

:
 : 1996 2000 5 1112
 가 23 MR
 : 가 20 47 31 ,
 가 17 .
 17
 6
 가 45
 가 28 가 , I
 15 , III 2 ARCO IV 1 . 11 (ilium)
 10 (core
 decompression), 5 (vascularized fibular graft), 6

MR 가 .

1980 가 1987 Atkinson (9)
 , , , 가 가
 , (bone marrow 가 가
 transplantation, BMT) (1-3). (4, 8, 11,
 가 5 60% 가 13-15).
 (4, 5).
 가 MR
 (graft versus host disease)
 10% 가
 (5-7). 60-70%
 가
 (4, 5, 8). 1996 2000 5 가
 1112 MR MR
 23
 가 13 , 10
 31 (20-47) 23 ((1) 17
 5 , 15 , 2 , 4
 (allogeneic transplantation)
 (unrelated transplantation), 2 가
 2002 12 9 2003 6 11

1가
 2가
 3가

(autologous peripheral blood stem cell transplantation)

가 , 가 20 47
 , 31 가 2 31
 , 가 17 가
 1.5T (Magnetom Vision Plus, Siemens, Erlangen, Germany) 가 4 MR 가 가
 T1 (TR/TE=750/12 msec), T2 19 10
 (TR/TE=3000 - 4000/100 - 120 msec) gadopentetate dimeglumine 0.2 ml/kg 18 cyclophosphamide,
 T1 (TR/TE=900/12 msec) busulfan, melphalan 4
 . Matrix number 228 × 256 256 × 512, FOV procarbazine, antithymocyte globulin, cyclophosphamide
 330 mm, 4.0 mm 5.0 mm BCNU, VP - 16 Ara - C
 0.4 mm 0.5 mm
 MR ARCO (Association cyclosporin FK506 methotrexate
 Research Circulation Osseous) (16)
 가 17
 15% A, 15 - 30% 250 - 500 mg/day prednisolone 5 - 7
 B, 30% C 6 cyclosporin

Table 1. Characteristics of 23 Patients Developing Osteonecrosis of the Femoral Head after Marrow Transplantation

Patient No	Initial disease*	Age at osteonecrosis diagnosis (yr)	Sex	BMT type [†]	Interval	Hip pain	Stage [‡] , RT	Stage [‡] , Lt	Steroid pulse	Surgery [§]
1	AA	19	F	unrelated	23	+	II-C	II-C	+	THR, Lt
2	AA	20	F	Allo	23	+	II-C	II-C	+	Core, both
3	AA	24	F	Allo	18	+	II-B	II-C	+	none
4	AA	27	F	unrelated	2	-	II-C	II-C	-	none
5	AA	47	M	Allo	10	+	II-B	II-B	-	THR, both
6	ALL	20	M	Allo	17	+	II-C	II-B	+	THR, Rt
7	ALL	31	F	Allo	24	+	II-B	II-B	-	none
8	ALL	33	M	unrelated	3	-	II-C	I-B	-	none
9	AML	26	F	Auto	31	+	II-C	II-C	+	Core, Rt
10	AML	28	F	Allo	13	+	I-A	I-B	+	VFG, both
11	AML	31	M	Allo	23	+	II-C	II-C	-	VFG, Rt
12	AML	32	M	Allo	16	+	II-C	II-C	+	THR, both
13	AML	33	M	Allo	15	+	I-B	I-B	+	Core, Lt
14	AML	35	M	Allo	19	+	I-B	I-B	+	Core, Lt
15	AML	45	M	Allo	24	+	I-B	II-C	+	Core, Lt
16	CLL	35	M	Allo	15	+	II-B	II-B	+	Core, both
17	CML	23	M	unrelated	18	+	II-C	II-C	+	VFG, both
18	CML	30	M	Allo	21	-	III-B	II-C	+	Core, Rt
19	CML	42	M	Allo	14	+	I-B	I-B	+	none
20	CML	43	F	Allo	16	+	II-C	III-C	+	none
21	MDS	27	F	Allo	18	+	none	II-B	+	Core, Lt
22	MDS	33	F	Allo	3	-	I-B	I-B	-	none
23	NHL	33	M	Auto	15	+	I-B	I-B	+	none

*CML: chronic myelogenous leukemia, ALL: acute lymphocytic leukemia, AA: aplastic anemia, AML: acute myelogenous leukemia
 NHL: non-Hodgkin's lymphor, MDS: myelodysplastic syndrome, CLL: chronic lymphocytic leukemia, Interval: Interval (months) from
 MBT to development of osteonecrosis, [†]BMT: bone marrow transplantation, Allo: allogeneic, Auto: autologous peripheral stem cell trans-
 plantation, + : presence, - : absence, [‡]ARCO: classification, A: < 15% involvement of the femoral head, B: 15 - 30% involvement of the
 femoral head, C: > 30% involvement of the femoral head, [§]Core: core decompression, VFG:vascularized fibular graft, THR: total hip re-
 placement

