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Treatment of Hip Dislocation in Cerebral Palsy with Extraarticular Intervention

Léčení dislokované kyčle u DMO extraartikulární intervencí

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ABSTRACT

PURPOSE OF THE STUDY

Hip dislocation is one of the major causes of disability in children with cerebral palsy (CP). Surgical treatment can be achieved using different techniques including proximal femoral varus derotation osteotomy (FVDRO), pelvic osteotomies, and open hip reduction (OHR). However, we claim that pathologies originating from extraarticular structures in the dislocated hip in CP can be reconstructed by extraarticular methods and OHR may not always be necessary. Therefore, this study aims to discuss the results of hip reconstruction with extraarticular intervention in patients with CP.

MATERIAL AND METHODS

In total, 141 hips (95 patients) were included in the study. All patients underwent FVDRO, either with or without a Dega osteotomy. Changes in the Acetabular Index (AI), Migration Index (MI), neck-shaft angle (NSA), and center-edge angle (CEA) were assessed on the preoperative, postoperative, and final follow-up anterior-posterior radiographs of the pelvis.

RESULTS

Median age was 8 years (range between 4–18 years). The average follow-up duration was 5 years (range between 2–9 years). Changes in AI, MI, NSA and CEA values were statistically significant for postop and follow-up periods when compared to preoperative values. Of the 141 operated hips, 8 (5.6%) hips required revision surgery due to redislocation/resubluxation detected at the follow-ups, and unilateral operation can be accepted as a risk factor for redislocation.

CONCLUSIONS

Our results demonstrate that reconstructive treatment consisting of FVDRO, medial capsulotomy (in the case of reduction difficulty) and transiliac osteotomy (in the case of acetabular dysplasia) provides satisfactory outcomes in hip dislocation in CP.

Key words: hip displacement, cerebral palsy, hip reduction.

INTRODUCTION

Hip dislocation is one of the major causes of disability in children with cerebral palsy (CP) (21, 36). A dislocated hip may cause pain, poor sitting balance, difficulty with perineal care, and pelvic obliquity, which may lead to scoliosis (21, 27). There is complete consensus among scientists and clinicians that hip dislocation arises from extraarticular structures, including overactive hip adductors and flexors, which lead to muscle imbalance at the hip joint, insufficient decrease in the neck shaft angle during development (coxa valga), acetabular dysplasia, and subsequent posterolateral and superior dislocation of the femoral head in most cases (24). Hip dislocation can be addressed by treatment of the underlying pathology and reestablishment of proper femoroacetabular congruency (30, 35).

Surgical reestablishment of the femoroacetabular relation can be achieved by using different techniques, which can be classified as extraarticular and intraarticular procedures. Extraarticular procedures, namely, proximal femoral varus derotation osteotomy (FVDRO), pelvic osteotomies and soft tissue balancing, are the preferential methods, and their success in the treatment of hip subluxation has been demonstrated in the literature (10, 14, 18, 29, 40). Although deemed necessary, the efficacy and necessity of intraarticular procedures are still controversial, and there is no consensus on the open hip reduction (OHR) technique (18, 20, 22, 36). Jozwiack et al. (20) suggested that for the treatment of hip dislocation in CP, OHR with capsulorrhaphy should be performed systematically in all cases, in addition to FVDRO. Sankar et al. (36) reported that elongated ligamentum teres and hypertrophied pulvinar prevent hip reduction and should be eliminated with open arthrotomy. However, some authors have suggested that the addition of OHR to the hip reconstruction procedure does not significantly affect the recurrence rate but can lead to significant complications,

