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Re-dislocation following open reduction for developmental dysplasia of the hip

Abstract We have reviewed 17 patients (18 hips) who required repeat open reduction for recurrent or persistent dislocation after a previous attempt at open reduction for developmental dysplasia of the hip (DDH). The mean follow-up was 5.5 (3–15) years. At the review, five patients were limping and had limited hip motion but no pain. Six hips were classified as Severin class III or more, and avascular necrosis was evident in 11. We suggest that technical failure is usually the cause for re-dislocation in unilateral cases, as we discovered at repeat open reduction in five of six patients with unilateral dislocation. The biological behaviour of bilateral dislocations may in someway be different since in nine of 11 patients with bilateral dislocations, no obvious cause could be attributed. The outcome is usually poor.

Résumé Nous avons examiné 17 malades (18 hanches) qui ont nécessité une réduction ouverte répétitive de la hanche pour une luxation récidivante ou persistante après une première réduction ouverte pour dysplasie congénitale (DDH). Le suivi moyen était de 5,5 ans (3–15). À la révision cinq malades boitaient et avaient une limitation des amplitudes articulaires mais aucune douleur. Six hanches ont été classées comme Severin classe III ou plus et une nécrose avasculaire était présente dans 11 hanches. Nous suggérons que l'échec technique est la cause des luxations récidivantes dans les cas unilatéraux, comme nous l'avons constaté lors de la nouvelle réduction chez 5 des 6 malades avec luxation unilatérale. Le comportement des luxations bilatérales est différent puisque chez 9 des 11 malades avec luxation bilatérale aucune cause évidente ne pouvait être attribuée. Le résultat est habituellement mauvais.

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Introduction

The goal of treatment in developmental dysplasia of the hip (DDH) is to obtain and maintain a stable concentric reduction as quickly and as easily as possible. Uncommonly, open reduction is not successful, and re-dislocation occurs. The reported incidence of re-dislocation after open reduction varies. It would appear to depend upon the approach used, the age of the patient at the time of initial reduction and, perhaps, the expertise of the surgeon. It has been reported to occur in 0–8% following open reduction via an anterolateral approach [3, 6],and when the medial approach is used, this figure rises to 5–14% [4, 6, 9].

Previous reports have highlighted the problems of management of this difficult problem [1, 3, 5, 6]. We present our experience with 17 patients (18 hips) who had re-dislocation following open reduction for DDH, analyse the possible causes of failure and examine the outcome on both a clinical and radiological basis.

Materials and methods

The study included 17 patients (15 females and two males) with 18 hips treated at the Royal Hospital for Sick Children, Glasgow, between 1981 and 1996. All had recurrent or persistent dislocation after a previous attempt at open reduction, and all had typical DDH without neuromuscular abnormality, an identifiable syndrome or teratological dislocation. The medical records and radiographs of all patients were available for review. At the initial diagnosis, 11 patients had bilateral dislocations and five had left-sided and one a right-sided unilateral dislocation. Nine bilateral cases and two unilateral cases had primary treatment at our institution. The others had been referred for secondary treatment following failure of primary open reduction. Of the bilateral cases, one had re-dislocation on both sides, eight on the left and two on the right (Figs. 1, 2).

The mean age at diagnosis was 18.5 (0–48) months, and the mean age at first open reduction was 25 (13–49) months. Eight bilaterally dislocated hips underwent open reduction

Fig. 1 One side re-dislocated within the spica cast

of both sides under the same anaesthetic. Four of the bilateral cases had simultaneous bony operations (Table 1). Post-operative immobilisation after open reduction was in a plaster spica with the hips in 30° abduction, flexion and internal rotation. The mean age at final open reduction was 39 (24–72) months. Two patients had failed closed reduction before the first open reduction. Pre-operative traction was used in nine patients. Eighteen additional operations were performed at the primary open reduction, including two adductor tenotomies, three Salter osteotomies and 13 proximal femoral osteotomies (Table 1).

