Arthroscopy in 19 children with Perthes' disease

Pathologic changes of the synovium and the joint surface

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Arthroscopy of the hip joint was performed in 19 children with Legg-Calvé-Perthes' disease. Proliferation of the synovium was pronounced both in the acetabular fossa and over the inner wall of the capsule. Hypervascularity was seen on the acetabular labrum in every stage of the disease. Microscopically, hyperplasia of the synovial lining cells was observed, but inflammatory changes in the synovial tissue were inconspicuous in the early stage of the disease. Although hypertrophy of the endothelial cells of the vessels was seen in the late stage of the disease, it was not distinct in the initial or fragmentation stages. Joint pain improved after irrigation during arthroscopy.

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There are few reports on the pathologic changes on the intra-articular surfaces of the hips in Perthes' disease because it is seldom feasible to open the joint. In this report we demonstrate the inner aspect of the hips in various stages of Perthes' disease by means of arthroscopy and describe the histological observations of biopsy specimens of the synovial membrane. We also report the effects of irrigation with saline during arthroscopy on pain and range of hip motion.

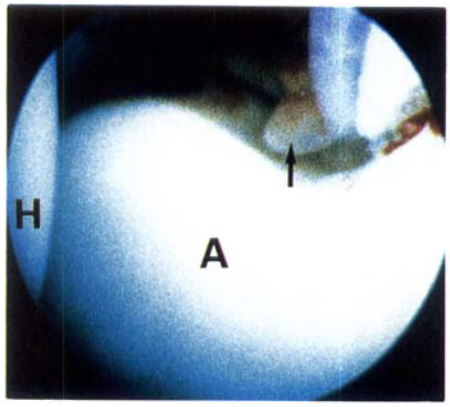
Patients and methods

From 1988 to 1992 arthroscopy was performed in 19 children with Perthes' disease (Table 1). The mean age was 8 (5–13) years. After the diagnosis, the patients were admitted to the hospital and received skin traction with the hip in 30–40 degrees of flexion in order to relieve hip pain and to improve the range of motion. The indications for athroscopy were 1) per-

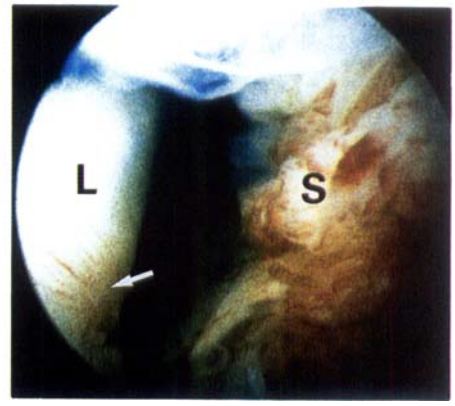
Table 1. Details concerning 19 patients with Perthes' disease who underwent arthroscopy

Case	Sex	Age	Side affected	Days after the onset	Stage	Catterall group	Acetabulum-head index
1	M	5	Left	29	Initial	IV	79
2	M	6	Left	32	Initial	IV	74
3	F	8	Right	35	Initial	IV	81
4	M	7	Left	40	Initial	IV	72
5	M	6	Right	57	Initial	IV	103
6	M	10	Right	58	Initial	III	68
7	F	5	Left	60	Initial	III	69
8	F	6	Left	61	Initial	III	92
9	M	7	Left	86	Initial	IV	74
10	M	6	Left	143	Fragmentation	IV	91
11	M	8	Right	154	Fragmentation	III	63
12	M	7	Right	180	Healing	IV	80
13	M	9	Right	245	Fragmentation	III	91
14	M	9	Right	282	Fragmentation	III	88
15	M	11	Right	383	Healing	II	84
16	M	9	Left	385	Healing	IV	76
17	M	11	Left	420	Healing	IV	78
18	F	11	Left	754	Growing	IV	95
19	F	13	Left	1460	Growing	IV	95

Figure 1. Arthroscopy in Perthes' disease.



Case 9. The left hip, H, the femoral head, and A, the acetabular cartilage. Arrow shows proliferation of the synovium in the acetabular fossa.



Case 13. The right hip, L, the labrum with vascular invasion, and S, the synovium proliferating around the neck of the femur. Arrow shows hypervascularity of the labrum.

sisting hip pain or limited range of motion after 3–4 weeks of traction, 2) recurrence of hip pain during or after treatment and 3) when diagnosis needed to be ruled out. The interval between the onset of the symptoms and the arthroscopy ranged from 29 days to 4 years. 9 hips were in the initial phase of the disease, 4 in the fragmentation phase, 4 in the healing phase, and 2 in the growing period. The type of head involvement according to Catterall (1971) was Group II 1, Group III 6, and Group IV 12. Acetabulum-head index (Heyman and Herndon 1950) was also included.