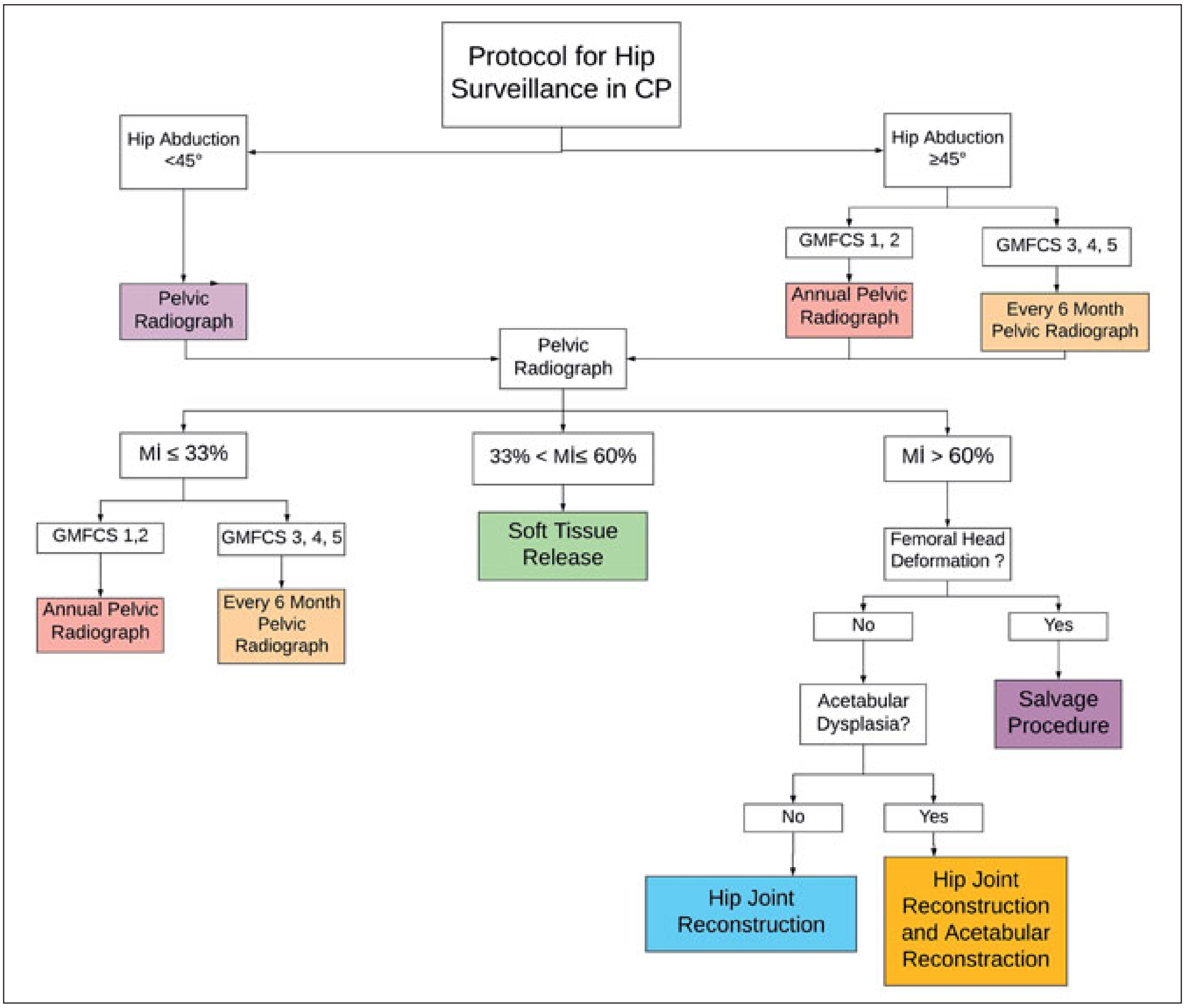


Fig. 1. Protocol for hip treatment in cerebral palsy.

such as joint stiffness and avascular necrosis, advocating that OHR should not be an essential part of hip reduction in CP (18, 22).

We believe that hip dislocation in CP, which is caused by extraarticular pathologies, can be treated generally with extraarticular methods and that OHR may not always be necessary. The present study aimed to present the results of hip reconstruction using extraarticular intervention in patients with CP.

MATERIAL AND METHODS

This retrospective study was approved by the local institutional review board (IRB) (ethical approval number:10840098-204), and written parental permission was obtained from parents and guardians.

The inclusion criteria were as follows: primary diagnosis of CP with hip subluxation/dislocation with an MI ≥60% or an MI ≥30% that increased by more than 10% after soft tissue surgery during the 3-month follow-up; no previous bony surgery for hip subluxation or dislocation; and an age older than 4 years. Patients with a previous history of bony surgery, additional bone diseases and previous proximal femur fractures were excluded.

