Open Reduction of Congenital Hip Dislocation by Medial Approach: Case Series

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Aim. To present the results of medial approach in open reduction of congenital hip dislocation, with the preservation of the medial femoral circumflex artery.

Methods. We operated on 48 nonreducible hip dislocations diagnosed in children aged 6-27 months. Twenty-two hips (17 patients) were available for clinical and radiographic follow-up. The median age of children at the time of operation was 15 months (range 7-29), and median duration of the follow-up was 4.5 years (range 3-14). The latest radiographic evaluation of the treatment outcome was based on Severin’s classification.

Results. There were three hips with the loss of concentric reduction. Osteochondritis developed in three, and coxa magna in seven hips. On final evaluation, 19 hips were rated as excellent or good (Severin I or II), and three hips as poor (Severin III or IV): one hip with evident osteochondritis lesions, and two hips with the loss of concentric reduction due to treatment discontinuation.

Conclusion. By preserving circumflex medial artery and eliminating obstacles to reduction, vascularization of the femur head is ensured. The loss of concentric reduction is prevented by complete removal of all obstacles on the way of the femur head down to the bottom of acetabulum, by postoperative cast immobilization, and by walking with abduction orthosis for an appropriate period of time. Medial approach in surgical management of congenital hip dislocation in infants under 24 months of age is considered safe and efficient procedure.

Key words: hip dislocation, congenital; hip joint; infant; orthopedic procedures

The issue of congenital hip dislocation has now acquired a different dimension due to its early screening – early, thorough, repeated clinical examinations of the hip in infants, along with great possibilities of sonography in its early detection. Most of thus detected unstable or dislocated hips can be successfully treated by conservative methods. However, there is a number of early detected, nonreducible hips that require surgical therapy.

A surgical approach to the hip between the long adductor muscle and pectineus muscle was first described by Ludolff in 1908, 1913, and 1914 (1-3). This procedure had fallen into obscurity until 1970s, when it was reintroduced with some modifications (4-7). One of the changes was an anterior approach between the pectineal muscle, and the femoral artery and vein. In 1973, Ferguson (8) described a similar, posterior approach to the hip – behind the long adductor muscle. All these modifications have been jointly designated as inguinal or medial approach. Our idea was to follow the route described by Salzer and Zuckriegl (4), but also to preserve medial femoral circumflex artery because of its role in the femoral head vascularization (9). In this study, we present our experience with open reduction by medial approach used in the surgical treatment of children with congenital hip dislocation (22 hips) in whom conservative approach proved unsuccessful.

Patients and Methods

Patients

During the 1986-2000 period, 48 hips with nonreducible congenital dislocation were operatively treated in children aged 6-29 months, in whom all previous attempts at conservative treatment had failed (Fig. 1). Arthrogryposis and cerebral palsy were ruled out. The patients operated on until 1991 were mostly lost to the follow-up because of the war, so that only 11 of them were available or had had an adequate follow-up until 1991. Between 1995 and 2000, 13 hips were operated on, 8 of them with an adequate period of follow-up. Eventually, 17 children (4 boys and 13 girls) with 22 operated hips and a median follow-up of 4.5 years (range 3-14) were included in the study. Bilateral hip dislocation was found in 5 children. Fifteen hips were classified as high dislocation (type 4), and seven as type 3 dislocation, according to the classification of the Commission for the Study of Hip Dysplasia of the German Society for Orthopedics and Traumatology (13). The median age of children at the time of surgery was 15 months (range 7-29). Only two children were over the age of 2 years (27 and 29 months). In all cases of bilateral hip dislocation, both hips were operated on in a single act.

Indications for Surgery

An unstable infantile hip should be stabilized by abduction bandage, Pavlik harness, or abduction orthosis, depending on the clinical finding. In case of difficulties in reduction or retention, various traction methods are applied until atraumatic reduction is
achieved (13,14). When these methods failed in our patients, our indications for open reduction were as follows: (a) the infant was suffering, and there was no progress in bowing the femoral head down to the level of acetabulum or lower; (b) redislocation following atraumatic reduction by traction; and (c) reduction or retention was only possible in a forced position.

