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Sonography, arthroscopy, and intracapsular pressure in juvenile chronic arthritis of the hip

Sonography was used in the preoperative evaluation of the hip joint in 14 patients with juvenile chronic arthritis (JCA). The joint capsule distension found at sonography and the intracapsular pressure were increased in patients with severe synovitis revealed at arthroscopy. Sonography and intracapsular pressure-recording can be recommended for assessments of synovitis of the hip joint in JCA.

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The evaluation of synovitis of the hip joint in the preoperative assessment for synovectomy or in the follow-up of therapy in juvenile chronic arthritis (JCA) is difficult. Conventional radiography offers little information on the presence or intensity of synovitis (Brown 1975). The only reliable method until now has been arthroscopy (Holgersson et al. 1981). We have studied the diagnostic value of sonography and intracapsular pressure recording in hip joint synovitis.

Patients and methods

Fourteen patients, aged 15 (7–22) years, were studied. They all had juvenile chronic arthritis (Wood 1978) and they were admitted consecutively to the Center for juvenile arthritis at our hospital because of hip pain and/or loss of motion. Two patients had bilateral symptoms at the time of examination. Thus, 16 hips were examined.

The hips were examined clinically, radiographically, and sonographically before intracapsular pressure recording and arhtroscopy; the range of motion and pain at rest or in motion were recorded. Anteroposterior and frog leg radiographs were obtained in all but one hip.

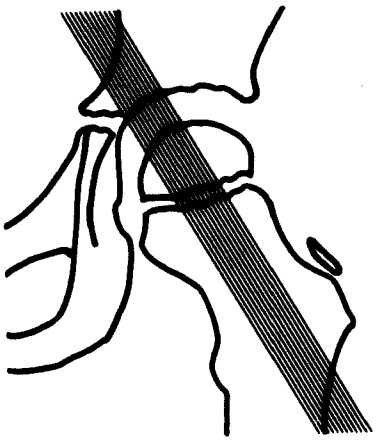
The radiographs were classified according to Pettersson and Rydholm (1985). The presence or absence of osteoporosis, epiphyseal enlargement or other growth disturbance, erosions, cyst formation and deformation of the subchondral joint surface were each recorded as 1 or 0. The acetabulum and femur were scored individually. Thus, a normal radiograph scored 0 points and an abnormal radiograph could reach a maximum of 10 points.

Sonography was performed using a real-time scanner (Diasonics DRF 12) with a 7.5 MHz transducer in a sagittal plane along the axis of the neck of the femur from the ventral aspect of the hip (Figure 1).

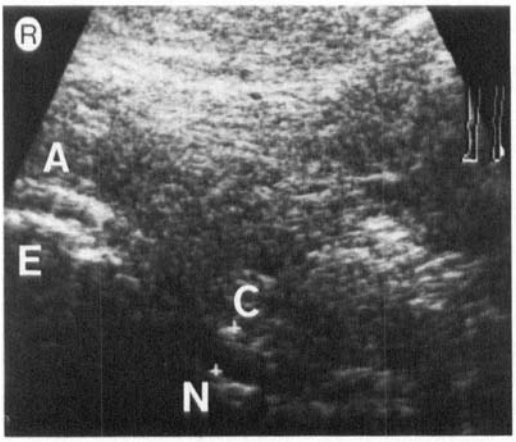
The distance between the anterior aspect of the capsule and the neck of the femur was recorded in the symptomatic and in the contralateral nonsymptomatic hip (Figure 1) as described by Egund et al. (1986).

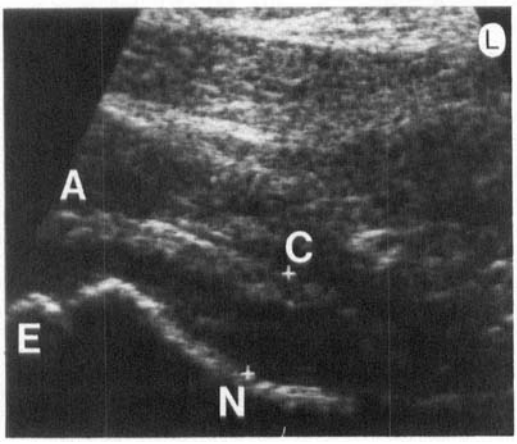
Intracapsular pressure recordings and arthroscopy were performed with the patient supine on a traction table under muscle relaxing anesthesia. A two-plane image intensifier was used. The joint capsule was punctured with a 1.2 mm epidural needle connected via a tube with heparinized saline to a piezoelectric pressure transducer (Wingstrand et al. 1985). The joint pressure was recorded immediately after puncture of the joint in neutral extension, in maximal inward and outward rotation in extension, and at 45 degrees of neutral flexion. The joint was then distended with heparinized saline under simultaneous traction. When the joint was maximally distended, a 3.8 mm Storz arthroscope was introduced (Holgersson et al. 1981). Inspection of the synovial membrane laterally and centrally in the joint was always possible with the aid of 30° and 70° optics.

