CLINICAL ARTICLE

Legg-Calvé-Perthes disease: The results of a prospective clinical trial comparing the outcomes of surgery and symptomatic treatment for patients presenting at age 5 years or younger

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Abstract

It is widely recommended that children with Legg-Calvé-Perthes (LCP) disease aged 5 years or younger be treated non-surgically. Studies have nevertheless shown that this group does not have a universally good outcome. A prospective clinical trial was started in 1978, using lateral subluxation (extrusion) of the femoral head in the fragmentation stage of the disease as an indication for surgery. A review of 71 patients with 73 involved hips treated at age 5 years or younger shows that children who present with a Catterall 4/Herring C classification, as well as the presence of lateral subluxation, do better following a Salter innominate osteotomy than a comparable group that was treated with intermittent analgesics, rest and physiotherapy.

Key words: Perthes' disease, Salter osteotomy, age under 5 years, untreated controls, outcomes

Introduction

The treatment of Legg-Calvé-Perthes (LCP) disease continues to be controversial with disputed and uncertain outcomes reported. The work by the Perthes Study Group reported by Herring, Kim and Browne[1] dealt with children 6 years of age and older, and did not include the younger age groups. The treatment recommended for children 5 years or younger by Kim[2] in a review article is non-surgical, despite reports that this group does not have a universally good outcome.[3-6] It would be beneficial to be able to define accurately which children are likely to have a poor outcome, and whether any treatment can change this.

Rosenfeld, Herring and Chao[6] reporting on 188 hips showed that the prognosis in this age group is favourable with 80% having a good result, and that patients with a Herring lateral pillar classification B-C or C have a less favourable outcome. Of note is that all their patients were treated conservatively. Fabry, Fabry and Moens[5] reported on 36 hips in 30 patients with more than 50% presenting with a Herring C or Catterall 3 or 4 classification. They found a high percentage of poor results and stated that 'young age is not a free ticket to a good result'. A meta analysis of the literature led them to conclude that a comparison of results is difficult due to different final evaluation methods, an absence of exact numbers and omission to mention the severity of the cases.

In 1971 Catterall[7] described what he termed the 'head at risk', and based on this formulated guidelines for the future management of LCP disease. Following this work a protocol for the treatment of LCP disease was formulated at the Transvaal Memorial Hospital for Children in Johannesburg, and surgery was recommended for children with a head at risk. In 1978 the senior author (AS), modified this protocol on going into private practice, and adopted lateral subluxation (extrusion) of the femoral head as the only indication for surgical intervention. Our aim in this study is to evaluate the treatment protocol that was followed, and to determine if surgery has a role to play in this young age group.

Material and methods

Between 1978 and 1996 the senior author (AS) treated 87 patients with 89 involved hips at the age of 5 years or younger. The prospective protocol used was that hips with no lateral subluxation (extrusion) of the femoral head would receive only symptomatic treatment irrespective of classification or of the degree of femoral head involvement. At the time the Catterall classification was used to determine the extent of femoral head involvement. Acetabular coverage was assessed on the AP X-ray and was expressed as the percentage of the femoral head that was covered by the acetabulum. Lateral subluxation was considered to be present if the acetabulum covered less than 90% of the epiphysis.[8] Those hips that presented with lateral subluxation in the fragmentation stage of the disease had surgery recommended. Pre-operatively an arthrogram was done. If the femoral head was spherical and containable, a Salter innominate osteotomy was performed. If the femoral head was either aspherical or non-containable then a Chiari osteotomy was performed (algorithm, *Figure 1*).

The current study is a retrospective review of these patients' radiographs. Of the 89 involved hips 16 were excluded as they were not followed up until either full bony reconstitution of the epiphysis was present or skeletal maturity had been reached. Of these ten had no treatment, and six had Salter osteotomies. That left 73 hips for evaluation. The X-rays at initial presentation were re-classified using both the Catterall[7] classification and the Herring[9] lateral pillar classification. The Stulberg classification as modified by Herring to assess the final outcome was used.[10]

All patients had their gender, age at presentation, side of involvement and age at final follow-up recorded, as well as the percentage subluxation on the arthrogram (*Table I*). On arthrogram the lateral subluxation was confirmed with a range between 7% and 39% (average 26.1%). A Stulberg I or II was classified as a good result, Stulberg III a fair result and Stulberg IV and V as poor results.

