

CT MR 1

: CT MR . 13
 : 2 , 11 . 10
 CT(CT 6 , CT 9) 6 MRI
 : 84.6% (11/13) 2 - 6
 CT (5/9) (5/6)
 6 (7/9) , CT (4/9) 7
 (2/6) , T2 T1 (4/6)
 T1 (6/6)
 4 (4/6) T1 (6/6) , T2
 61.5% (8/13) , 69.2% (9/13) ,
 53.8% (7/13)
 : CT MR ,
 ,
 .

2,147

1.44%

(1).

7,000
8 (0.11%)

(2).

CT MRI
 13
 CT 10 (CT 1 ,
 CT 4 , CT 5) MR 6
 9:4 , 42.0
 (8 - 79) . 7 , 5

(3).

가

, 1 (Table 1, 10)

CT MR (4 - 7).

CT MR

12 (non - Hodgkin lymphoma)
 (Hodgkin 's lymphoma) 1
 (Table 1).

11 3 가 7 가 , 5
 , 1
 , 2
 7
 CT 6 Somatom (II, Plus, Plus-S, Plus 40; Siemens Medical System, Erlangen, Germany), 3
 TCT 80A (Toshiba, Tokyo, Japan), 1 GE8800 (GE Medical System, Milwaukee, U.S.A.)
 MR
 3 1.5T Magnetom 63SP, 1 1.5T
 Magnetom Vision plus (Siemens, Erlangen, Germany), 2
 0.2T MRP 20-2 (Hitachi, Tokyo, Japan)가
 . MR T1 (TR = 480 - 750 msec, TE = 17 - 38 msec) T2 (TR = 1500 - 2100 msec, TE = 70 - 90 msec)
 , T1