The medical records and radiographs of these 17 patients were reviewed. Additionally, all patients were examined for the purpose of this study. Radiographs were evaluated for adequacy of reduction and evidence of avascular necrosis.

Revision operation

Prior to the revision operation, the hip was mobilised where there was significant stiffness. Pre-operative traction before the revision operation was used in seven patients (five unilateral and two bilateral dislocations). The standard repeat operation was performed through an antero-lateral approach. The apophysis was split and reflected from both sides of the ilium. The capsule was dissected anteriorly, superiorly

Fig. 2 At latest follow-up after repeat open reduction

and inferiorly. It was then opened in a T-shaped manner, and the joint was inspected. Adhesions, which were usually dense, were then released. Any obstruction to reduction—usually the psoas tendon, the ligamentum teres, the transverse ligament, the limbus or the pulvinar—that had not been dealt with at the primary procedure was then released. If the limbus was inverted, it was everted by making radial cuts. The acetabular notch was cleared of scar tissue. Once the hip was reduced, a capsulorrhaphy was performed. In many revision cases, the capsule was very scarred, and an adequate capsulorrhaphy was not possible. Four hips required release of the psoas tendon, four eversion of the limbus and five division of the transverse ligament (all unilateral cases). Among the bilateral cases, eversion of the limbus and release of the transverse ligament was required in one case each. Additional osseous procedures were performed, as required. Eight hips required femoral shortening (average of 2 cm), with derotation at the time of final open reduction. Three hips underwent Salter's innominate osteotomy, and one hip required triple osteotomy. One case needed a Chiari osteomy and three cases a shelf acetabuloplasty at a later date due to persistent dysplasia.

The reduction was confirmed clinically and by intra-operative radiographs. Post-operative immobilisation in a hip spica was maintained for 6–12 weeks, depending on the need for secondary femoral or pelvic procedures.

Results

Between 1981 and 1996, there were two re-dislocations (1.2%) among 161 patients with unilateral DDH following open reduction. Of the 56 bilateral cases with DDH, ten hips had re-dislocations (17.8%). At the final follow-up, all patients were clinically assessed by the authors using Ponseti grading (Table 2) [7]. All had limb-length measurements and Trendelenburg tests performed. The radiological status of the joint was assessed using Severin grading (Table 3) [8] and avascular necrosis using the criteria of Kalamchi and McEwen (Table 4) [4]. The mean age at last follow-up was 7 (4.5–17) years, and the mean length of follow-up was 5.5 (3–15) years.

At final review, five patients had Ponseti grade 4 (27.8%). The Trendelenburg test was positive in five patients, and five had a leg-length discrepancy (LLD) of 2 cm or more. Limb equalisation surgery has so far not been required in any of the patients with LLD. Radiological assessment revealed a Severin grading of 3 or more in six hips. Avascular necrosis was evident in 11 hips, of which four had total involvement (grade 4). No patient had avascular necrosis on the sound side or on the side that was not re-dislocated in bilateral cases.

Discussion

In all but one of the unilateral dislocations, failure to maintain reduction could be attributed to an inadequate soft tis-

Table 1 Patient details and result. *TL* Transverse ligament; *LT* ligamentum tere; *PO* pemberton osteotomy; *OPNS* operations; *LAB* labrum (limbus); *TO* triple osteotomy; *OR* open reduction; *case no 1 to 6* unilateral DDH; *PS* psoas tendon; *FS* femoral shortening; *DRO* derotation osteotomy; *case no 7 to 17* bilateral DDH; *PUL* pulvinar tissue; *SO* Salter's innominate Osteotomy; *AD.TEN* adductor tenotomy