Forty-six patients with 48 involved hips received no treatment other than symptomatic. Of the 48 hips 28 had no lateral subluxation, whereas 20 of the hips did develop lateral subluxation. These 20 were not treated surgically for three reasons. The parents either refused surgery, returned for follow-up much later than requested, or the treating surgeon (AS) misread the X-ray. The remaining 25 patients with lateral subluxation were treated by means of a Salter osteotomy. All the patients were 5 years old or younger. There were 53 males and 18 females (*Table I*). No patients in this age group met the criteria to perform a Chiari osteotomy.

Eighty-five per cent of the hips that developed lateral subluxation were initially classified as a Catterall 4 or Herring C. Of the non-subluxed hips, 46.4% were a Catterall 4 or Herring C (*Table II*).

Results *(Table III)*

Of the 28 non-subluxed hips there were 25 good results (Stulberg I or II), and three fair results (Stulberg III). Eight of the good results were initially classified as a Catterall 4/Herring C, and all three fair results were a Catterall 4/Herring C. Of the entire group, 46.4% were Catterall 4/Herring C. A typical result is shown in *Figure 2*.
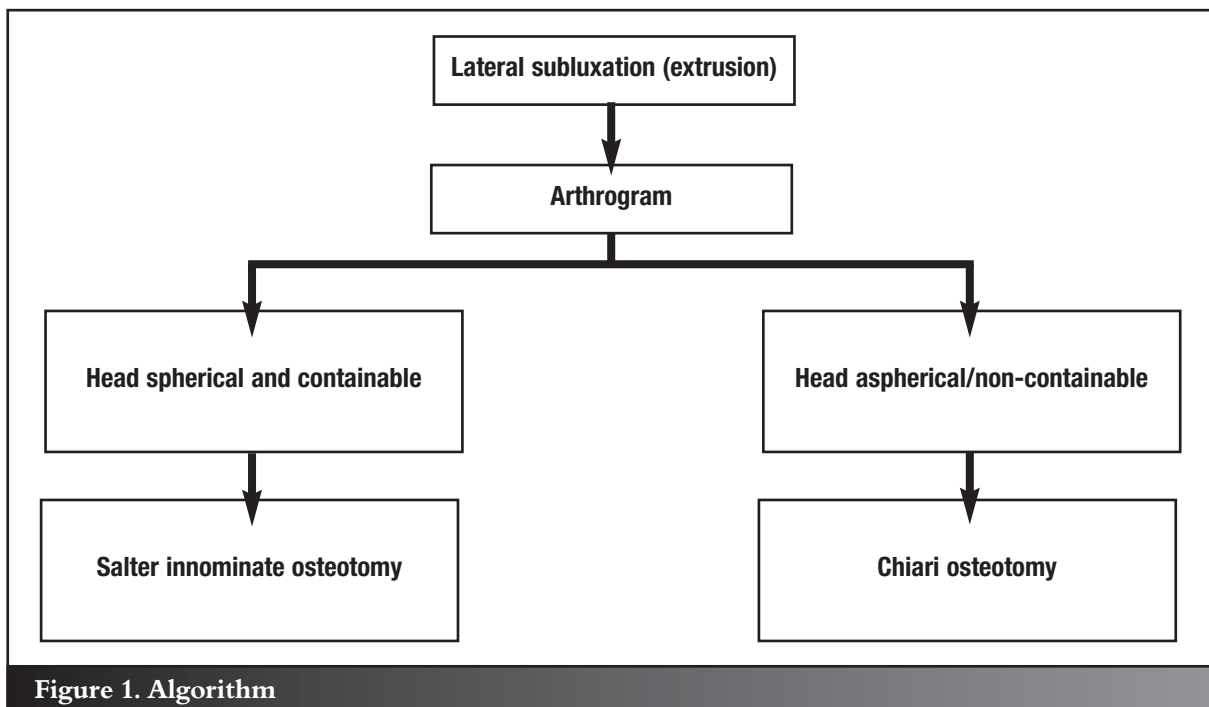

