



Hip subluxation and dislocation in cerebral palsy : Outcome of bone surgery in 21 hips

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The prevalence of hip subluxation and dislocation in cerebral palsy ranges between 3% and 75% in the literature. Clinical signs are rigidity, pain and instability.

We assessed functionality, stability and symptoms in 20 patients preoperatively and after follow-up. A varus derotation osteotomy was performed in cases with subluxation or dislocation, while a Chiari osteotomy was performed in the presence of a concomitant acetabular dysplasia.

Results were good in 64%, fair in 22% and poor in 14% of patients treated with a varus derotation osteotomy. In patients treated with a Chiari osteotomy, results were good in 43% of cases, fair in 43% and poor in 14%.

Subluxated or dislocated hips generally show several anomalies : their severity is directly proportional to the degree of neurological impairment. In the most severe cases, correction of just one of such anomalies might not be sufficient to guarantee good results of the surgery.

Keywords : cerebral palsy ; hip subluxation ; hip dislocation ; varus derotation osteotomy ; Chiari osteotomy.

INTRODUCTION

The prevalence of hip subluxation and dislocation in cerebral palsy ranges between 3% and 75% (1,3,4,5,6,7,8,9,13,15,16). It is attributable to muscular unbalance, as well as femoral and acetabular dysplasia. In quadriplegic patients, the mean age of

onset is 7 years (1,16). The prevalence is directly proportional to the degree of neurological impairment : 0-10% of hemiparetic patients are affected, while the chance of being affected is 6% in diplegic and 6.8% in paraplegic patients. Finally, quadriplegic patients are considered high-risk patients (prevalence ranges from 2.6% to 75%), especially when they are not ambulating (3,4,5,8,9,15). Seventy five percent of hip joints whose Reimers index (12) was lower than 30% did not show any worsening of their overall condition ; the remaining percentage is made up of patients that had not reached skeletal maturity .On the other hand, the subluxation worsens in 25% of cases whose migration index ranged between 30% and 60%, and in all cases with an index higher than 60% (5,11).

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Clinical signs of hip subluxation and dislocation are rigidity, pain and instability, which interfere negatively with the quality of life. It is difficult to assess pain in severely affected patients, because of their frequent communicative incapacity. However, the prevalence of pain symptoms ranges between 33% and 70% (1,6,13,16).

Problems linked to femoral head migration include: pelvic obliquity, scoliosis, difficulties in maintaining a sitting position and problems related to perineal hygiene.

The choice of the type of surgical intervention depends on the age of the patient, degree of dislocation, articular excursion and the presence or absence of pain. The aim is to provide mobility, absence of symptoms and stability. Early treatment is based upon soft tissue surgery, combined in the most severe cases with bony procedures (femur and/or pelvis). Salvage procedures are used for treating inveterate forms.

The aim of this study is to assess functional and radiographic results of varus derotation osteotomy (VDO) and Chiari osteotomy (CO), and to try to determine the indication for the two different methods.

MATERIAL AND METHODS

Twenty one patients with cerebral palsy and hip subluxation or dislocation underwent a VDO or a CO at the orthopaedic department of the "Sapienza" University, in Rome, between 1990 and 2005. Inclusion criteria were as follows: diagnosis of spastic cerebral palsy and a minimum of a 2-year follow-up. Twenty-one subjects met our criteria; one of these could not be located, so that our study group was made up of 20 patients (21 hips).

VDO was performed on subluxations and dislocations, while CO was performed in case of concomitant acetabular dysplasia.

Our study was based on patient's history and on objective and radiographic data. In 14 cases, the anamnesis was made thanks to the support of a family member. After recording a patient's personal data, we assessed the functionality, stability and symptoms preoperatively and at follow-up. Moreover, we took into account the communicative abilities, the severity of the cerebral palsy, previous and/or concomitant surgical interventions,

possible complications and the duration of the follow-up period.

Functionality was determined as follows: bedridden, in a wheelchair, assisted ambulation and autonomous ambulation.

Stability was studied through an analysis of anterior-posterior radiographs of the patient's pelvis. The parameters considered for dislocation included: Reimers' migration index (normal value < 33%) and the Wiberg centre edge angle (normal value 20-40°). The parameters for dysplasia were: the angle of inclination of the femoral neck (normal value 125°) and acetabular roof obliquity (normal value 25°).

In two cases we experienced problems in calculating geometric data because of the difficulty in finding radiographs with an appropriate incidence.

Finally, we assessed pain.

The result was considered to be good if the functional status improved or remained unchanged, if pain was absent and if the Reimers index was lower than 33% and the Wiberg angle higher than or equal to 20°; fair, if functionality improved or remained unchanged and pain was still present and if the Reimers index ranged between 33% and 50% and the Wiberg angle between 0° and 19°. Finally, the result was considered poor if functionality worsened and pain arose or worsened and if the Reimers index was higher than 50% and the Wiberg angle lower than 0°.