We decided to use medial approach in children under 24 months of age. Initially, we performed several operative procedures according to Ludloff and Salzer (1-4). However, since the operating field thus exposed was quite inappropriate, especially in view of the medial circumflex artery control, we decided to expose the artery and made all efforts to preserve it properly (9).

Operative Technique

A 5-cm inguinal incision was made along the edge of the long adductor muscle, which was cut at its proximal insertion. Short adductor muscle was drawn back. The pectineal muscle was visible at the bottom of the incision, its fibers lying obliquely downwards and carrying anteriorly a constant, superficial branch of the medial circumflex artery. The branch was coagulated distant from its origin. The pectineal muscle was retracted in the first few procedures. However, since the muscle always sustained excessive contusion due to retraction, we found it more appropriate to cut it, bearing in mind the medial circumflex artery behind it. Thus we obtained a clear view of the anteroinferior side of the joint, medially crossed by medial circumflex artery and its origin from the femoral artery (Fig. 2a and 2d). Unless the medial circumflex artery was mobilized, any intervention on this side of the hip would obviously cause a lesion. Therefore, the artery and the accompanying vein were gently dissected and mobilized in both directions for 5-8 mm (Fig. 2d). This had to be done very gently, because too rough retraction could lead to vascular thrombosis. Upon hip reduction, lesser trochanter with iliopsoas muscle tendon could be palpated distally in the wound. The medial circumflex artery was retracted proximally, the iliopsoas muscle epimysium opened, and the muscle cut at the insertion. Then the artery was retracted distally, thus allowing free access to the hip joint. The joint was opened by an incision along its neck, and the capsular isthmus was resolved by another cross-sectional incision, whereby femoral artery and vein were retracted anterosuperiorly (Fig. 2b). The round ligament of femur (Fig. 2b and 2c), which is always hypertrophic, fibrous fatty tissue filling the acetabulum (Fig. 2c), and transverse ligament of acetabulum were regularly removed. After the head of the femur had reached the bottom of the acetabulum, we proceeded with the reduction. The best position for hip stability was estimated, usually at 90° flexion, 60° abduction, and 20° internal rotation. If necessary, the same procedure was performed contralaterally in the same.

Figure 1. Follow-up of the patients in the study.

Figure 2. Open reduction of congenital hip dislocation: medial approach with vascular preservation. a. The femoral artery (1) and the medial femoral circumflex artery (2) exposed after pectineal muscle section. b. Articular capsule is opened and hypertrophic round ligament of the femur head (4) is exposed. c. The head of the femur in the neoacetabulum (6) with inverted lip of the superoexternal segment (8). d. The head of the femur still in the neoacetabulum (6); the acetabulum has not yet been cleaned. e. The acetabulum is cleaned and prepared for reduction.

Table 1. Severin’s criteria for radiographic evaluation of the hipa

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Center-edge angle (age, years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Normal appearance</td>
<td>&gt;15° (5-13)</td>
</tr>
<tr>
<td>II</td>
<td>Mild deformity of the femoral head and neck or acetabulum</td>
<td>&gt;15° (5-13)</td>
</tr>
<tr>
<td>III</td>
<td>Dysplasia or moderate deformity of the femoral head and neck or acetabulum, or both</td>
<td>&lt;15° (5-13)</td>
</tr>
<tr>
<td>IV</td>
<td>Subluxation of the femoral head</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Articulation of the femoral head with a false acetabulum</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Redislocation</td>
<td></td>
</tr>
</tbody>
</table>

aAccording to ref. 12.
Congenital hip dislocation detected at the age of 11 months; open reduction. Twelve months after reduction – free weight-bearing and walking for as long as 6 months. Sonograms on weight-bearing: concentric reduction maintained.