Figure 1. Algorithm

Table I: Demographics of 73 hips under six years of age		
Untreated hips (n=48)		**Salter osteotomies (n=25)**
No subluxation (n=28)	**With subluxation (n=20)**	**All with subluxation**
Mean age 38 months	Mean age 51 months	Mean age 53 months
(Range 25–57)	(Range 36–57)	(Range 36–57)
Sex 8 F, 20 M	Sex 3 F, 17 M	Sex 8 F, 17 M

Table II: Initial classification of hips (n=73)		
Untreated hips (n=48)		**Salter osteotomies (n=25)**
No subluxation (n=28)	**With subluxation (n=20)**	**With subluxation**
3 Catterall 1, 2/Herring A		
3 Catterall 4/Herring A		
9 Catterall 4/Herring B	3 Catterall 4/Herring B	6 Catterall 4/Herring B
13 Catterall 4/Herring C	17 Catterall 4/Herring C	19 Catterall 4/Herring C
46.4% Catterall 4/Herring C	85% Catterall 4/Herring C	76% Catterall 4/Herring C

Table III: Overall results at skeletal maturity or after full reconstitution of the femoral head

Untreated non subluxed hips (n=28)

	Stulberg I & II	Stulberg III	Stulberg IV & V
3 Catterall 1, 2/Herring A			
3 Catterall 4/Herring A	25	0	0
9 Catterall 4/Herring B			
10 Catterall 4/Herring C			
3 Catterall 4/Herring C	0	3	0
%	**89.3%**	**10.7%**	**0%**

Untreated subluxed hips (n=20)

	Stulberg I & II	Stulberg III	Stulberg IV & V
3 Catterall 4/Herring B	2	1	0
17 Catterall 4/Herring C	3	10	4
%	**25%**	**55%**	**20%**

Salter osteotomies – Subluxed hips (n=25)

	Stulberg I & II	Stulberg III	Stulberg IV & V
6 Catterall 4/Herring B	5	0	1
19 Catterall 4/Herring C	13	5	1
%	**72%**	**20%**	**8%**

Of the 20 subluxed untreated hips there were five good results (Stulberg I or II), 11 fair results (Stulberg III) and four poor results (Stulberg IV). Three of the good results were classified as a Catterall 4/Herring C, and ten fair results were a Catterall 4 and Herring C. All four poor results were a Catterall 4/Herring C. Eighty-five per cent of the entire group were a Catterall 4/Herring C. A poor result is shown in *Figure 3*.

In the group of 25 subluxed hips that were treated by a Salter osteotomy there were 18 good results, five fair results and two poor results. Thirteen of the good results were a Catterall 4/Herring C, and the remaining five a Catterall 4/Herring B. All five fair results were a Catterall 4/Herring C. The two poor results were a Catterall 4/Herring B, and a Catterall 4/Herring C. Seventy-six per cent of the entire group were a Catterall 4/Herring C. A good result is shown in *Figure 4*.

Figure 2a. Untreated non-subluxed hip (AP)

Figure 2b. Untreated non-subluxed hip (lat)

Figure 2c. Untreated non-subluxed hip (AP) outcome

Figure 2d. Untreated non-subluxed hip (lat) outcome

When comparing the two sub-groups with lateral subluxation they are seen to be very similar in initial classification. The results of the surgically treated group are better than the non-surgical group.

Discussion

Fabry, Fabry and Moens concluded from their meta analysis of the literature that 'hips affected by LCP in children in the younger age group are not protected from severe involvement'.[5] They report on 78% poor outcomes for patients with a Herring C classification in this age group. They found it very difficult to compare their results with others reported in the literature. The age groups vary from under 4 years of age to under 6 years, and the Mose method to assess outcome was not uniformly applied.

The results of the surgically treated group are better than the non-surgical group

The severity of head involvement was not always listed, and the Catterall classification alone was used. This classification has been criticised for its poor intra- and inter-observer accuracy,[11-13] which has been found to be better with the lateral pillar classification.[14]

Rosenfeld, Herring and Chao[6] found that severity of head involvement was more predictive of a poor outcome. They found that 48% of the Herring C group had a good outcome, but did not distinguish those with or without lateral subluxation (extrusion) as done in this study. In addition their patients' treatment was not standardised to a definite protocol, and all were treated non-operatively. They stated the patients 'received minimal treatment for the disease'. Herring, Kim and Browne[1] found that non-operative treatment equated to no treatment in the study of older children.