Varus derotation osteotomy (VDO)

This group consisted of one diplegic, two hemiplegic and 10 quadriplegic patients, with a total of 14 hips. Seven were male and six female. Four patients were able to communicate, while the remaining nine were not. One patient was bedridden, seven were wheelchair-bound, five walked with an ambulator and one was an autonomous ambulator. Eight hips were asymptomatic, whereas six were painful.

Eleven hips were subluxated and three dislocated.

One patient underwent a bilateral surgical intervention. The remaining hips were six on the right and six on the left side. The mean age at surgery was 9.4 years (range 3 years to 14 years and 8 months). The mean follow-up period was 5.7 years (range 2 years to 10 years and 5 months). Previous and/or concomitant interventions on soft tissues (10) and/or bones (3) were performed on 10 out of the 14 hips.

All patients were immobilized in a hip spica cast for 6 to 8 weeks.

Chiari osteotomy (CO)

This group consisted of two hemiplegic and five quadriplegic patients, with a total of seven hips. Two patients were male and five female. Two patients were able to communicate, while the remaining five were not.

One patient was bedridden, four were wheelchair-bound and two could ambulate autonomously. Two hips were asymptomatic, whereas five were painful. Six hips were subluxated and one was dislocated.

There were four right and three left hips. The mean age at surgery was 13.3 years (range 8 years to 22 years). The mean follow-up period was 3.8 years (range 2 years to 6 years and 5 months). Previous and/or concomitant

interventions on soft tissues were performed in six out of the seven hips.

All patients were immobilized in a hip spica cast for 6 to 8 weeks.

RESULTS (Tables I and II)

Varus derotation osteotomy

Thirteen patients (14 hips) were treated with a varus derotation osteotomy.

From the point of view of function, six patients were able to ambulate (with or without assistance)

Table I. — Patient features

VDO										
Patient	Sex	Diagnosis	Side	Age at surgery (yy,mm)	Duration of follow-up (yy,mm)	Previous or concomitant interventions	Pre function	Pre pain	Pre Reimers' index (%)	Pre Wiberg's index (°)
1	M	T	R	8.5	7	ST	AsA	No	76	-20
2	M	T	L	8.5	5.8	ST	W	Yes	91	-34
3	F	T	L	8.2	7	ST	W	No	56	0
4	M	T	R	9.5	10	ST+BT	AsA	No	73	-18
5	F	D	L	13	3	ST	AsA	No	40	10
6	F	T	R	10	4	ST	W	No	50	0
7	M	H	R	10	4		W	Yes	88	-29
8	F	T	L	9	9	ST+BT	W	Yes	100	-38
9	M	T	L	6.2	3		W	No	43	9
10*	M	T	R	6	4	ST+BT	AuA	Yes	100	-49
11*	M	T	L	3	7		AsA	No	41	10
12	F	T	R	13.9	3.1		BR	Yes	100	-40
13	M	T	L	11.4	2	ST	W	Yes	77	-25
14	F	DH	R	14.8	10.5	ST	AsA	No	58	-1
CO										
Patient	Sex	Diagnosis	Side	Age at surgery (yy,mm)	Duration of follow-up (yy,mm)	Previous or concomitant interventions	Pre function	Pre pain	Pre Reimers' index (%)	Pre Wiberg's index (°)
1	F	H	R	14	2.3	ST	AuA	No	75	-4
2	M	T	L	12	6.5	ST	W	No	80	14
3	F	T	L	8	3	ST	BR	Yes	100	-12
4	F	T	R	22	2.6	ST	W	Yes	79	15
5	M	T	L	9.1	6		W	Yes	73	-32
6	F	T	R	15.5	4	ST	W	Yes	92	-50
7	F	DH	R	12.7	2	ST	AuA	Yes	70	-34

Legend : * = same patient ; Pre = preoperative ; M = Male ; F = Female ; T = Tetraplegic ; H = Hemiplegic ; D = Diplegic ; DH = Double hemiplegic ; L = Left ; R = Right ; ST = Soft tissue ; BT = Bone tissue ; BR = Bedridden ; W = Wheelchair ; AsA = Assisted ambulation ; AuA = Autonomous ambulation.

Table II. — Results

VDO						
Patient	Post function	Post pain	Post Reimers' index (%)	Post Wiberg's index (°)	Result	Complications
1	AsA	No	6	31	Good	
2	W	No	50	0	Fair	Subluxation
3	W	No	25	20	Good	
4	AsA	No	9	25	Good	Consolidation delay ; Femoral fracture
5	AsA	No	12	24	Good	
6	W	No	15	21	Good	
7	W	No	52	-3	Poor	Subluxation
8	W	No	12	18	Fair	
9	AsA	No	22	19	Fair	
10*	AuA	No	0	39	Good	Femoral fracture
11*	AuA	No	10	22	Good	
12	W	Yes	68	-16	Poor	Dislocation ; Decubitus ulcer
13	W	No	18	40	Good	
14	AsA	No	0	36	Good	
CO						
Patient	Post function	Post pain	Post Reimers' index (%)	Post Wiberg's index (°)	Result	Complications
1	AuA	No	4	10	Fair	
2	W	No	10	30	Good	
3	W	Yes	80	-15	Poor	Dislocation ; Superficial infection
4	W	No	0	30	Good	
5	W	No	40	0	Fair	Subluxation
6	W	No	12	22	Good	Decubitus ulcer
7	AuA	No	20	10	Fair	