Treatment protocol

We established a screening and treatment protocol based on the past experiences of the senior author (MI) and the literature for the prevention and treatment of spastic hip dislocation based on the patient's age, degree of hip abduction in the hip-knee extension position, GMFCS level, and MI, and we performed patient follow-ups and treatments accordingly (25, 32) (Fig. 1). Previous studies have indicated a high risk of the development of hip subluxation between the ages of 2 and 8 years old (23, 31). Restricted hip abduction is an accepted screening method for hip subluxation in spastic CP (3, 23, 29, 31, 38). Therefore, an anteroposterior pelvic radiograph was recommended immediately between the ages of 2 and 8 years old when hip abduction was restricted to <45° with the hip and knee extended. There is a consensus in the literature that the risk of hip dislocation is related to GMFCS level, and it is higher in GMFCS 3–5 patients when compared to GMFCS 1–2 patients (3, 4, 9, 11, 12 16, 17, 33). While the GMFCS is accepted as one of the reliable tools for predicting the relative risk of hip dislocation and the need for treatment in CP, anteroposterior pelvis radiographs are recommended for GMFCS 1 and 2 patients (independent ambulatory) annually and every six months for GMFCS 3, 4, and 5 patients between the age of 2 and age 8 years old (19). In accordance with Reimer's definition of subluxation, we performed soft tissue release in those patients with an MI value of >33% (2, 4, 11, 16, 32). Miller et al. reported that children with an MI >60% or patients with increased MI by more than 10% at the 3-month follow-up after soft tissue surgery have a great risk of complete dislocation, and if the MI is >60%, many authors recommend bony reconstruction of the hip to reestablish good coverage and joint shape (9, 16, 40, 83). In patients with an MI >60%, we examined for femoral head deformation, and hip reconstruction with an FVDRO was recommended to all patients if their femoral head was not deformed. A Dega transiliac osteotomy was performed, in conjunction with an FVDRO, when acetabular dysplasia was present (in cases when the acetabular index (AI) was measured over 25°) or when posterolateral instability was determined on the intraoperative physical examination (31). Salvage procedures were recommended to patients where their femoral head was deformed (4, 16, 23, 53, 63).

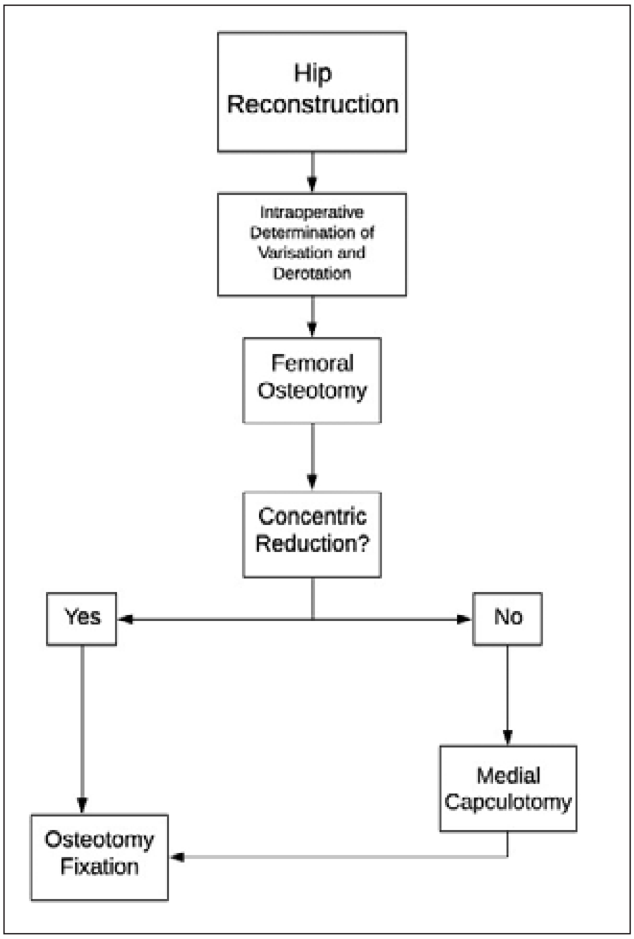


Fig. 2. Intraoperative surgical treatment algorithm.

Surgical technique

Soft tissue release technique

For adductor release a transverse incision was made 1–2 cm distal to the groin crease starting at the level of the adductor longus and extending posteriorly for 4 cm. After opening the fascia overlying the tendon longitudinally, adductor longus tendon was isolated from surrounding tissue with a clamp and/or finger and muscle fibers were divided with electrocautery. With medial retraction, the muscle compartment surrounding the gracilis tendon was opened and myotomy was performed in a same manner. Hip abduction with the hip and knee in extension was evaluated, and if it is less than 45° myotomy of the adductor brevis was performed in a same manner. Then after exposure of the iliopsoas was performed through the interval between the pectineus and adductor brevis and muscle fiber were divided. In the ambulatory child GMFCS I, II, or III, an incomplete myotomy was performed and the muscle fibers of iliacus were leaved intact.