The main goals in the management of congenital hip dislocation are always the same irrespective of the method of open reduction, subluxation was found 5 years later. Upon cast removal and short-term application of abduction orthosis, the parents discontinued the child’s treatment. These cases were classified as group IV. Osteochondritis as a complication was found in 3 hips. The fate of one hip (Fig. 5) remained uncertain even after repeated acetabuloplasty (group III), whereas 2 hips (Fig. 6) with late osteochondritic lesions and coxa magna were classified as group II. Coxa magna was observed in 7 hips, classified as group II. There was no redislocation or need for position change while the children were in the cast.

**Discussion**

Our results of the method of open reduction of congenital hip dislocation were consistent with those described in other reports, summarized in Table 2. On the last checkup, after the correction of concentric reduction in 2 hips, the X-ray analysis according to Severin’s criteria showed excellent or good results in 19 hips, osteochondritis in 1 hip, and subluxation due to treatment discontinuation in 2 hips.

The aim of this report was to present the medial approach with anterior shift (4) as more direct, and section of the pectineal muscle providing a better view of the operative field. The technique is more radical, as the main purpose is to expose and preserve the medial circumflex artery. Although deemed “hazardous” (17), the technique has turned out to be safer than other variants of the method. Salzer and Zuckriegl (4) and others (5-7) did not cut the pectineal muscle nor did they preserve the medial circumflex artery, even though they were fully aware of its importance. Even more so, Weinstein and Ponseti (7) used ligation of the medial circumflex artery in 18 of 22 cases. Other authors (4-6) did not report on an exact number of cases, but they described difficulties encountered when trying to preserve the artery, which is why they frequently had to use ligation. Cutting the pectineal muscle seems acceptable since it provides an excellent view of the operative field. We had to use ligation of the medial circumflex artery in one case only, due to its lesion.

The main goals in the management of congenital hip dislocation are always the same irrespective of the...
patient’s age: 1) to achieve and maintain concentric reduction; 2) to avoid osteochondritis; and 3) to establish normal morphological parameters in the hip.

Reduction

The aim of reduction is to remove all obstacles preventing the femoral head from sitting properly in the acetabulum, which is also the main precondition of concentricity. We do not see any reason for doing it selectively (4-7). The round ligament of the femur head is always elongated and hypertrophic, thus hampering reduction by interposing itself between the bottom of acetabulum and head of femur. In this age group (<2 years), no hemorrhage has ever been observed on its resection and excision. We emphasize the importance of the iliopsoas muscle section. It is always strained, which may not be clearly evident during anesthesia. Upon reduction, it produces an increased pressure and, if left in place, it exerts an additional pressure upon the medial circumflex artery passing between the iliopsoas muscle and pectineal muscle. Later on, it elicits an eccentric effect on the dysplastic hip in an upright standing position. Therefore, we recommend it to be regularly cut off; we do not do it selectively (4-7). The loss of concentric reduction is further overcome by retention in the cast for an adequate period of time, use of walking abduction orthosis, and timely acetabuloplasty if necessary. This is the reason why the hip is followed-up by regular sonographic examinations with weight-bearing.

Figure 4. Open reduction of congenital hip dislocation: loss of reduction concentricity after surgery. a. Bilateral congenital hip dislocation detected at the age of 24 months; age 39 months – 15 months following open reduction: persisting acetabulum dysplasia, the cervico-obturatory arch interrupted on the left. b. Sonogram obtained in upright posture: normal concentricity on the right. c. The left hip is eccentric. d.-e. CT based scheme: identical finding. f. Acetabuloplasty and derotational osteotomy of the left femur; the right hip was left free to observe its spontaneous evolution; 15 months later, at age 54 months, the right hip was well developed, and was further monitored (right: Severin II; left: Severin I).

