4	OR, Salter	7.6
3	F	L	III A	2.9	DVO, Salter	15.4
				10.1	DVO, DTGT	
4	F	R	III A	3.6	OR, DVO, Salter	19.4
5	M	L	III A	3.6	OR, Salter	13.4

OR, open reduction of the hip ; DVO, femoral varus osteotomy ; DTGT, distal transfer of the greater trochanter

hip(Case 3, Choi III A) needed revision surgery of femoral varus osteotomy and distal transfer of the greater trochanter at 10.1 years old for residual subcapital coxa valga deformity (Fig. 2). (Table 1)

We evaluated the achieved clinical results using Hunka's criteria⁶⁾. The clinical results were considered satisfactory if all the following three requirements were met ; 1) the hip joint was stable ; 2)the flexion arc was 50° or more, with a flexion contracture of no more than 20° ; and 3) the patient was free from pain and able to carry out activities of daily living. The radiographic results were evaluated based on the femoral head coverage and the acetabular angle of Sharp. Hip containment and acetabular development were assessed at the time of the most recent follow-up.

RESULTS

Satisfactory clinical results were found in four patients. Only Case 5(Choi III A) was unsatisfactory due to a 2 cm leg-length discrepancy and consequent mild limp. The radiograph of this case showed delayed ossification of the femoral head caused by avascular necrosis with marked soft tissue in the joint before surgery. The follow-up radiograph at 17 years old showed the acetabular roof covered severe coxa brevia et plana(Fig. 3).

All hips showed good acetabular contour with the deformed femoral head. Successful hip containment and development were seen at the

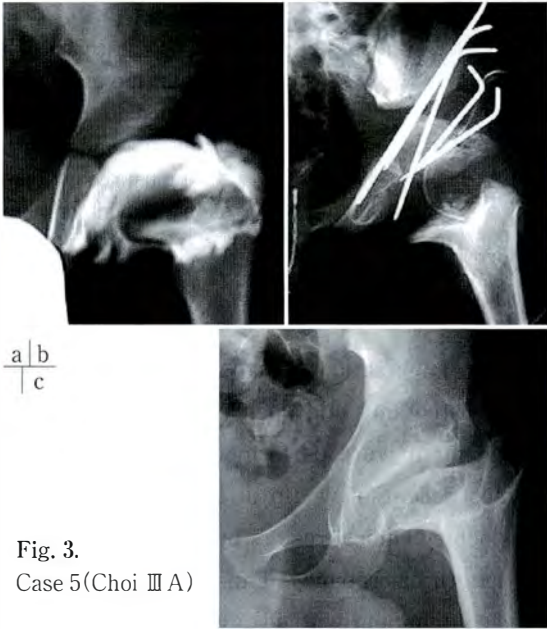


Fig. 3.
Case 5(Choi III A)

- a : At 3.4 years old, the radiograph of the left hip showed avascular necrosis in the femoral head with marked soft tissue interposed.
- b : Salter osteotomy after maximally downward displacement was fixed with multiple K-wires.
- c : F/U radiograph at 17 years old showed the low position of the acetabular roof full cover coxa brevia et plana.

most recent follow-up (88-100% femoral head coverage, 25°-34° of acetabular angle of Sharp). (Table 2)

Case presentation

Case 2

At age 1 month, he was treated for MRSA infection in his right hip with surgical drainage at our hospital. At the age of 2.3 years, the left hip

Table 2. Clinical Results and Radiographic Measurements at most recent Follow-up

Case	Femoral head coverage (%)	Acetabular Angle of Sharp (degrees)	Clinical result
1	100	25	satisfactory
2	88	32	satisfactory
3	100	34	satisfactory
4	100	26	satisfactory
5	100	32	unsatisfactory

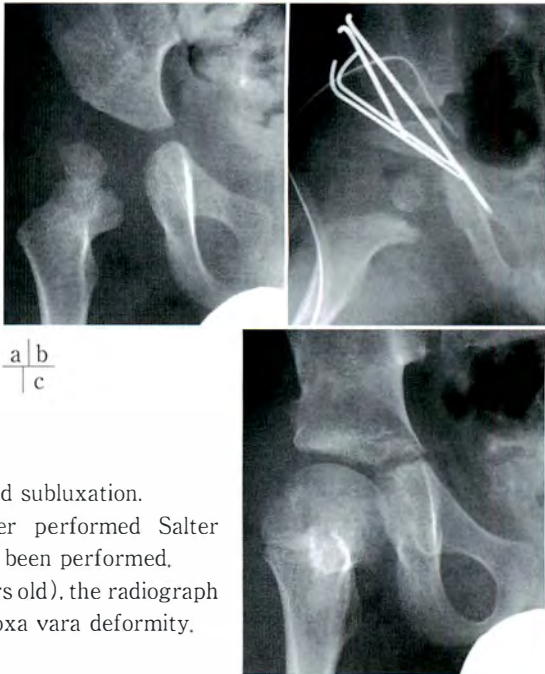


Fig. 4. Case 2(Choi II B)
a : Right hip at 2.4 years old showed subluxation.
b : Immediate postoperatively, after performed Salter osteotomy and open reduction had been performed.
c : At most recent follow-up(10 years old), the radiograph showed good containment of the coxa vara deformity.