Hip reconstruction technique

All patients were treated with femoral varus derotation and shortening osteotomy (FVDRO), either with or without a Dega transiliac osteotomy. The desired angles for derotation and femoral neck shaft varus were assessed intraoperatively. The proximal femur was abducted and internally rotated until an appropriate femoroacetabular congruency was established and confirmed by fluoroscopy before osteotomy. Figure 2 shows the intraoperative surgical treatment algorithm. Before fixation of the osteotomy, we confirmed the clinical midpoint in the neutral position, at least 40° of internal rotation remaining, and the spontaneous external rotation position of both lower limbs.

FVDRO was performed with closing wedge resections of a trapezoidal piece of bone at the level of the lesser trochanter. The osteotomized trapezoidal wedge included iliopsoas tendon insertion (hereafter, the iliopsoas tendon was released). The length of the femoral shortening corresponded to the overlapping distance of the proximal and distal segments of the osteotomized femur after the first cut. Following resection of the bone wedge, the proximal femur was abducted based on the desired angular correction to determine if the femoral head was reduced concentrically. Because the femur was placed in the varus position and shortened, there was no need for adductor tenotomy. In most patients, a neck shaft angle of 110° to 130° was achieved. The distance between the acetabular tear drop and the femoral head was evaluated on X-ray images taken by fluoroscopy. If concentric reduction (the center of the capital epiphysis was inferior to the Hilgenreiner line, and the Shenton line was intact) and clinical stability were achieved under fluoroscopy, the femoral osteotomy was then fixed with a locking plate (TST Medical, Istanbul, Turkey).

If reduction as described above could not be achieved with isolated abduction of the proximal segment (we describe this situation as 'reduction difficulty'), the tendon of the iliopsoas, if it had not been completely released, was transected. The medial joint capsule was then incised longitudinally in line with the femoral neck (medial capsulotomy), and adductor tenotomy was performed. Following medial capsulotomy, reduction was exclusively controlled by fluoroscopy, and no additional procedures, such as OHR (repositioning of inverted labrum; excision of pulvinar, transverse acetabular ligament, or ligamentum teres; and capsulorrhaphy) were performed (27).

Patients for whom concentric reduction could not be achieved (in cases of reduction difficulty) were first checked by hip arthroscopy before medial capsulotomy. A 70-degree scope was positioned in the central compartment inferior to the femoral neck through a stab incision. The presence of ligamentum teres, the transverse acetabular ligament, or the pulvinar, which could interfere with the reduction, was investigated. In all patients, we observed that the medial capsule was the only obstacle for reduction. For these patients, open medial capsulotomy was performed as described in the previous paragraph.

A Dega transiliac osteotomy was performed together with an FVDRO when acetabular dysplasia was present (in cases when the AI was measured over 25°) or when posterolateral instability was determined on intraoperative physical examination.

A hip spica cast was not used for immobilization. Only patients who underwent medial capsulotomy used an abduction brace for three weeks postoperatively. Passive hip range of motion exercises were implemented on the third postoperative day in all patients, and patients were allowed to become fully weight-bearing during the third postoperative week.

Concomitant surgical procedures on the same extremity were recorded, and preoperative GMFCS levels were recorded.

Postoperative radiographies were taken immediately after surgery, every three weeks until bone healing was completed, and once every three months until the last follow-up visit. All anteroposterior pelvic radiographs were taken in a standard position with the patient lying parallel to the film within the cassette, the legs in a neutral rotation, and neutral abduction/adduction to decrease assessment errors. In some patients, preoperative demonstration of the acetabular roof was only possible when a Thomas test was performed with the opposite hip being fully flexed to obliterate the lumbar lordosis and unflex the pelvis. A single author (IAS) evaluated the changes in the neck-shaft angle (NSA), AI (only in patients who had undergone Dega transiliac osteotomy and for whom endochondral ossification of the triradiate cartilage (TRC) was incomplete), MI, and center-edge angle (CEA) on the preoperative, postoperative, and final follow-up anterior-posterior radiographs of the pelvis. All measurements were performed by a single author (IAS) to avoid interobserver errors.