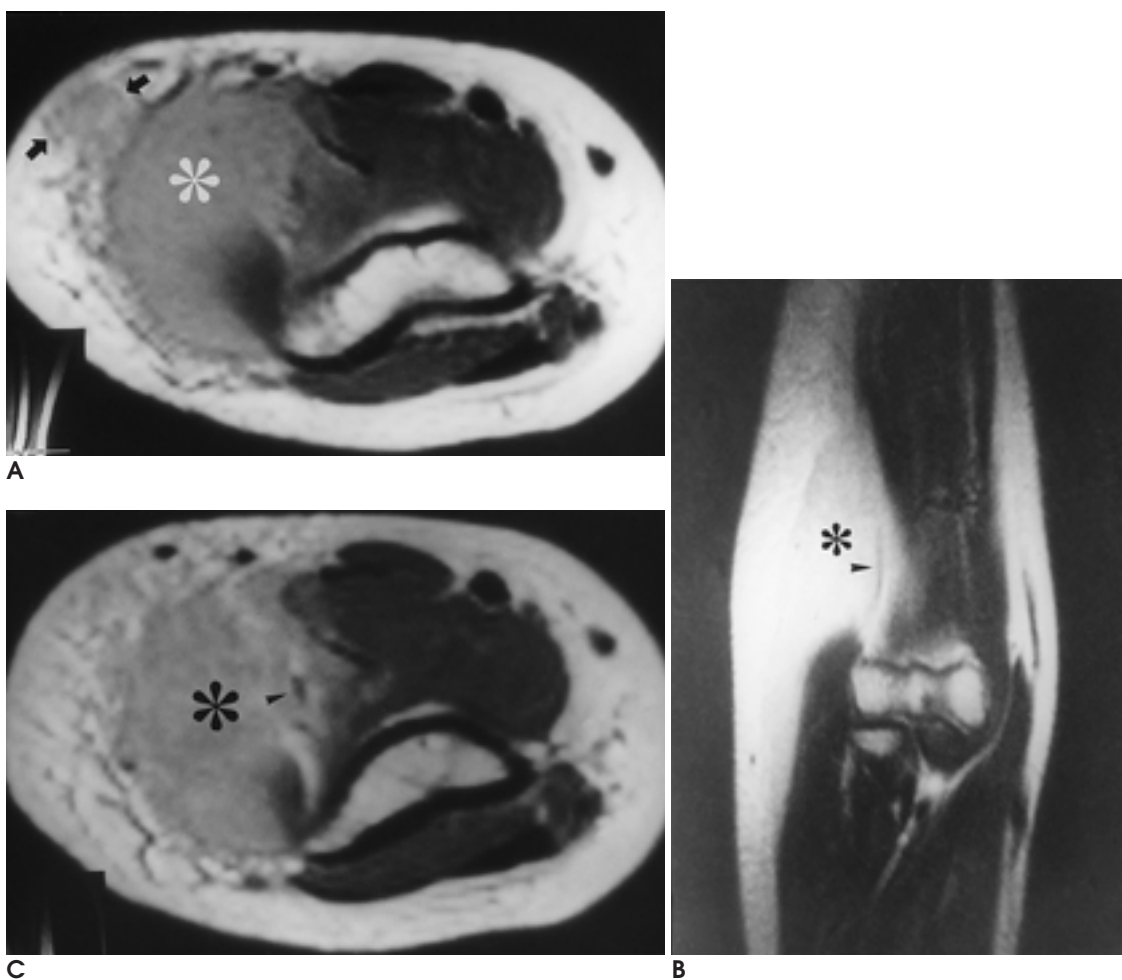


Fig. 1. Primary muscle lymphoma (Stage IE, case 2).

A. Axial T1-weighted spin-echo (TR = 750, TE = 38 msec) MR image shows diffusely thickened brachioradialis muscle (asterisk) without definite focal mass lesion. The signal intensity of the involved muscle is homogeneously higher than that of adjacent normal muscles. Infiltration into adjacent subcutaneous fat tissue is well demonstrated (arrows).

B. On coronal T2-weighted spin-echo (TR = 1500, TE = 90 msec) MR image, the brachioradialis muscle (asterisk) shows homogeneous high signal intensity and vascular encasement (arrowhead).

C. After Gadolinium-DTPA injection, the involved muscle (asterisk) shows moderate enhancement and vascular encasement (arrowhead). The lesion in adjacent subcutaneous fat-tissue is also enhanced.

Table 1. Locations and Histopathologic Diagnosis of Lymphoma with Muscular Involvement

Patient/ Age/Sex	Stage	Location	Histopathologic Diagnosis
1/58/M	I	Deep abdomen and pelvis	Diffuse, large cell type, immunoblastic type
2/22/F *	IE	Brachioradialis	T cell (Lennert 's type)
3/50/M	IE	Pelvis	Diffuse large cell, T cell type
4/28/M	IE	Pelvis	Large cell cleaved type
5/35/M *	IE	Arm	T cell, diffuse, mixed small and large cell
6/59/M	IE	Arm	Diffuse large B cell type
7/42/M	IV	Rectus muscle	Diffuse large cell, B cell type
8/61/F	IV	Chest wall	Type undetermined, intermediate grade
9/11/F	IV	Head and neck	Lymphoblastic lymphoma, non-cleaved cell type
10/8/M	IV	Pelvis	High grade, Burkitt 's type, B cell phenotype
11/18/F	IV	Pelvis	Anaplastic large cell, T cell
12/79/M	IV	Arm	Diffuse, large cell, immunoblastic B cell
13/75/M [†]	IV	Abdominal wall	Lymphocytic depletion, reticular type

* Primary muscle lymphoma

†Hodgkin 's lymphoma

Table 2. CT Findings of Muscular Involvement in Lymphoma

Patient *	Density / Homogeneity NCCT	CECT	Bone change	Fat stranding	Neurovascular encasement
1	I / +	SH / -	-	+	+
3	I / +	SH / +	+	+	-
4	I / +	I / +	+	-	-
5	I / +		+	+	-
7		I / +	-	-	+
8		SH / +	+	-	+
9	I / +	I / +	+	-	-
10		I / +	+	+	+
11		SH / +	+	-	-
13	SL / +	SH / -	+	-	-

* Patient numbers are the same as those in table 1.