Canavese and Dimeglio[15] reported on a large series of 166 hips in children under 6 years of age. They used only the Catterall classification, grouping them into Catterall 1 and 2, and Catterall 3 and 4.

Figure 3a. Untreated subluxed hip (AP)

Figure 3b. Untreated subluxed hip (lat)

Figure 3c. Untreated subluxed hip (AP) outcome

Figure 3d. Untreated subluxed hip (lat) outcome

They did not treat their Catterall 1 and 2 patients, and further evaluated their Catterall 3 and 4 patients with a bone scan and MRI. Patients with Conway[16] type-A changes were treated conservatively, and patients with Conway type-B changes with a containable femoral head and lateral extrusion (subluxation) on MRI and arthrography were treated surgically with a Salter innominate osteotomy. They found no difference in their results between the conservative and surgically treated groups of the Catterall 3 and 4 cases using the Stulberg and Mose method of outcome evaluation, but did find that the Catterall 4 group fared worse than the Catterall 3. Eighty per cent of Catterall 3 hips had a good result as compared to 51% Catterall 4 hips. They concluded that young children are not protected from severe disease and a poor outcome.

Ismail and Macnicol[17] found that the Herring classification and sphericity of the femoral head on arthrography were the best predictors of a good outcome in their study on 81 hips. They had only 15 (18.5%) hips with a Herring C

classification and 16 (19.8%) with a Catterall 4 classification. The age of onset of their patients ranged from 2-and-a-half to 9-and-a-half years, and roughly half (40) of their patients were treated by Salter innominate osteotomy. They note that younger patients more often had spherical heads, but their indications for performing an arthrogram or an osteotomy are not listed aside from stating that bilateral disease or repeated episodes of stiffness are a 'relative indication' for surgery. They do not distinguish patients with lateral subluxation that were treated or not.

Using only lateral subluxation (extrusion) of the femoral head as an indication for surgery our results are different. This may be due to using both the Catterall and Herring classifications for initial evaluation. In the non-subluxed (mild) cases there was a preponderance (15) of Herring A and B classifications (53.6%), with 13 Catterall 4/Herring C classifications (46.4%). All three of the fair results were a Catterall 4/Herring C. Nevertheless it appears that hips without subluxation do not need any active treatment, and certainly not if the Herring classification is A or B.

Figure 4a. Subluxed hip, pre-operative (AP)

Figure 4b. Subluxed hip, pre-operative (lat)

Figure 4c. Outcome post Salter innominate osteotomy (AP and lat)

In the more severely involved hips with lateral subluxation there is a preponderance of Catterall 4/Herring C classification, with 17 (85%) in the untreated group and 19 (76%) in the surgically treated group. If one looks at only the Catterall 4/Herring C hips, then the results of the untreated hips is three good (17.6%), ten fair (58.9%) and four poor (23.5%).

Comparison with the surgically treated group shows 18 good (72%), five fair (20%) and two poor (8%). In both groups the Catterall 4/Herring B hips fared better, with only one of six poor (16.7%) in the surgically treated group.

It would be interesting to study all patients with an MRI, and separate the group with damage to the growth plate and see how their results compare to those with an intact growth plate, following a strict treatment protocol. De Sanctis, Rega and Rondinella[18,19] showed good inter-observer reliability to establish physeal involvement and lateral extrusion (subluxation) using MRI, and an ability to predict a poor prognosis. Lateral extrusion was found by Green, Beauchamp and Griffin[20] to be a good predictive sign, and although this has been the finding in our study, it is not widely accepted.

We conclude that the Salter innominate osteotomy improves the outcome in the treatment of Catterall 4/Herring C hips with lateral subluxation (extrusion) in children 5 years of age or younger. We acknowledge that further investigation such as MRI could be useful, and a prospective randomised trial should be performed to accurately establish the efficacy of treatment for LCP disease in this age group.

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