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Radiological evaluation of surgical treatment in Perthes' disease

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Abstract We compared the late radiographic results of femoral head coverage in two unselected groups of patients with Perthes' disease, one treated conservatively and one with surgical containment. Forty-eight hips were treated surgically and 28 hips were managed conservatively. The preoperative radiographs were classified using both the Salter and Herring classifications. We found no significant difference in femoral head coverage between the groups. However, there was a trend towards a better femoral head coverage following surgical containment of Salter type B and Herring type II and III hips. The authors conclude that surgical containment may offer a better prognosis for patients with the more severely affected hips.

Résumé Nous avons comparé les résultats radiographiques tardifs de la couverture de la tête fémorale dans deux groupes non sélectionnés de patients atteints de maladie de Perthes', l'un traité d'une manière conservatrice (48 hanches) et l'autre de façon chirurgicale (28 hanches). Les radiographies préopératoires ont été classées en utilisant les classifications de Salter et de Herring. Nous n'avons trouvé aucune différence notable de la couverture de la tête fémorale entre les 2 groupes. Cependant il y avait une tendance à une meilleure couverture après une amélioration chirurgicale dans le type Salter B et les types Herring II et III. Les auteurs concluent que la chirurgie offre un meilleur pronostic pour les malades ayant les hanches le plus sévèrement affectées.

Introduction

The objective in the surgical treatment of Legg-Calve-Perthes' disease is to achieve containment and thus minimize the development of deformities and subsequent osteoarthritis [4, 17]. Favorable results have been achieved when the involved femoral head has been contained during the active phase of the disease [2, 6, 8, 12]. The advantage of operative containment is that the child can resume a normal life without further interruptions for treatment. We compared the late radiographic results of femoral head coverage in two groups of patients with Perthes' disease, one treated surgically and one treated conservatively.

The aims of this study were to assess whether the outcome following femoral osteotomy depends on the severity of the condition at the time of presentation and to assess whether there is a difference between surgical and conservative management in achieving containment.

Patients and methods

The study included 72 children (76 affected hips) diagnosed with Perthes' disease and who were seen consecutively at Royal Manchester Children's Hospital in the years 1989–1995. Children younger than the age of 4 years, classified as a Salter A and Herring I were excluded from the study because of their generally satisfactory prognosis. Sixty children out of the 72 investigated, were male (4 had bilateral Perthes' disease) and 12 were female. These 72 children either presented at the local Accident and Emergency Department with hip pain or were referred from other hospitals. Anteroposterior and frog lateral radiographs of both hips were obtained at the time of admission. Investigations excluded other causes of hip pathology.

Patients were treated either surgically or by using conservative methods for containment. Surgical containment included upper femoral or pelvic osteotomies. Only patients who had femoral osteotomies were included in this study. Conservative containment consisted of a period of bed rest until pain subsided followed by the use of containment orthosis. There was no single uniform protocol for the consultant orthopaedic surgeons to follow as to which children would be treated by either surgical or conservative containment.

When the possibility of femoral osteotomy was considered, the hip was examined under anesthesia and an arthrogram was carried

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Table 1 Salter classification

Group A	Less than 50% involvement of the femoral head
Group B	More than 50% involvement of the femoral head

Table 2 Herring classification

Group I	There is no collapse of the lateral pillar
Group II	The lateral pillar has maintained at least 50% of its original height
Group III	There is more than 50% loss of the lateral pillar original height

out. If there was less than 20°–30° of abduction, an adductor tenotomy was carried out and the patient received postoperative physiotherapy in an attempt to improve the range of hip abduction. Femoral osteotomy was not carried out if the hip abduction was less than 30°, all the surgeons agreeing that following osteotomy the patient must be left with at least 20° hip abduction. If the arthrogram showed that a femoral head, which was not contained in the neutral position, could be contained following an osteotomy, the osteotomy was carried out, either at the time of arthrography or during a subsequent procedure. All the children had their operation within 6 weeks of presentation. It is likely that the more severely affected hips underwent surgery and that the study was biased against surgery.

The femoral osteotomy was performed distal to the lesser trochanter and was fixed using a plate. Postoperative weight bearing was restricted until there was radiographic evidence of bone union. The plate was removed a year after surgery. The mean follow up was 7.2 years in the operative group and 6.9 years in the non-operative group. All patients were followed up for at least 4 years.

A consultant radiologist and a senior house officer in orthopedics retrospectively reviewed the preoperative and most recent postoperative radiographs. Disagreements were discussed and a mutual decision was reached. The preoperative hip radiographs were classified (Table 1 and Table 2) using the lateral pillar (Herring) classification [10] and the Salter classification [15]. The most recent postoperative radiographs were reviewed in order to assess containment. Containment was assessed by measuring femoral head coverage. This was measured as a ratio between the width of the acetabulum above the femoral head and the width of the femoral head. The higher this ratio the better the containment achieved.