Patients with an MI >40% in their postoperative and follow-up radiographs were defined as resubluxation/redislocation, and they underwent revision surgery. Any recurrent subluxation and/or dislocation was recorded, and factors that caused resubluxation and redislocation were investigated.

Wound infection, joint stiffness, implant failure, chronic hip pain, and avascular necrosis of the femoral head were recorded as complications.

Statistical analysis

The statistical analysis was performed with JASP 14.1.0 (open-source software with structural support from the University of Amsterdam) and R 4.1.0 (free software environment for statistical computing and graphics). Categorical data are presented as percentages with confidence intervals. Contingency tables were utilized to compare groups. Continuous data are presented as the mean and 1,000 bootstrap confidence intervals. For significance testing of the contingency tables, either the chi-square test or Fisher's exact test was used in accordance with appropriate criteria. Significance assessment of the improvement in NSA, AI, MI, and CEA scores with respect to Pre-Op, Post-Op, and follow-up was analyzed with Robust Repeated Measures ANOVA (Mair P, Wilcox RR. Robust statistical methods in R using the WRS2 package. Behavior Research Methods. 2020;52:464–488).

In addition, 0.2 trimming and 1,000 bootstrap replicates were preferred as per recommendations of the authors. Cohen's D was calculated to state effect-sizes. All statistical tests with P values less than 0.05 were considered as significant.

RESULTS

A total of 128 patients (total of 165 hips) who underwent hip reconstructions for CP-related dislocation in our clinic between 2010 and 2018 were reviewed. In total, 95 patients and 141 hips were included in the study, and 33 patients and 24 hips were excluded based on the study criteria.

In the present study, 48% of the patients (46 patients) underwent bilateral operations. The mean age at the time of surgery was 8 ± 2.72 (range 4–18) years, and the mean follow-up duration was 5 ± 1.95 (range 2–9) years.

Dega transiliac osteotomy was performed in 43 (30.5%) of the hips. In 11 (7.8%) hips, medial capsulotomy was performed, and abduction braces were used.

Concomitant surgical operations were reported (Table 1). Among the patients, 12% (11) were Grade 2, 35% (34) were Grade 3, 41% (41) were Grade 4, and 9% (9) were Grade 5 according to GMFCS.

The postoperative and final NSA values were significantly lower than the preoperative NSA value (Table 2). The postoperative and final AI values were significantly lower than the preoperative AI values (Table 3). The postoperative and final MI values were significantly lower than the preoperative values. Additionally, the postoperative MI values were significantly lower than the final values (Table 4). The postoperative and final CEA values were significantly higher than the preoperative values (Table 5).

Failure rate was 5.7% (8 cases). In addition, the GMFCS level, medial capsulotomy, and Dega osteotomy

Table 1. Additional simultaneous operations

Additional operations	Frequency
None	82
Achilloplasty	14
Hamstring lenghtening	11
Gastrocnemius lenghtening	11
Adductor tenotomy	11
Distal femoral extension osteotomy	4
Tibialis anterior tendon transfer	2
Achilloplasty + hamstring lenghtening	3
Lateral column lenghtening	2
Achilloplasty + lateral column lenghtening	2
Halluks valgus surgery	1
Tibial derotation osteotomy	1
Gastrocnemius lenghtening+ fleksor carpi ulnaris transfer	1
Hamstring lenghtening+ gastrocnemius lenghtening	1
Tibialis anterior tendon transfer + hamstring lenghtening	1
Gastrocnemius lenghtening + pronator teres tenotomy	1
Hamstring lenghtening + lateral column lenghtening	1
Fleksor carpi ulnaris transfer	1
Tibialis anterior tendon transfer + Achilloplasty	1
Achilloplasty + hamstring lenghtening + tibial derotation osteotomy	1

Table 2. Improvement in neck shaft angle (NSA)

		95% bca* CI**	
NSA	Mean	Lower	Upper
Preoperative NSA	157.7	154.9	160.5
Postoperative NSA	130.8	128.5	133.1
Final follow-up NSA	134.6	132.4	136.9