Density: The density of muscle lymphoma comparing to that of normal muscle

NCCT: Non-contrast CT

CECT: Contrast enhanced CT

I: Isodense

SL: Slightly low

SH: Slightly high

8 1 (5) 가 (strand) 1 (Fig. 1).
 9 , 8 가 (strand) 1
 (Fig. 1, 5) 8 (8/13, 61.5%) (Fig. 1, 2) 7 (7/13, 53.8%) (Table

Table 3. MR Findings of Muscular Involvement in Lymphoma

Patient *	SI / Homogeneity			Bone change	Fat stranding	Neurovascular encasement
	T1	T2	Gd-T1			
2	MH / +	MH / +	ME / +	-	+	+
5	SH / +	MH / -	ME / -	+	+	+
6	SH / +	MH / -	ME / -	+	+	-
7	I / +	SH / +	SE / +	-	-	+
11	I / +	MH / +	ME / +	+	+	-
12	SH / +	MH / +	SE / +	-	+	+

* Patient numbers are the same as those in table 1 and 2.

SI: The signal intensity of muscle lymphoma comparing to that of normal muscle

T1: T1 weighted image

T2: T2 weighted image

Gd-T1: Gadolinium enhanced T1 weighted image MH: Moderately high

SH: Slightly high

I: Iso signal

ME: Moderate enhancement

SE: Slight enhancement

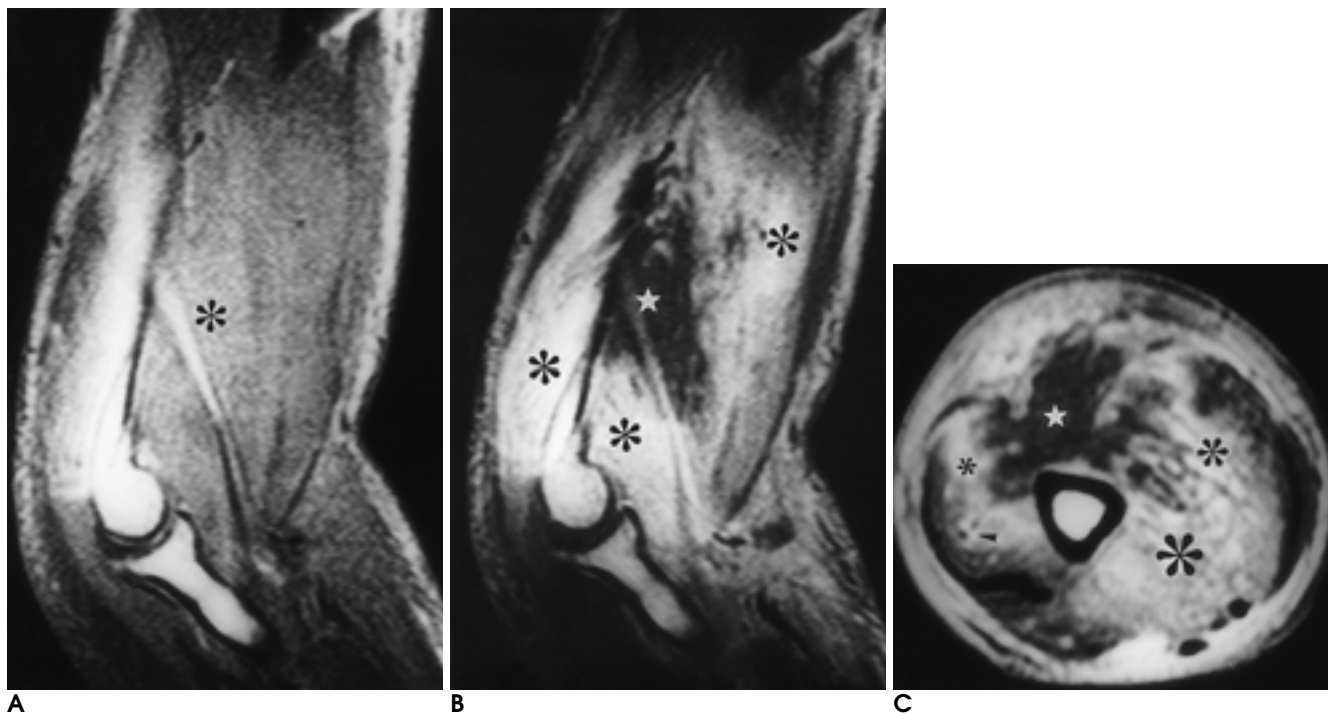


Fig. 2. Primary muscle lymphoma with heterogeneous enhancement (Stage IE, case 5).