The inflammatory changes of the synovial membrane were divided into four stages: normal, mild synovitis, moderate synovitis and severe synovitis (Holgersson et al. 1981). The state of the articular cartilage could also be inspected in parts of the acetabulum and the femoral head and was classified according to four stages: normal; mild with yellow areas and flaking; moderate with large and deep car-



A





B

Figure 1. A. Plane of sonographic sectioning from the ventral aspect of the hip.
B. Sonography of the right (R) nonsymptomatic hip and the left (L) symptomatic hip in Case 8. E = epiphysis, A = acetabular labrum, N = neck of femur, C = anterior aspect of the joint capsule. In the left hip the capsule is distended owing to synovitis.

tilage erosion; and severe with erosions through cartilage to or into bone (Holgersson et al. 1981).

Sonography was performed by only one investigator, who had no knowledge of the clinical or the radiographic findings. Moreover the sonographic findings were not available at the time of pressure recording or arthroscopy. Finally all the arthroscopies were performed by the same investigator.

Data were analyzed statistically with the Wilcoxon two-sample rank test, Fisher's exact probability test, and with the Spearman correlation test.

Results

The mean intracapsular pressure in neutral extension was 1,3 kPa; in inward rotation in extension, 10.9 kPa; in outward rotation in extension, 3.7 kPa; and in neutral flexion of 45 degrees, 0.4 kPa.

The capsular distension was correlated with the stage of synovitis ($r=0.7$, $p<0.01$) (Figure 2) as was intracapsular pressure ($r=0.6$, $p<0.05$) (Figure 3). The stage of synovitis was correlated to the stage of cartilage destruction ($r=0.5$, $p<0.05$) as was the radiographic score ($r=0.7$, $p<0.01$). There was no correlation of intracapsular pressure to capsular distension. The radiographic scores of the two hips in each patient correlated well ($r=0.9$, $p<0.001$).

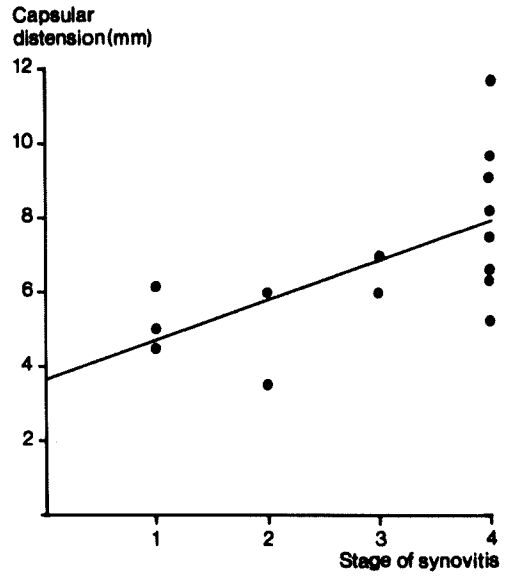


Figure 2. Capsular distension in 15 hips compared with stage of synovitis ($R = 0.7$; $P < 0.01$).

Table 1. Observations in 14 patients with juvenile chronic arthritis of the hip

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	F	16	L	6.6	6.6	1.7	0	2.5	0	4	2	5	5	yes
2	F	17	R	6.4	6.0	0	0.5	0.4	–0.7	4	2	0	0	yes
3	M	11	R	–	–	0	–4.0	16.7	–	1	1	2	2	yes
4	M	7	R	6.0	–	–0.4	–	0.3	–	2	2	1	3	no
5	F	14	R	3.5	4.1	–1.5	0	1.3	–2.5	2	4	7	8	yes
6	F	19	L	6.2	5.8	–0.8	–	–	0	1	1	0	0	no
7	M	13	L	9.7	11.2	0.8	–	–	0	4	2	9	5	yes
8	F	13	L	7.5	4.5	–	–	–	–	4	2	2	4	yes
9	F	18	L	4.5	–	0.8	–0.3	1.6	1.3	1	1	2	2	yes
	F	18	R	5.2	–	3.6	18.0	53.3	0	4	1	2	2	yes
10	F	11	R	6.0	5.4	0.7	0.7	10.0	2.0	3	1	0	2	yes
11	M	13	L	11.8	12.0	3.7	9.7	9.3	4.0	4	2	4	4	yes
12	M	19	L	8.2	–	5.3	12.7	32.0	1.2	4	3	–	–	yes
	M	19	R	9.1	–	2.8	5.5	14.4	0.7	4	3	4	4	yes
13	F	20	L	5.0	5.2	1.7	1.3	4.8	1.3	1	1	0	0	no
14	F	22	L	7.0	7.8	0.4	0.1	0.8	–0.5	3	2	3	2	no

