Core decompression for femoral head necrosis

Prospective study of 28 patients

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Totally, 28 consecutive patients with nontraumatic osteonecrosis of the femoral head were included in a prospective study of the clinical and radiographic results of core decompression. One patient (one hip) was lost to follow-up. Preoperatively, the stage according to Ficat (1985) was assessed by plain radiography and scintimetry. After 1–2 years, hip replacement had been performed in 4/11 Stage 1, 7/11 Stage 2, and 4/7 Stage 3 hips, while the remaining 12 hips were judged satisfactory. We conclude that the outcome of core decompression for nontraumatic necrosis of the femoral head is unpredictable.

Core decompression remains controversial in the treatment of nontraumatic osteonecrosis of the femoral head, and recent reports of this procedure have been quite conflicting (Hungerford 1979, Ficat 1985, Camp et al. 1986, Warner et al. 1987, Hopson and Siverhus 1988, Tooke et al. 1988, Learmonth et al. 1990).

We report the clinical and radiographic outcome of core decompression in a prospective series of 27 patients with nontraumatic necrosis of the femoral head.

Patients and methods

Totally, 28 consecutive patients (25 men and 3 women), with an average age of 40 (22–62) years, were included in a prospective study from January 1986 to January 1990.

The most frequent risk factors in the patients in this study were a history of alcohol abuse or intake of steroids (Table 1). In about one fifth of the cases, no risk factors could be identified.

Preoperatively, the patients were evaluated clinically using the scoring system of Harris (1969), and staging of the disease was made according to Ficat (1985) by plain radiography (anteroposterior and frog-leg projections) and by static ^{99}Tc-MDP scintimetry. No patients without clinical, radiographic, or scintigraphic signs of osteonecrosis (i.e., Ficat's Stage 0) were included in this study, because we did not investigate any patients by measuring the intraosseous pressure or by core decompression for microscopy on clinical suspicion alone.

The anesthetized patient was placed on a fracture table, and the long saphenous vein was cannulated with a long catheter, placing the tip of the catheter in the proximal part of the vein for measurement of the intravenous pressure. A slightly conical 3-mm cannula with a trochar was inserted distally in the trochanter and advanced into the central axis of the femoral neck and head under image-intensifier control. The trochar was removed, and the intraosseous pressure in the femoral head was recorded, allowing 5 minutes for the pressure to stabilize. Subsequently, the intravenous pressure was subtracted from the measured intraosseous pressure to calculate the true intraosseous baseline pressure.

In 16 hips, the Ficat (1985) stress test was performed by injecting 5 mL of heparinized saline into the intraosseous cannula. A positive outcome of this test was considered when the intraosseous pressure

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was more than 10 mmHg above the baseline pressure 5 min after the injection of the saline solution.

Finally, an 8-mm core was removed from the femoral neck and head, taking care to include the osteonecrotic lesion of the femoral head in the biopsy.

At least 1 of the authors participated in all but two of the operations.

Following decompression, the patients were allowed partial weight bearing only for 6 weeks.

In Case 10 the pain became much more intense immediately after the decompression, although no fracture or other lesion was observed. Otherwise, no adverse effects of the decompression occurred, notably no fracture at the decompression hole.

Case 11 was lost to follow-up because he had moved abroad. The remaining patients were followed by clinical examination and radiographs at regular intervals until the final follow-up or until failure of the procedure had become obvious. An increase in the preoperative Harris score and no progression in the radiographic stage were considered a successful outcome of the core decompression. Failure of the procedure was defined as deterioration in the Harris score, and the time of failure was recorded as the date on which further surgery, usually total hip replacement, was decided on.