Case no.	Gender	Age at 1st O.R	Assoc. opns	Later opns	Age at final O.R.	Operative findings at final O.R. LT	LAB	PS	PUL	TL	Assoc. opns	Age at final F/U	Pons	Trend	LLD in cm	Sever	Avn Kalamchi
1	F	4 Y	–	DRO	4 Y	–	–	+	+	–	–	12	4	+	2	2	0
2	F	3 Y	–	DRO	3.25 Y	–	+	+	+	+	SO+DRO+FS	10	2	–	3	2	0
3	M	2.5 Y	–	DRO+SO	4 Y	–	+	–	+	+	DRO+FS	10	4	–	1	4	3
4	F	13 M	ADD. TEN	ORX2 PO +SHEL	4.25 Y	–	–	–	+	+	–	8	2	+	1	2	4
5	F	19 M	–	–	22 M	–	+	+	+	+	DRO+FS	16	3	+	1	3	3
6	F	22 M	–	OR	2.5 Y	–	+	+	+	+	–	5	1	–	0	2	0
7	F	33 M	SO +DRO +FS	OR+PO +DRO +FS	3.5 Y	–	–	–	+	–	–	6	4	+	2	2	4
8	F	13 M	–	DRO	3.25 Y	–	–	–	+	–	SHELF	14	1	–	<1	2	4
9	F	2 Y	–	DRO+SO	2.5 Y	–	–	–	+	–	SHELF	15	2	–	0	2	0
10	F	2.25 Y	–	–	2.5 Y	–	+	+	+	–	DRO+FS	7	2	–	0	2	0
11	F	2.5 Y	–	DRO	2 Y 8 M	–	–	–	+	+	DRO+FS +SHELF	9	2	–	0	3	3
12	F	1.5 Y	SO +DRO +FS	–	1 Y 8 M	–	–	–	+	–	–	10	1	–	0	2	0
13	F	2 Y	–	DRO	2.25 Y	–	–	–	+	–	DRO+FS +	9	1	–	<1	2	2
14	F	1.25 Y	–	OR×2	5 Y	–	–	–	–	–	TO+DRO +FS	8	2	–	<1	3	0
15	F	1.25 Y	AD. TEN +DRO	OR	2 Y	–	–	–	+	–	SO	13	2	–	1	4	2
16	F	2.5 Y	–	–	22 M	–	–	–	+	–	SO+DRO +FS	6	R-2 L-4	R- L-	2	R-2 L-2	R-2 L-2
17	M	1.5 Y	SO +DRO +FS	–	2 Y	–	–	–	+	–	CHIARI	18	4	+	2	4	4

sue release or insufficient clearance of the structures, which obstruct reduction. Our findings in these unilateral cases agree with others [1, 3, 5, 6].

This fact emphasises the need for the open reduction of DDH to be performed by experienced paediatric orthopaedic surgeons. The bilateral dislocations, treated primarily at our institution, had no definitive soft tissue obstruction evident at re-operation apart from adhesions and pulvinar tissue. All had been operated upon by experienced paediatric orthopaedic surgeons well versed in the management of DDH [2, 10]. Eight of the 11 bilateral cases were performed

Table 2 Ponsetti classification of clinical outcome

1	Asymptomatic
2	Slight hip pain after long walks
3	Limp, free motion and no pain
4	Limp and limitation of motion, no pain
5	Limp and pain
6	Limp, limitation of motion and pain

Table 3 Severin grading of radiological outcome

1	Normal
2	Moderate deformity of femoral head or neck or acetabulum
3	Dysplastic, not subluxed
4	Subluxed
5	Head articulating with the secondary acetabulum in the upper part of the original acetabulum
6	Dislocated
7	Arthritic

Table 4 Kalamchi classification of avascular necrosis of the femoral head

Kalamchi	
1	Changes affecting the ossific nucleus
2	Lateral physeal damage
3	Central physeal damage
4	Total damage to the head and physis

under the same anaesthetic, and in all but one, where both sides re-dislocated, one side subsequently re-dislocated despite the identical procedure having been performed on both sides by the same surgeon.

As in all the previous reports [1, 3, 5], the poor final clinical and radiographic results reflect the numerous procedures performed in these children to obtain a stable, concentric reduction, the most common complication being avascular necrosis. We suggest that technical failure—namely inadequate soft tissue release—is usually the cause for re-dislocation in unilateral dislocations. In bilateral dislocations, no obvious reason was evident, and it may be that the biological behaviour of these hips is in someway different.

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