Arthroscopy was performed according to Suzuki et al. (1986). Punch biopsies of the synovium were taken in 11 patients. At the end of arthroscopy, the joint was irrigated extensively with large quantities of saline, more than 1000 cc.

The range of motion of the involved hip was obtained from the charts. Only data which were recorded within 2 weeks before and after arthroscopy were used. Statistical analysis was performed using the Student's *t*-test.

Results

A distinctive feature was proliferation of the synovium in the acetabular fossa (Figure 1) and of the femoral side of the capsule. Degenerated fibrous tissues, originating from synovial tissue, were abundant in the early stage of the disease and were floating in the joint.

Hypervascularity was seen on the acetabular labrum. Although vascular proliferation was limited to small areas in the early stage of the disease, it spread all over the acetabular labrum in the later stage. In 1 case, invasion of the synovial membrane into the labrum was observed. A torn acetabular labrum was detected in 3 cases.

Microscopically, hyperplasia of the synovial lining cells was observed, as shown in Figure 2. The synovium inside the capsule hypertrophied with villous formation.

The number of blood vessels increased and it was marked in the healing phase. Hypertrophy of the wall of the blood vessels was apparent in the healing phase, but it was not distinct in the initial or fragmentation phases.

Although a number of inflammatory cells were recognized in the hips in the healing phase, there was no evidence of inflammatory reaction in the initial or fragmentation phases.

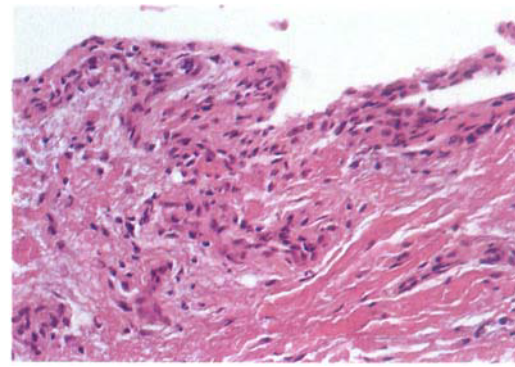


Figure 2. Case 2. Histopathology of the synovium. Arrow shows hyperplasia of synovial lining cells.

Table 2. Hip motion before and after arthroscopy

Position	N	Before arthroscopy		After arthroscopy		*P*-value
		Mean	Range	Mean	Range	
Hip extended						
Flexion	6	126	90–140	130	110–140	NS
Abduction	7	31	15–40	42	25–70	NS
Adduction	6	23	10–30	27	10–40	NS
Internal rotation	6	37	10–70	51	15–80	NS
External rotation	5	13	−25–40	29	−5–60	NS
Hip flexed						
Internal rotation	9	21	3–35	34	3–60	< 0.05
External rotation	8	27	−3–45	44	10–60	< 0.05

Before arthroscopy, the range of motion was restricted, especially in adduction and internal and external rotation at 90 degrees of hip flexion (Table 2). The patients complained of pain on maximum adduction and internal rotation with the hip flexed. After arthroscopy and irrigation, the ranges of adduction and rotation at 90 degrees of hip flexion improved ($P < 0.05$). The pain on adduction and internal rotation with the hip flexed 90 degrees before arthroscopy decreased after the procedure.

Discussion

Proliferation of the synovium in the acetabular fossa and over the inner wall of the capsule was a distinctive arthroscopic feature. The increase in the tissue volume in the acetabular fossa pushes the femoral head laterally and may become the cause of subluxation, as Jonsäter (1953), Axer and Schiller (1972), and Kamegaya et al. (1989) have suggested. Proliferation of the synovium inside the capsule may produce excessive fluid, which partially replaces the volume of the femoral head and produces joint instability (Wingstrand et al. 1990).

Hypervascularity on the labrum was a striking finding, which we observed in every stage of the disease. Although it is not known whether this phenomenon is the result of subluxation or is a primary pathology specific to Perthes' disease, vascular proliferation could be one of the causes of subluxation, as it prevents tight covering of the labrum over the femoral head.

Thus, patients with Perthes' disease have the factors causing joint instability. Hip instability may be related to the femoral head deformity, since an unfavorable load in the head-acetabulum fit may involve the weight bearing area of the femoral head as Wingstrand et al. (1990) described.

Histologic examination indicates that synovial change is a reactive proliferation rather than an inflammatory one. Jensen and Lauritzen (1976) at necropsy, and Larsen and Reimann (1973) in specimens obtained at operation, both observed that an inflammatory reaction was not conspicuous in Perthes' disease. Although the etiology of the disease is still unknown, it appears that the inflammatory reaction is not a major factor.

Irrigation of the joint during arthroscopy relieved the pain and improved the range of motion. Some patients had persistent hip pain which was difficult to control, and we found that in most such patients the pain was relieved after arthroscopy. In the treatment of Perthes' disease, restoration and maintenance of full range of hip motion is particularly important, because it remodels the joint deformity and contains the femoral head in the concentric position which, in turn, prevents subluxation.

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