Legend : * = same patient ; Post = postoperative ; BR = Bedridden ; W = Wheelchair ; AsA = Assisted ambulation ; AuA = Autonomous ambulation.

before surgery. Among them, one patient improved this ability, whereas five remained unchanged. Eight patients were not able to walk (they were bedridden or were forced to use a wheelchair). After surgery, two patients improved their ability (one very young patient (6 years and 6 months) developed the ability to assisted ambulation), while six maintained their pre-existing condition. Overall, function improved in three cases and remained unchanged in 11. None of our cases showed evidence of a worsening in function.

Before surgery, eight hips were asymptomatic, whereas six were painful. In five of the six painful hips, surgery led to a resolution or a significant reduction of symptoms, while in the remaining case

pain remained unchanged. None of our cases showed an increase in pain.

Preoperative radiographs showed 11 subluxated and three dislocated hips. At follow-up, three hips were subluxated, none was dislocated.

Results were good in nine patients, fair in three and poor in two.

We experienced complications in 36% of cases : two recurrences of subluxation, one recurrence of dislocation, one decubitus ulcer, one delay in consolidation and two femoral fractures.

Chiari osteotomy

Seven patients (7 hips) were treated with a Chiari osteotomy. From the point of view of function, two

patients were able to ambulate autonomously before surgery ; after surgery both remained essentially unchanged. Five patients were not able to walk (they were bedridden or were forced to use a wheelchair). After surgery, one improved, and four maintained their preexisting condition. Overall, function improved in one case and remained unchanged in six. None of our cases showed evidence of worsening in function. Before surgery, two hips were asymptomatic, whereas five were painful. In four out of the five painful hips, surgery led to a resolution or a significant reduction of symptoms, while in the remaining case pain persisted. None of our cases showed an increase in pain.

Preoperative radiographs showed six subluxated hips and one dislocated hip. At follow-up, two hips were subluxated, none was dislocated.

Results were good in three patients, fair in three and poor in one.

We experienced complications in 43% of cases : one recurrence of subluxation, one recurrence of dislocation, one decubitus ulcer and one superficial infection.

DISCUSSION

The best treatment of the paralytic hip is still controversial. The objectives to be achieved are : mobility, absence of pain and stability. The range of classical treatments include release of soft tissues in patients at risk, as well as reduction / reconstruction of subluxated or dislocated hips and finally salvage procedures in inveterate forms.

This study shows that both in VDO and CO the possibility of bad results increases with the age of the patient at surgery (the older the patient, the lower the possibility of bone remodelling), the degree of preoperative migration and the initial value of the femoral head coverage (4,9,10,13).

Our data show that a VDO is effective in treating a subluxated or dislocated hip and that a CO is effective in treating cases of concomitant acetabular dysplasia.

We assessed the results through an analysis of function, symptoms and radiographic indices. Even though an improvement in preoperative ability was

detected in only 21% of VDO-treated patients and in 14% of CO-treated patients, we noted an improvement in the preexisting range of motion in all patients, which allows an easier assistance. Concerning pain, we achieved a resolution or significant reduction of pain in almost all cases with both surgical techniques (83% with VDO and 80% with CO). Another interesting factor was the effect on stability, both with VDO (complete reduction in 79% of hips, with a 21% recurrence) and with CO (complete reduction in 71% of hips, with a 29% recurrence). The results were good in 64% of VDO-treated cases and in 43% of CO-treated cases (fair in 22% and 43% respectively). The worse outcome in the CO group depended mainly on the worse preoperative situation of this group of patients.

Finally, we must highlight the fact that it is not possible to intervene on the neurological pathogenesis of cerebral palsy, but only on its manifestations. Therefore, we may anticipate gradual worsening of the objectives achieved, even if an adequate post-operative care is performed.

CONCLUSION

The main limitation of our study is its retrospective nature which, should relevant data be missing in the hospital file, might have led to imprecisions. Moreover, difficulties in finding radiographs in the appropriate position may have influenced the value of certain geometric data that were calculated on these radiographs.

Subluxated or dislocated hips generally show several anomalies. As previously pointed out, the main anomalies are muscular imbalance and femoral and acetabular dysplasia. In the most severe cases, the correction of only one of such anomalies may not be sufficient to guarantee a good outcome.

In our study, a VDO was used in subluxation and dislocation, while a CO was preferred in case of a concomitant acetabular dysplasia. Our data suggest the possibility to combine the two surgical techniques in the most difficult cases, in order to reduce the risk of recurrence. Such a possibility has already been implemented, with good results, by different authors (2,14).

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