

Magnetic resonance imaging not indicated in healed Perthes' disease

Comparison with radiography in 10 cases

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We examined 10 patients with unilateral healed Perthes' disease with plain radiographs and magnetic resonance imaging (MRI). The mean time between

the onset of symptoms and follow-up was 8 (4–10) years. The MRI scans did not contribute more information than the plain radiographs.

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Magnetic resonance imaging (MRI) in Perthes' disease has proved useful in determining necrosis, revascularization, sphericity, and lateral subluxation of the femoral head (Scoles et al. 1984, Toby et al. 1985, Pinto et al. 1989, Henderson et al. 1990, Bos et al. 1991). However, the only comparison of MRI scans with plain radiographs in healed Perthes' disease (Henderson et al. 1990) did not show that the new technique was advantageous.

We have compared MRI scans with plain radiographs in healed Perthes' disease.

Patients and methods

10 patients (8 men and 2 women) with a previous history of unilateral Perthes' disease, where all hips had been classified as Catterall (1971) Group 3, were examined with plain radiographs, MRI scans and a clinical evaluation (Table 1). The right hip was involved in 6 patients and the left in 4. The mean age at onset was 7 (5–10) years. The mean time between onset and follow-up was 8 (5–11) years. 5 of the 10 patients were treated with innominate osteotomy, 3 with femoral osteotomy and the remaining 2 with abduction brace.

The sphericity of the femoral head was measured by the method of Mose (1964) on the plain radiographs in anteroposterior and lateral projections. If the femoral head was spherical in both the anteroposterior and lateral projections with no deviation of the concentric rings, the result was considered good. A deviation of up to 2 mm was considered fair and a deviation of more than 2 mm was considered poor. The center-edge angle (Wiberg 1939) was used to measure the lateral

subluxation of the femoral head, where an angle greater than 25° was classified as good, between 20–25° as fair and less than 20° as poor.

The MRI scans were obtained in coronal and axial views (both hips) and a sagittal view (involved hip) on a superconductive Siemens Magnetom, 0.5 T. Technical factors included double-echo with repetition times (TR) of 500 and 1500 ms and echo times (TE) of 30, 35, and 90 ms, 5 mm thick contiguous slices and a 256 × 256 matrix from the MRI scans.

The MRI scans were evaluated concerning signal pattern, sphericity and containment of the femoral head, thickening of the articular cartilage, possible elevation of the articular labrum and intraarticular fluid. Attempts were made to judge the joint capsule. The contralateral hip was regarded as a normal control. The MRI scans were read by 2 experienced radiologists and compared with the plain radiographs.

The clinical assessment comprised an examination of the hip joint mobility and a questionnaire on walking, running, limping, sporting activities and eventual pain during normal daily or strenuous activities.

Results

The plain radiographs showed in all but Case 5 (Figure 1) a complete healing of the necrosis of the femoral head. This patient had a pathological MRI signal pattern in a small area with abnormally low signal intensity in both the T1 and T2-weighted images. The other 9 cases had normal fat signal patterns of the femoral heads (Figure 2). Two femoral heads (Cases 5 and 7) were deformed, which was seen with both the radiological methods.

Table 1. Plain radiography, MRI, and clinical examination in healed Perthes' disease

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	M	R	7	11	1	3	1	1	2	1	1	1	1	1	1	1	1	45/20	30/60
2	M	L	7	10	1	3	1	1	2	1	1	2	2	2	1	2	1	45/30	15/60
3	M	R	8	9	1	3	1	1	1	1	1	1	1	1	1	2	1	50/50	30/45
4	M	R	5	9	1	3	1	1	1	1	1	1	2	2	2	1	2	10/20	20/45
5	M	L	8	8	1	3	3	2	1	3	2	2	2	2	2	1	1	5/10	15/45
6	M	L	6	8	2	3	1	1	1	1	1	1	1	1	1	2	1	30/30	45/60
7	M	R	10	7	2	3	2	1	3	2	1	2	2	2	1	2	1	45/45	30/45
8	M	L	8	5	2	3	1	1	1	1	1	1	1	1	1	1	1	10/45	60/60
9	F	R	8	10	3	3	1	1	2	1	1	1	1	1	1	2	1	60/30	30/60
10	F	R	5	8	3	3	1	1	2	1	1	2	1	2	2	2	1	30/45	60/60

A Case	J Center-edge angle	O Labrum
B Sex	1 good	1 normal
C Side	2 fair	2 elevated
D Age at onset (years)	3 poor	P Fluid
E Years between onset and follow-up	MRI scan	1 no
F Treatment	K Caput form	2 yes
1 innominate osteotomy	1 round	Clinical examination
2 femoral osteotomy	2 slightly deformed	Q Pain
3 abduction brace	3 deformed	1 on strenuous physical activity
G Catterall group	L Caput signal	2 no
Plain radiography	1 normal	R Limping
H Mose	2 abnormal	1 no
1 good	M Containment	2 yes
2 fair	1 contained	S Internal rotation (degrees)
3 poor	2 not contained	involved/uninvolved
I Caput structure	N Articular cartilage	T External rotation (degrees)
1 normal	1 normal	involved/uninvolved
2 abnormal	2 thickened	

Figure 1. Case 5. Follow-up period 7.5 years.