*bca – bias corrected accelerated ** CI – confidence interval

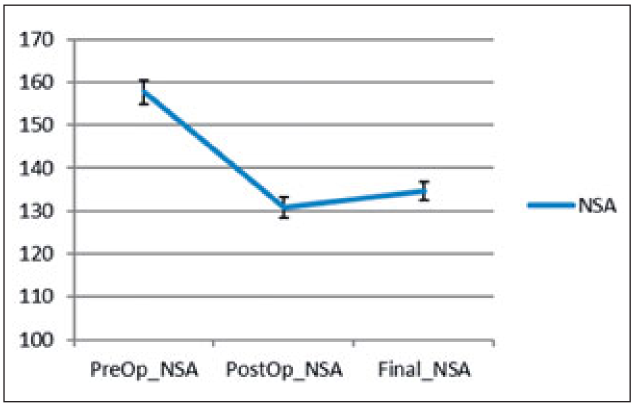


Table 3. Improvement in acetabular index (AI)

		95% bca* CI**	
AI	Mean	Lower	Upper
Preoperative AI	29,6	28,2	30,9
Postoperative AI	24,7	23,5	25,9
Final follow-up AI	23,7	22,5	25,0

*bca – bias corrected accelerated ** CI – confidence interval

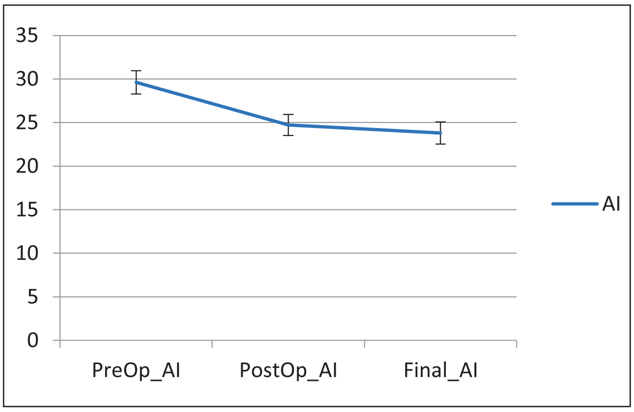
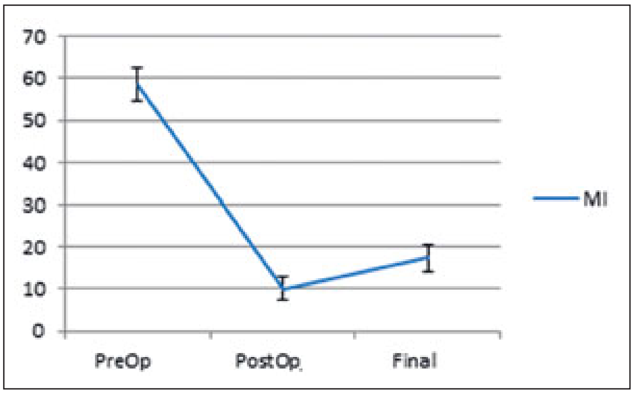


Table 4. Improvement in migration index (MI)

		95% bca* CI**	
MI	Mean	Lower	Upper
Preoperative MI	58,4	54,4	62,4
Postoperative MI	10.0	7,3	12,7
Final ffollow-up MI	17,3	14,0	20,6

*bca – bias corrected accelerated ** CI – confidence interval



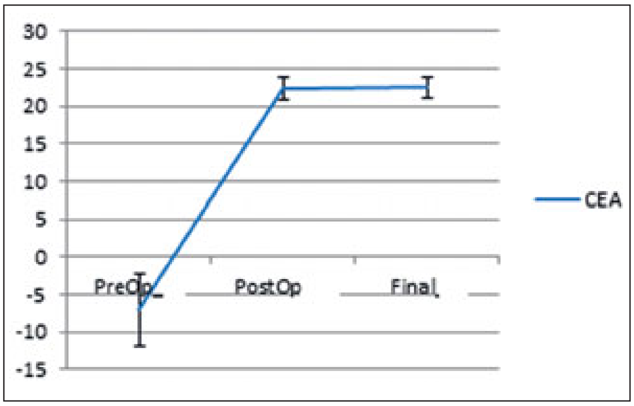
were not found to be risk factors for redislocation. The failure (resubluxation/redislocation) rate in unilateral hip operations was 12.2%, and the failure rate in bilateral operations was 2.2% (Table 6).