A = patient; B = sex; C= age; D = symptomatic hip (R-right, L = left); E = capsular distension as recorded sonographically (mm); F = as in E in the *non-symptomatic hip;* G-U = intracapsular pressure (kPa) with the hip in extended *neutral position,* neutral outward rotation, neutral inward rotation and in 45° of neutral flexion, respectively; K = stage of synovitis found at arthroscopy; L + stage of cartilage changes found at arthroscopy; M = radiographic score, left hip; N = radiographic score, right hip; O = presence of pain in the affected hip; (– = missing observation).

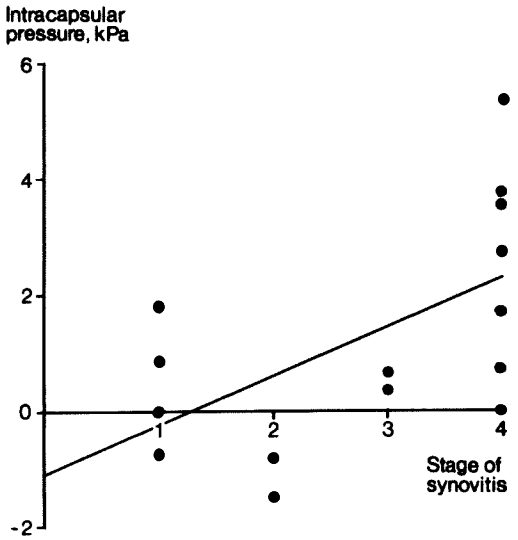


Figure 3. Intracapsular pressure in neutral position of the hip compared with stage of synovitis ($R = 0.6$; $P < 0.05$).

Capsular distension in the symptomatic and in the nonsymptomatic hips was 7 mm, i.e., there was no sonographic difference between the symptomatic and nonsymptomatic hips.

Discussion

Synovitis of the hip in children with juvenile chronic arthritis causes pain and restricts active motion. Anti-inflammatory drugs, intraarticular administration of steroids, and synovectomy all aim at reducing synovitis. It is useful to have direct information on the intensity of synovitis before treatment, as well as in the follow-up and evaluation of the effect of the treatment given. Clinical examination, however, offers little information in this respect, and neither conventional radiography (Brown 1975). Arthroscopy, hitherto the only diagnostic alternative (Holgersson et al. 1981), has the disadvantage of requiring general muscle relaxation.

Sonography has proved to be an accurate diagnostic tool in children with intracapsular effusion due to transient synovitis of the hip (Wingstrand et al. 1985). The mean intracapsular pressure was 12.9 kPa with the hip in extension and neutral position and dropped to 2.3 kPa at 45 degrees of flexion. These pressures were generally lower in our patients with juvenile chronic character of the disease, with relapsing distension of the capsular structures. Patients with low pressures had less intense pain and better motion, suggesting that syn-

ovitis with increased intracapsular pressure is a symptomatic, pain-producing factor.

Sonographically observed capsular distension was correlated with the stage of synovitis, which was most evident in joints with severe synovitis (Figure 2). However, the distension in the contralateral hip cannot be used for comparison because these patients often have bilateral arthritis with intermittent symptoms as confirmed by the radiographic scores of the nonsymptomatic hips.

The intracapsular pressure was correlated with the stage of the synovitis, with a marked increase in Stage 4 synovitis (Figure 3). We know that patients with juvenile chronic arthritis may be asymptomatic even when the hip has been severely destroyed. Hip pain in these patients probably implies exacerbation of the synovitis, with increase of the intracapsular pressure. However, there was no correlation of intracapsular pressure to capsular distension in our patients, which is in accordance with the findings in children with transient synovitis of the hip (Wingstrand 1986).

As in patients with transient synovitis of the hip, the intracapsular pressure increased drastically when the hip was forced into full extension. The position of extension causes pain contributing to the loss of full passive extension, which with time develops into a manifest flexion contracture seen in many patients with juvenile chronic arthritis.

We conclude that sonography and intracapsular pressure recording are useful diagnostic tools for assessing severe hip joint synovitis in juvenile chronic arthritis, and they may also be useful in the follow-up of therapeutic measures aimed at reducing synovitis.

Acknowledgements

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