Results

Forty-eight hips were treated operatively by means of an upper femoral osteotomy and the other 28 hips were treated conservatively by means of containment orthosis. The two groups were similar in terms of age and sex distribution. Table 3 shows the preoperative classification of these hips using the Herring and the Salter classification, the mean age of presentation in each group and the femoral head coverage measured from the most recent anterior-posterior radiographs. The only bias between the operative and non-operative groups was the younger age at presentation of children in the non-operative group with Salter A and Herring I hips.

The data were analyzed by applying the Student's *t*-test for the equality of means. The results of the statistical analysis showed no significant difference in femoral head coverage between the operative and non-operative groups. There was a trend towards a better femoral head coverage following surgical treatment of Salter type B and Herring type II and III hips.

One of the patients in the operative group required replating because of a fracture at the osteotomy site. Another patient in the operative group required surgical intervention because of leg shortening. There were no cases of non-union, infection or any other postoperative complications.

Discussion

The treatment of Perthes' disease is controversial. Initially, treatment was according to weight relief, with a variety of techniques being used, but this is rarely carried out today. The majority of surgeons advocate no active treatment, except for rest or limited weight bearing if there is a lot of muscle spasm, in the presence of favorable prognostic signs such as onset under the age of 5 years, collapse of the lateral pillar of less than 50% and partial involvement of the femoral head. Active treatment is advocated for the patient over the age of 6 years with unfavorable prognostic signs, where the surgeon feels that treatment may be of benefit.

Table 3 Final outcome of the study groups

Group	Number of patients		Mean age (range) in years	Mean femoral head coverage
	Males	Females		
Salter A				
Operative	10	2	6.17 (4–9)	0.85
Non operative	8	2	4.43 (4–6)	0.96
Salter B				
Operative	31	5	6.53 (4–11)	0.79
Non operative	15	3	6.56 (4–12)	0.73
Herring I				
Operative	12	3	6.21 (4–9)	0.82
Non operative	9	1	5.00 (4–7)	0.96
Herring II				
Operative	16	2	6.38 (4–11)	0.85
Non operative	7	1	6.86 (4–11)	0.75
Herring III				
Operative	13	2	6.64 (4–11)	0.79
Non operative	7	3	6.88 (4–12)	0.71

If active treatment were required, most surgeons would advocate containment [16], either conservatively or surgically. In this study we attempted to assess whether surgical containment by femoral osteotomy provided better results than conservative treatment. The beneficial effects of surgical containment include permanent femoral head coverage and less restriction of mobility when compared to the use of orthosis. Furthermore, it has been suggested [1, 18] that the vascular effects of the osteotomy may hasten recovery in Perthes' disease. On the other hand the disadvantages of surgical containment include intra and post-operative complications, the need for a second operation to remove the plate and leg shortening. Our study revealed only one complication following femoral osteotomy when re-plating was required for a fracture at the osteotomy site. Because of the retrospective nature of our study we are unable to comment on the incidence of leg shortening in the two groups. However, literature review suggests no difference between the two groups [3, 5, 7].

In this study, we tried to answer the question whether the outcome of surgical or conservative containment differs, depending on the severity of the condition at the time of presentation. The severity of the condition of the children's hips was measured by preoperative classification of the hips using two well-recognised classifications, the Salter and the lateral pillar (Herring) classifications. The outcome of the treatment depends on femoral head coverage since the more deformed and extruded the femoral head becomes, the worse the prognosis.

We found that operative treatment did not improve femoral head coverage of the hips classified as Salter A; this is not surprising as less than 50% of the femoral head was involved. In Salter B hips, the operation improved containment but the difference was not statistically significant. These results are similar to those reported by Lahdes Vasama et al. [11] who also used the Salter classification to compare the late radiographic results in two groups of unselected patients with Perthes' disease.

The Herring classification is more reproducible, is a better predictor of outcome [14] and is becoming more widely used. Our results suggest that patients with Herring Type II (there is collapse of the lateral pillar but it has maintained at least 50% of its original height) and Herring Type III (there is more than 50% collapse of the lateral pillar) are likely to benefit most from osteotomy, although the difference was not statistically significant.

In addition, this study attempts to provide an answer to the complex issue as to whether surgical containment is more beneficial when compared to conservative measures in the treatment of Perthes' disease. The issue is still controversial. Some studies have shown better radiographic results in the operative group [5, 13] whereas others show no difference between the two methods [7, 9]. In this study, a number of surgeons were involved in the treatment of these patients and there was no specific protocol. It was the individual consultant's decision as to whether a patient should be investigated for the possibility of containment osteotomy.

The main advantage of osteotomy over conservative methods of containment, such as the use of orthosis, is

that once the osteotomy has united the patient can resume a normal life, whereas prolonged use of containment orthosis may have detrimental psychological and educational effects. For example, some schools will not accept patients in a containment orthosis for "safety" reasons. If anything, the results of surgery are better than those of conservative measures, with their potential drawbacks. None of the patients in this series developed complications following osteotomy and it is our opinion that the advantages of osteotomy outweigh the disadvantages of conservative methods of containing the hip, even though surgery carries risks. Not only does surgery minimize the disruption this condition causes in a child's life, but may also offer a better prognosis for patients with Salter B or Herring II or Herring III Perthes' disease.

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