23 MR Table 3 2
 1 1 가 45 25 7
 가 ARCO II
 가 28 가 , I 15 , III 2
 IV 1 가
 30% 가 24 , 30% 21
 . 11 (ilium) (hemoglobinopathy),
 (Fig. , , , , 가
 1). (16 - 19). 1987 Atkinson (9)
 21 (core decom- 가 가 (4, 8, 9, 11, 13 - 15)
 pression), 5 (vascularized fibular 가
 graft), 6

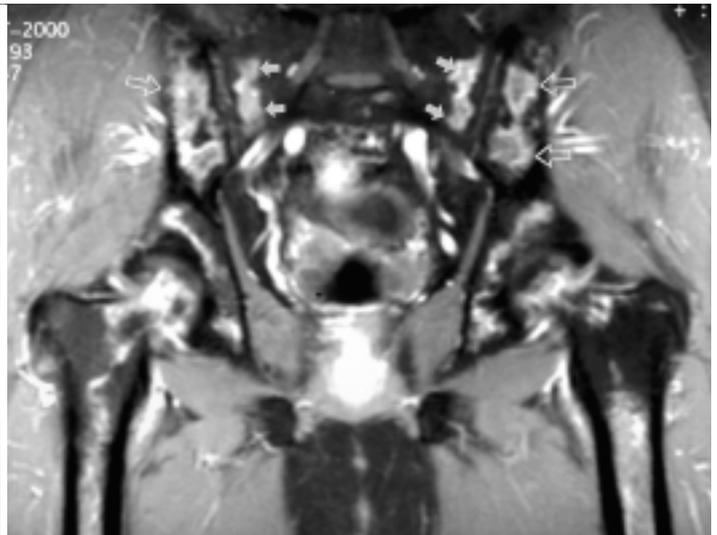
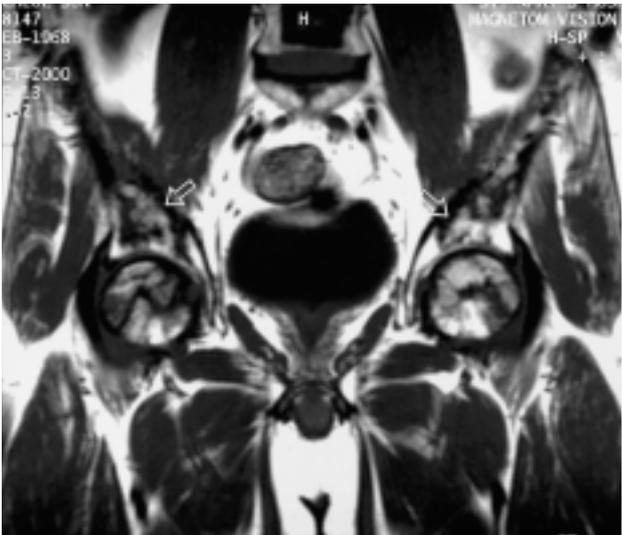


Fig.1. A thirty-two-year old male with acute myelocytic leukemia received allogeneic marrow transplant 16months ago and steroid pulse therapy was done immediately after the trasnplantation because of acute graft versus host disease. Coronal T1-weighted pre-contrast (A), post-contrast (B) and T2-weighted images (C) of the hip show large irregular defects in both femoral heads anterosuperiorly. In addition to osteonecrosis in both femoral heads, there are multiple medullary infarcts in both iliums (hollow arrows), sacrum (white arrows), and femoral diaphyses (black arrows).

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Osteonecrosis of the Femoral Head after Bone Marrow Transplantation¹

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Purpose: To retrospectively review finding of osteonecrosis of the femoral head after bone marrow transplantation.

Materials and Methods: We reviewed the clinical and MR findings of osteonecrosis of the femoral head in 23 of 1112 patients who underwent marrow transplantation during a five-year follow-up period lasting from 1996 to 2000.

Results: Mean age at the time of diagnosis was 31 (range, 20 - 47) years, and the mean time from transplant to diagnosis was 17 months. All patients developed variable graft-versus-host disease and seventeen were treated with high-dose prednisolone and/or cyclosporin for severe acute or extensive chronic graft versus host disease. Osteonecrosis was diagnosed by magnetic resonance (MR) imaging, which allowed early detection of disease assessment of its stage. At the time of diagnosis, 15 hips were at stage I, 28 at stage II, two at stage III, and none at stage IV, according to the international ARCO classification system. Osteonecrosis of femoral diaphyses, the lower lumbar spine, or pelvic bones in the MR field was also found to have occurred in 11 patients. Initial treatment was conservative: 21 hips underwent surgery [core decompression ($n=10$), vascularized fibular bone graft ($n=5$), and joint replacement ($n=6$)].

Conclusion: In patients receiving high-dose steroids for the treatment of graft-versus-host disease, MR screening might help detect osteonecrosis at an early stage.

Index words : Bone marrow, transplantation
Bones, necrosis
Hip, MR
Steroids, complications

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