Table 1. Associated diseases in 28 patients (30 hips) with nontraumatic osteonecrosis of the femoral head and number of failures (n 15) after core decompression

	Number of hips	Failures
Alcohol abuse	11	5
Steroid intake	7	3
Renal transplantation	4	3
Dysbarism	1	–
Malignant lymphoma	1	–
Idiopathic	6	4

Table 2. Radiographic and clinical outcome related to Ficat's (1985) stage in 27 patients (29 hips) with nontraumatic necrosis of the femoral head

Stage	n	Clinical success	Radiographic deterioration	THA	Time from CD to THA
1	11	7	3	4	5 (2–7)
2	11	4	5	7	9 (1–36)
3	7	3	3	4	10 (4–18)
4	0	–	–	–	–

Table 3. The Harris score preoperatively and at follow-up in 14 patients who had no further surgery after core decompression. Mean (range)

		Harris' score		Follow-up
Stage	n	preop	postop	(mo)
1	7	54 (44–68)	91 (76–100)	16 (2–44)
2	4	48 (34–64)	86 (78–96)	16 (3–36)
3	3	52 (40–74)	75 (72–78)	21 (4–38)

Results

The clinical and radiographic results of the core decompression were not correlated with the etiologic groups (Table 1). Half of the patients in Stages 1 and 2, i.e., before collapse of the femoral head, needed further surgery less than 1 year after the core decompression (Table 2).

In 7 patients with Stage 1 osteonecrosis, the average Harris score increased from 54 preoperatively to 91, 16 months after the decompression (Table 3). Correspondingly, in 4 patients with Stage 2 osteonecrosis, the Harris score increased from 48 to 86, whereas the increase in 3 patients with Stage 3 osteonecrosis was more limited. One patient in Stage 3 did not obtain any benefit from the decompression; but, because no further surgery had been decided on at the time of follow-up, he was not listed as a failure.

The average intraosseous baseline pressure was 45 (4–90) mmHg (Table 4). The baseline pressure in 11 patients who eventually had a total hip replacement was 43 (4–67) mmHg, whereas the baseline pressure in 13 patients considered clinical successes at follow-up was 47 (15–90).

In 16 hips (13 patients), the average intraosseous baseline pressure was 35 (4–60) mmHg, increasing to 49 (20–105) mmHg 5 min after injection of 5 mL heparinized saline.

Discussion

Due to the compartmental nature of bone, a chronically elevated intraosseous pressure and a retarded venous sinusoidal drainage in the femoral

Table 4. Observations in 28 patients (30 hips) with necrosis of the femoral head

A	B	C	D	E	F	G	H	I	J	K
1	30	F	1	1	2	45	THA	6	4	21
2	45	M	2	1	1	44	95	44	60	80
3	31	M	2	2	3	35	THA	36	50	70
4	37	M	2	2	3	64	96	36	24	46
5	22	M	3	1	1	54	100	40	15	27
6	38	M	4	3	3	74	72	38	43	54
7	49	M	2	2	3	48	THA	3	–	36
8	32	M	3	3	4	41	THA	12	35	28
				2	4	41	THA	14	37	30
9	38	M	4	3	4	33	THA	6	55	55
				3	4	33	THA	18	35	45
10	45	M	4	2	2	40	THA	1	–	–
11[a]	52	M	1	3	–	45	–	–	–	–
12	37	M	2	3	3	31	THA	4	27	27
13	59	M	1	1	1	45	THA	5	–	–
14	49	M	1	1	2	31	THA	2	67	–
15	62	M	2	3	4	43	74	20	55	–
16	28	M	5	2	2	48	86	13		
17	34	M	2	2	3	32	THA	2	53	105
18	52	M	4	2	3	46	84	10	35	60
19	39	M	2	2	2	69	THA	3	54	–
20	51	F	1	1	1	51	96	8	52	–
21	44	M	2	1	3	51	90	9	43	71
22	44	M	4	1	1	63	87	2	20	20
23	32	M	1	1	1	–	THA	7	–	–
24	30	M	2	1	1	47	76	6	32	–
25	40	F	4	2	2	34	78	3	64	–
26	46	M	3	2	3	47	THA	3	59	–
27	27	M	6	1	1	68	96	3	90	–
28	39	M	2	3	3	40	78	4	80	–

A Case
[a]Lost to follow-up
B Age
C Sex
D Associated disease
1 Idiopathic
2 Alcohol abuse
3 Renal transplantation
4 Steroid intake
5 Malignant lymphoma
6 Dysbarism
E Radiographic stage preoperatively
F Radiographic stage postoperatively
G Harris' score preoperatively
H Harris' score postoperatively
I Follow-up time in months
J Baseline intraosseous pressure
K Stress-test intraosseous pressure