Figure 5. Osteochondritis following open reduction after the congenital hip dislocation. a. Six months after open reduction: sharp contracture, aplanatic epiphysis. b. Upon the management of contracture unsuccessful Salter osteotomy which resulted in subluxation on support; aplanatic, spherical epiphysis, extended metaphysis. c. State after Tonnis osteotomy: enlarged, aplanatic, spherical epiphysis; extended metaphysis – the finding completely normal (Severin III).
Some authors advocate the anterior approach, stating that capsulorrhaphy is impossible to perform by medial approach, which would subsequently cause subluxation or even redislocation (19). Their objections are obviously refuted by our results as well as by the results of other authors (Table 2). In our series, the loss of reduction (subluxation) was recorded in 4 hips, which could be ascribed to errors in the postoperative strategy. In case 1 (Fig. 4), the child wore abduction orthosis for walking for 10 months after the open reduction, and acetabuloplasty should have been done earlier. In case 2 (Fig. 5), poor Salter osteotomy (20) resulted in the loss of concentric reduction on weight-bearing. It was resolved by Tonnis osteotomy (13) when the child was 3.5 years of age. In case 3 (2 hips), the child’s parents discontinued the treatment. Five years later, X-rays showed subluxation of both hips, but the parents continued to refuse the operation.

**Osteochondritis**

The rate of osteochondritis (3 hips) in our series seems acceptable and is consistent with rates reported by other authors (Table 2). In case 1 (Fig. 5), it must have developed as the result of persistent attempts at closed reduction. In case 2 (Fig. 6), mostly mild changes developed only several years later, indicating that, in spite of the strict criteria, the real state can only be properly evaluated upon the completion of skeletal maturation process (16). There are probably numerous factors leading to the development of osteochondritis, including increased pressure exerted by the adjacent musculature, unsolved obstacles eliciting pressure against the head of femur upon reduction, lesions to the medial circumflex artery, and inappropriate position in the cast. We believe that all these factors can be eliminated. As vascular lesion is one of the known causes of osteochondritis, we made efforts to preserve the medial circumflex artery, and demonstrated it to be feasible, although its involvement in the development of osteochondritis was not experimentally proven (21). Quite intriguing is the fact that the authors (4-7) who used ligation of the medial circumflex artery reported on a relatively low rate of osteochondritis. Does it mean that this artery is not terminal at this level? Many are inclined to believe that osteochondritis develops as a consequence of previous unsuccessful attempts at conservative treatment (22) or is at least related to them (12), whereas others think that preliminary traction reduces the pressure against the head of femur and results in a reduced rate of osteochondritis. The proportion of

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**Table 2. Results of the open reduction for congenital dislocation of the hip by medial approach**