Seven (7.4%) patients had complications. One patient, who had excessive muscle contraction during the early postoperative period due to pneumonia, was diagnosed with implant failure and underwent reoperation on postoperative day 10 (femoral osteotomy revision). One patient felt pain during physical therapy on postoperative day 15, and osteotomy fixation failed. This patient underwent reoperation for repositioning and internal fixation. The remaining five patients complained of persistent pain in both thigh and groin regions within three weeks after surgery. We suspected persistent pain was

Table 5. Improvement in center edge angle (CEA)

		95% bca* CI**	
CEA	Mean	Lower	Upper
Preoperative CEA	-7,0	-11,9	-2,2
Postoperative CEA	22,3	20,9	23,8
Final follow-up CEA	22,5	21,1	23,8

*bca – bias corrected accelerated ** CI – confidence interval



due to inadequate stability. Therefore, we suggested hip braces (two cases) and additional screw placements (revision surgery) (three cases).

DISCUSSION

Hip dislocation is commonly encountered in children with spastic CP (8). The majority of clinicians accept that surgical reconstruction is the mainstay of treatment for progressive hip dislocation in spastic CP (7). Treatment options consist of soft-tissue surgeries, FVDRO, pelvic osteotomy, and capsulorrhaphy with OHR (8). We retrospectively evaluated the outcomes in 141 hips treated using FVDRO, either with or without a Dega transiliac osteotomy, and we found that joint reduction was achieved without OHR in all hips, including highly dislocated hips. In those hips, a significant improvement in radiographic parameters (AI, MI, NSA, and CEA values) was achieved, and these improvements and joint reductions were sustained without any deterioration over the duration of the study.

OHR is one of the main elements of developmental dysplasia of the hip (DDH) treatment, which aims to obtain and maintain a stable, concentric reduction. Likewise, OHR (excision of joint capsule and inverted labrum; removal of the pulvinar; and release of the transverse acetabular ligament and ligamentum teres) has been suggested by many authors as a part of surgical treatment for hip dislocation in CP (6, 11 14 36). Sankar et al. (36), who treated 12 CP patients with 14 dislocated hips, reported that elongated pulvinar and ligamentum teres must be excised to allow reduction of the hip joint. Likewise, Gavrankapetanovic et al. (14) suggested that OHR is an appropriate treatment method for CP patients, and David et al. (11) reported that open reduction to remove soft tissue obstacles, including interposed iliopsoas tendon, ligamentum teres, and contracted capsule, is necessary in cases where the femoral head has migrated proximally and has no contact with the acetabulum. However, Huh et al. (18) showed no statistically significant difference in the rate of recurrent subluxation/dislocation in patients who had undergone FVDRO versus FVDRO with OHR. Koch et al. (22) stated that OHR is associated with a high degree of avascular necrosis in the treatment of hip dislocation in CP patients.

In our technique, desired angles for derotation and femoral neck shaft varus were determined by fluoroscopy at the beginning of the procedure; until concentric reduction was achieved, varus and derotational correction

Table 6. Failure rate by GMFCS, Dega osteotmy, Brace usage and unilateral/bilateral operation

Failure		**GMFCS**		Total	Fisher's exact test (p)
		GMFCS 2&3	GMFCS 4&5		
No	Patient	44	44	88	
	% within column	91.6	93.6	92.6	
Yes	Patient	4	3	7	
	% within column	8.3	6.3	7.36	0.99
Total	Patient	48	47	95	
	% within column	100	100	100	
Failure		**Dega**		Total	
		No	Yes		
No	Patient	55	33	88	
	% within column	93.2	91.6	92.6	
Yes	Patient	4	3	7	
	% within column	6.7	8.3	7.3	0.99
Total	Patient	59	36	95	
	% within column	100	100	100	
Failure		**Brace**		Total	
		No	Yes		
No	Patient	84	4	88	
	% within column	94.3	66.6	92.6	
Yes	Patient	5	2	7	
	% within column	5.6	33.3	7.3	0.061
Total	Patient	89	6	95	
	% within column	100	100	100	
Failure		**Unilateral/Bilateral operation**		Total	
		No	Yes		
No	Patient	43	45	88	
	% within column	87.7	97.8	92.6	
Yes	Patient	6	1	7	
	% within column	12.2	2.1	7.3	0.112
Total	Patient	49	46	95	
	% within column	100	100	100	

were continued. If the reduction was inadequate or the hip remained unstable (in cases of reduction difficulty) with derotation and abduction of the proximal femur, we achieved hip reduction by using the longitudinal incision of the medial joint capsule (medial capsulotomy) in all cases. We found that the enlarged medial capsule adhered to the acetabulum and was the only obstacle preventing hip joint reduction. Therefore, instead of OHR, FVDRO and medial capsulotomy are sufficient in cases where reduction difficulties are encountered.