showed subluxation of coxa vara (Choi II B). Salter osteotomy and open reduction with joint debridement were performed at age 2.4 years. At most recent follow-up(at 10 years old), he had satisfactory clinical results but there was a 2 cm leg-length discrepancy. The radiograph showed good containment with coxa vara deformity(88% femoral head coverage, and 32° acetabular angle of Sharp).(Fig. 4)

Case 3

At age 1 month, she was treated for left septic hip at our hospital. The follow-up radiograph at 1.8 years old showed subluxation of left coxa valga(Choi III A). Salter osteotomy and femoral varus osteotomy were performed at age 2.9 years. However, a follow-up radiograph at 10.1 years old showed residual subcapital coxa valga deformity. Revision surgery was performed involving femoral varus osteotomy and distal transfer of the greater trochanter. At the most recent follow-up (at 18.3 years old) she had satisfactory clinical results and negative Trendelenburg sign, but had a 2cm leg-length discrepancy. The radiograph showed good containment

and congruency of left hip (100% femoral head coverage, and 34° acetabular angle of Sharp). (Fig. 2)

Case 5

He had delayed treatment for a septic left hip. At 3.4 years old he was referred to our hospital. A left hip arthrogram showed delayed ossification of the femoral head with coxa brevia deformity (Choi III A) with marked soft tissue in the joint. Salter osteotomy was performed with open reduction and joint debridement. The acetabular fragment was displaced downward maximally to cover the coxa brevia. The left acetabular roof was lower than the right, to compensate for leg-length discrepancy at the time of surgery. At most recent follow-up(at 17 years old), he had mild a limp with the 2 cm leg-length discrepancy. The radiograph showed the low position of the acetabular roof which fully covered the severe coxa brevia et plana well (100% femoral head coverage, and 32° acetabular angle of Sharp).(Fig. 3)

DISCUSSION

Although there was a lack in the prerequisites for good results which are spherical femoral head, concentric reduction, and congruency of the joint⁷⁾, we performed Salter osteotomy combined with femoral varus osteotomy or open reduction to achieve concentric reduction and congruency of the involved joint as far as possible. At most recent follow-up, all hips had good containment. The acetabular contour was good with the deformed femoral head.

Four patients in this study achieved satisfactory clinical results. They have been able to use their hip during childhood to early adulthood.

Avascular necrosis is a serious complication after open reduction and Salter osteotomy in developmental dysplasia in the hip.¹⁾⁷⁾⁸⁾ This problem is more serious in sequelae of infantile septic arthritis of the hip, because the condition of the femoral head might deteriorated after the operation. In our study, no femoral head showed any further deformity at follow-up. Decreased intraarticular pressure between the acetabulum and the femoral head, obtained by tenotomy of the ilioas and adductor muscle and by resecting the soft tissue in the joint, may have played an important role.

We performed Salter osteotomy early while the patients were still young (average age 3 years at surgery). Early osteotomy has the advantage that the acetabulum has a high potential for development, but there is a high risk of losing the displaced position of the lower fragment. To stabilize the graft and the downward fragment,

multiple K-wires fixation were necessary at the time of surgery.

In our series, Salter osteotomy for hip subluxation in sequelae of infantile septic arthritis of the hip was effective when concentric reduction was achieved although there were a basic lack in the Salter's prerequisites.

REFERENCES

- 1) Barrett WP, Staheli LT, and Chew DE : The effectiveness of the Salter innominate osteotomy in the treatment of congenital dislocation of the hip. *J Bone Joint Surg* **68-A** : 79-87, 1986.
- 2) Betz RR, Cooperman DR, Wopperer JM et al : Late sequelae of septic arthritis of the hip in infancy and childhood. *J Pediatr Orthop* **10** : 365-372, 1990.
- 3) Choi IH, Pizzutillo PD, Bowen JR et al : Sequelae and reconstruction after septic arthritis of the hip in infants. *J Bone Joint Surg* **72-A** : 1150-1165, 1990.
- 4) Choi IH, Shin YW, Chung CY et al : Surgical treatment of the severe sequelae of infantile septic arthritis of the hip. *Clin Orthop Relat Res* **434** : 102-109, 2005.
- 5) Dobbs MB, Sheridan JJ, Gordon JE et al : Septic arthritis of the hip in infancy : long-term follow-up. *J Pediatr Orthop* **23** : 162-168, 2003.
- 6) Hunka L, Said SE, Mackenzie DA et al : Classification and surgical management of the severe sequelae of septic hips in children. *Clin Orthop Relat Res* **171** : 30-36, 1982.
- 7) Salter RB, Dubos JP : The first fifteen year's personal experience with innominate osteotomy in the treatment of congenital dislocation and subluxation of the hip. *Clin Orthop Relat Res* **98** : 72-103, 1974.
- 8) Tonnis D : Surgical treatment of congenital dislocation of the hip. *Clin Orthop Relat Res* **258** : 33-40, 1990.