<table>
<thead>
<tr>
<th>Author (ref.)</th>
<th>Year</th>
<th>Approach</th>
<th>No. of hips</th>
<th>Median age (months)</th>
<th>Osteochondritis (n, %)</th>
<th>Subluxation or redislocation (n, %)</th>
<th>Secondary procedure (n, %)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salzer and Zuckriegl (4)</td>
<td>1967</td>
<td>Salzer</td>
<td>105</td>
<td>2-12</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Mau et al (5)</td>
<td>1971</td>
<td>Ludloff</td>
<td>46</td>
<td>20</td>
<td>2 (5)</td>
<td>0</td>
<td>25 (55)</td>
</tr>
<tr>
<td>Ferguson (8)</td>
<td>1973</td>
<td>Ferguson</td>
<td>100</td>
<td>–</td>
<td>0</td>
<td>3 (3)</td>
<td>–</td>
</tr>
<tr>
<td>Machacek and Salzer (6)</td>
<td>1977</td>
<td>Ludloff</td>
<td>128</td>
<td>0</td>
<td>63 (49)</td>
<td>15 (12)</td>
<td>57 (44)</td>
</tr>
<tr>
<td>Roose et al (17)</td>
<td>1979</td>
<td>Ferguson</td>
<td>26</td>
<td>7-16</td>
<td>0</td>
<td>9 (35)</td>
<td>9 (35)</td>
</tr>
<tr>
<td>Weinstein and Ponseti (7)</td>
<td>1979</td>
<td>Weinstein and Ponseti</td>
<td>22</td>
<td>0</td>
<td>2 (10)</td>
<td>2 (9)</td>
<td>–</td>
</tr>
<tr>
<td>Kalanchi et al (16)</td>
<td>1982</td>
<td>Ferguson</td>
<td>15</td>
<td>9</td>
<td>10 (67)</td>
<td>9 (60)</td>
<td>8 (53)</td>
</tr>
<tr>
<td>Diepstraten (18)</td>
<td>1985</td>
<td>Ferguson</td>
<td>56</td>
<td>7</td>
<td>2 (3)</td>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>Mankey et al (12)</td>
<td>1991</td>
<td>Ludloff</td>
<td>66</td>
<td>12</td>
<td>7 (11)</td>
<td>3 (5)</td>
<td>22 (33)</td>
</tr>
<tr>
<td>This report</td>
<td>2001</td>
<td>Salzer</td>
<td>22</td>
<td>15</td>
<td>3 (13)</td>
<td>3 (13)</td>
<td>10 (45)</td>
</tr>
</tbody>
</table>
osteochondritis cases in these series attributable to previous lesions or to the operative procedure itself will remain an unanswered question, because all the series contained a number of cases with preliminary closed reduction. We believe that previous traction is needed because we cannot neglect the fact that, in some cases, it proves successful. Furthermore, not all such children should readily undergo operative procedure, irrespective of the low rate of osteochondritis reported by those advocating primary open reduction (8,17,18). We abandon traction as soon as some initial problems occur.

Coxa magna, observed in 7 hips, is a trophic disturbance of the still obscure nature. We classified it as Group II according to Severin (cf. 12). We agree with the opinion of Izumida et al (cf. 13) that this is the consequence of arthrotomy. Although the head remains spherical and the hip concentrically reduced, coxa magna poses a great problem for the already insufficient acetabulum, ie, to cover the enlarged femor head.

### Acetabulum

The first and foremost precondition for the development of acetabulum is concentric reduction. It should be performed as early as possible to allow its rapid and complete development (23). If a child undergoes the surgery at the age of <1 year, the acetabulum is very likely to achieve normal parameters. It was previously believed that the development of acetabulum ceases after the age of 2 years (20). However, it has now been accepted that an appropriate development can be expected for several more years, provided the concentric reduction is properly maintained (13). However, there are no mathematical parameters predicting its later development. There is no consensus on time when to operate on a dysplastic acetabulum, or for how long to delay it. It appears that the development of acetabulum should be monitored over time (12,24) and acetabuloplasty performed only when a retardation in development is observed.

In our series, acetabular procedures were carried out in 10 cases (Table 2). The need of such a procedure could not be considered an unfavorable aspect of the method, as no intra-articular intervention or revision of the reduction was required, but primarily as reflecting the age of the child at the time of operation as well as of the pathoanatomical substrate involved, eg, severity of acetabular dysplasia or osteochondritis of the acetabular roof. We think that the age of 2 years is a reasonable upper age limit for open reduction by medial approach. Acetabuloplasty was required in all our patients aged >2 years (4 cases). In these cases, it was reasonable to choose anterior approach, which allowed simultaneous management of acetabular dysplasia.

In conclusion, open reduction is a crucial moment in the management of congenital hip dislocation. We believe that medial approach as described here-with is a safe and reliable method. Other advantages of this approach include direct approach to the hip joint and all obstacles interfering with concentric reduction, the possibility of their elimination, the possibility of managing both hips in a single act and during the same anesthesia, no blood loss, intact approach to the anterosuperior aspect of the hip, and cosmetically acceptable scar.

### References


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