Some authors have recommended the routine use of a spica cast after surgical hip reconstruction procedures in CP to achieve stability, prevent early dislocation, and relieve pain (34, 37). Philips et al. (28), who performed 70 cases of reconstructive hip surgery on 47 children with CP, placed the majority of their patients in either a spica or Petrie cast for approximately 4 weeks. However, spica immobilization is associated with an increased risk of complications, such as joint stiffness, decubitus ulcers, heterotopic ossification, and pain, especially in CP patients (39, 40). Huh et al. (18), who reconstructed hip subluxation or dislocation with FVDRO and pelvic osteotomy, experienced a 6% rate of decubitus ulcers or skin infections that were related to hip spica casts. Likewise, Ruzbarsky et al. (34) analyzed 61 nonambulatory children (93 hips) with CP who had undergone an FVDRO, either with or without an open reduction and/or pelvic osteotomy, and they stated that spica cast immobilization was linked to all complications. In our series, the total complication rate was 7%, and the most common complication was implant failure, which occurred in cases in the early postoperative period. However, we did not experience any complications associated with the spica cast, such as heterotopic ossification or joint stiffness. Therefore, we suggest that the spica cast should not be routinely used postoperatively. However, we speculate that in cases where fixation is considered to be insufficient or fixation is revised intraoperatively, immobilization should be performed, but an abduction brace instead of the spica cast will be sufficient during the postoperative period to address possible failures. In addition, patients should start early movement as allowed by the abduction brace.

In the literature, recurrence rates of hip dislocation procedures in children with CP range from 5% to 74% despite successful early radiological results (12, 36, 37). Patient age, GMFCS level, and preoperative MI are accepted as the most important and relevant factors in the recurrence of hip instability after hip reconstructive surgery in the literature (2, 6, 10). Rutz et al. (33), who treated 168 hips with a modified Pemberton osteotomy with a shortening varus derotation osteotomy, reported the MI as the only factor influencing postoperative outcomes. Similarly, Bayusentono et al. (2), who performed hip reconstructive surgery, including FVDRO, OHR and modified Dega osteotomy, in 144 hips of 76 patients with CP, stated that an increased GMFCS level is a major risk factor for recurrence. In our study, we detected 8 recurrences at the end of the follow-up period. We found that the recurrence rate was not affected by the level of GMFCS, age, or preoperative MI, but unilateral operation increased the recurrence rate. Some authors have recommended hip reconstructive surgery for the involved hip only, and contralateral hip surgery is not necessary (1, 6, 39). In contrast, some authors have recommended surgical reconstruction of the contralateral hip due to the increased risk of subluxation and the possible asymmetry and destabilization of the contralateral hip as a result of the unilateral procedure, which would negatively affect positioning as well as spinal and pelvic alignment (7, 38). Canavese (7) reported that the rates of recurrence of the original hip and contralateral hip subluxation and dislocation after unilateral bony surgery are higher than those of other earlier series, and they recommended that if unilateral bony surgery is performed, close radiological follow-up of both hips should be performed. Although it was not statistically significant ($p = 0.112$), the odds ratio, which is an effect size for contingency tables, was 6.28, indicating that unilateral operation can be accepted as a risk factor for redislocation in the present study. We had patients who were operated on unilaterally (only the involved hip) in the past, and we commenced bilateral surgeries after determining that unilateral surgery was a risk factor for redislocation (both for involved and uninvolved hips).

The present study had several limitations due to the study design and patient demographics. A major limitation of this study was the lack of a control group. Retrospective chart reviews were limited in terms of the availability and reliability of the data. In addition, the mean follow-up period was short, and not all patients had reached skeletal maturity at the last follow-up.

CONCLUSIONS

Our results demonstrated that it is highly possible to obtain satisfactory results for successful treatment of hip dislocation in CP without classical OHR techniques. When concentric reduction cannot be achieved during the operation (in cases of reduction difficulty), medial capsulotomy may be sufficient for reduction. Additionally, bilateral hip reconstruction should be considered to reduce the risk of recurrence.

Main points

– Reconstructive treatment consisting of FVDRO, medial capsulotomy and transiliac osteotomy (in the case of acetabular dysplasia) provides satisfactory outcomes in hip dislocation in CP.
– When concentric reduction cannot be achieved during the operation, medial capsulotomy may be sufficient for reduction without classical OHR techniques.
– Bilateral hip reconstruction should be considered to reduce the risk of recurrence.

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