Lateral view showing a small necrotic area in the involved hip. Note vacuum phenomenon which permits visualization of the articular cartilage of the femoral head.



T1-weighted image showing the small necrotic area in the same place as in the plain radiograph.

In 5 joints MRI demonstrated an elevation of the articular labrum which, in 4 cases, was combined with a thickening of the acetabular cartilage. In none of these cases the femoral head was completely

contained. These findings were in the corresponding plain radiographs seen as fair center-edge angles in 2 cases, as poor in 1 case, and in 1 case as a non-healed necrosis.



Figure 2. Case 8. Follow-up period 4 years and 7 months. T 1-weighted image showing no difference in signal intensity between right and left femoral heads.

Increased amount of fluid was seen in 3 joints, of which 1 had only a local fluid collection centrally. The joint capsule could in most cases not be demonstrated well enough. As a rule the radiological findings corresponded poorly to the clinical findings at follow-up. None of the 10 patients had pain in the involved hip during normal activity, but 4 had experienced pain during strenuous physical exertion. 3 patients had restricted internal rotation and 1 patient had a slight limp. Out of the 4 patients with pain or restricted mobility only 2 had pathological findings on plain radiographs and MRI. Both demonstrated a thickening of the acetabular cartilage and an elevation of the articular labrum. In 1 of these cases the necrosis was not completely healed.

Discussion

In their follow-up evaluation of 7 radiographically completely healed Perthes' patients, Henderson et al. (1990) showed that MRI did not contribute any essential information when compared with plain radiographs. In our 10 cases, configuration and structure of the femoral head were demonstrated equally well on plain radiographs and MRI. The single case with per-

sistent partial necrosis of the femoral head was seen on MRI as a locally low signal and on the plain radiographs as a black hole. Despite the fact that the patient was 15 years old at follow-up and had had a follow-up time of 7 years, the femoral head was not completely healed. This patient had pain, possibly because of the abnormal caput structure and the poor sphericity.

In the remaining 3 cases with pain, the information from the plain radiographs or the MRI scans did not provide any possible explanation for the pain. Lack of containment, however, was more easily seen in the MRI scans, usually as a thickening of the acetabular cartilage in combination with an elevation of the labrum. On the plain radiographs a lateral subluxation was seen as a reduction of the center-edge angle, and in 2 of 3 cases only as a slight reduction classified as fair. Fluid could, of course, be demonstrated only on MRI.

Thus, the additional MRI findings were few and moreover less than half of the patients with pathology had any clinical symptoms or restricted mobility.

References

- Bos C F, Bloem J L, Bloem R M. Sequential magnetic resonance imaging in Perthes' disease. *J Bone Joint Surg (Br)* 1991; 73 (2): 219-24.
- Catterall A. The natural history of Perthes' disease. *J Bone Joint Surg (Br)* 1971; 53 (1): 37-53.
- Henderson R C, Renner J B, Sturdivant M C, Greene W B. Evaluation of magnetic resonance imaging in Legg-Perthes' disease: a prospective, blinded study. *J Pediatr Orthop* 1990; 10 (3): 289-97.
- Mose K. Perthes' disease. Thesis, University of Århus, Århus, Denmark 1964.
- Pinto M R, Peterson H A, Berquist T H. Magnetic resonance imaging in early diagnosis of Legg-Calve-Perthes disease. *J Pediatr Orthop* 1989; 9 (1): 19-22.
- Scoles P V, Yoon Y S, Makley J T, Kalamchi A. Nuclear magnetic resonance imaging in Legg-Calve-Perthes disease. *J Bone Joint Surg (Am)* 1984; 66 (9): 1357-63.
- Toby B E, Koman A L, Bechtold R E. Magnetic resonance imaging of pediatric hip disease. *J Pediatr Orthop* 1985; 5: 665-71.
- Wiberg G. Studies on dysplastic acetabular and congenital subluxation of the hip joint. *Acta Orthop Scand (Suppl 83)* 1939.