Table 5. Number of successful outcomes of core decompression related to the Ficat (1985) stage in previously reported series

Author (year)	Stage 1			Stage 2			Stage 3 + 4		
	n	R	T	n	R	T	n	R	T
Camp et al.* (1986)	8	3	18	11	5	19	6	0	17
Ficat RP (1985)	82	77	116	51	42	111	–		
Hopson and Siverhus (1988)	10	3	39	10	5	39	–		
Hungerford D (1979)	18	17	42	23	17	32	–		
Learmonth et al. (1990)	12	3	31	29	5	31	–		
Tooke et al. (1988)	10	10	24	26	15	14	9	4	15
Warner et al. (1987)	12	10	16	16	5	10	11	1	15
This series	11	7	12	11	4	16	7	2	14

*Original staging according to Marcus et al (1973).
R Number of successes.
T Follow-up time in months.

head are considered to be important factors in the development of ischemia of the bone tissue (Hungerford 1979, Ficat 1983 and 1985). Consequently, decompression has been recommended to reduce the elevated intraosseous pressure in the early stages of necrosis of the femoral head (Hungerford 1979, Solomon 1981, Ficat 1985).

In most previous studies, the intraosseous pressure was measured in the intertrochanteric area, which technically is the easiest place to make measurements (Hungerford 1979, Camp and Colwell 1986, Hauzeur et al. 1987, Warner et al. 1987). However, although the vascular disturbances in non-traumatic necrosis of the femoral head probably are widely disseminated in the upper part of the femoral bone, a difference between the intertrochanteric pressure and the pressure in the femoral head can sometimes be noted (Ficat 1983). Consequently, we measured the intraosseous pressure in the femoral head. Further, because the intraosseous pressure is largely dependent on the pressure in the draining extraosseous veins and varies with this pressure, the intravenous pressure was subtracted from the measured intraosseous pressure (Arnoldi et al. 1980).

The mean intraosseous pressure in our patients was 45 (2–90) mmHg. This compares well with the pressures found in other series (Hungerford 1979, Camp and Colwell 1986, Hauzeuer et al. 1987, Warner et al. 1987), and this pressure is elevated as compared with the normal intraosseous pressure in the femoral head (Lemperg and Arnoldi 1978, Ficat 1985).

Hungerford (1979) and Ficat (1985) advocated measurement of the intraosseous pressure as indispensable for diagnosis of necrosis of the femoral head, especially in the early stages. However, not all patients in our series had an elevated intraosseous pressure, and we found no correlation between the baseline pressure of the femoral head and the clinical outcome of core decompression. This observation accords with other recent reports (Camp et al. 1986, Warner et al. 1987, Hopson and Siverhus 1988), indicating that an elevated intraosseous pressure in itself is not the only pathogenetic factor in osteonecrosis of the femoral head, and this is probably one of the reasons for the unpredictable results of core decompression in this disease.

Hungerford (1979) and Ficat (1985) found about 94 percent good results after core decompression in Stage 1 necrosis and about 80 percent good results in Stage 2 necrosis of the femoral head (Table 5). Our results were far less favorable, but they compare well with three recent series (Camp et al. 1986, Hobson and Siverhus 1988, Learmonth et al. 1990). Further, because the follow-up time in the latter reports, as in ours, was rather short, the rate of failures might eventually become even higher.

The divergence of the results of core decompression between these different reports is hard to explain, but it might, to some extent, be due to the relatively small series of patients in most of the reported series, to differences in the preoperative staging of the patients, and to differences in the reporting of the late results.

Generally, osteonecrosis is considered to be relentlessly progressive until final collapse of the femoral head and secondary arthrosis of the hip joint have occurred (Hungerford and Zizic 1980, Lee et al. 1980, Musso et al. 1986). In our series, core decompression did not seem to alter this spontaneous course to any substantial degree, because about half of our patients with early stages of osteonecrosis needed further surgery less than 1 year after the operation.

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