A. Sagittal T1-weighted spin-echo (TR = 500, TE = 25 msec) MR image shows ill-defined signal changes in biceps brachii, brachialis and triceps brachii muscles (asterisk) around the distal humerus.

B, C. On sagittal (B) and axial (C) T1-weighted spin-echo (TR = 500, TE = 25 msec) MR images after contrast enhancement, the outer portion of involved muscles are moderately enhanced and more well-defined (asterisk). However, the central portion of lesion shows irregularly-marginated low signal intensity (star). Extensive necrosis of tumor was demonstrated on histopathologic examination (not shown). Encasement of brachial artery and vein (arrowhead) is shown.

2, 3).

가 (2,

8, 9).

가

(1, 2,

10),

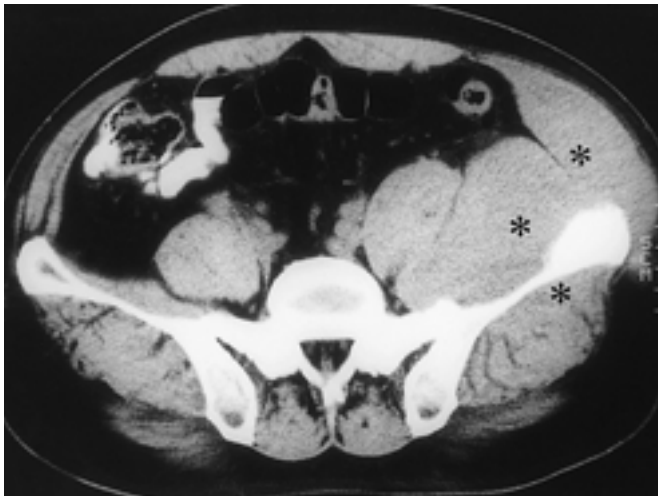
50%

가

(11, 12)가

15

가



A

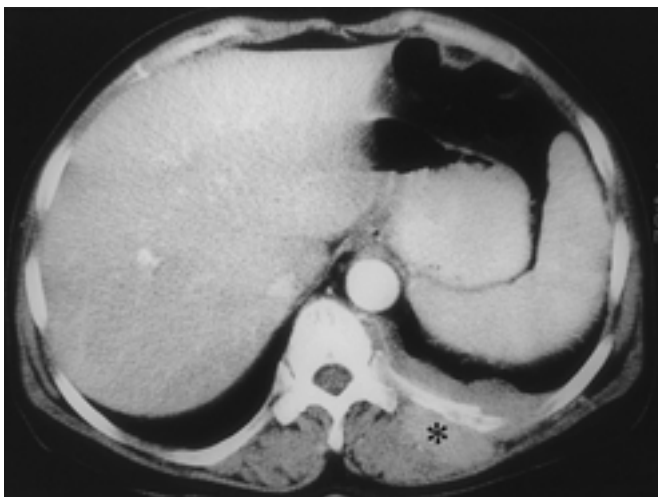


B

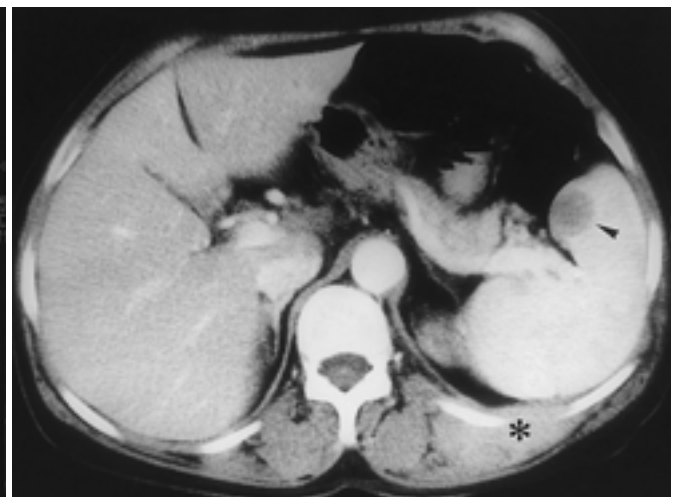
Fig. 3. Bone lymphoma extending into adjacent muscles (Stage IE, case 3).

A. Non-contrast enhanced CT scan shows marked enlargement of iliacus, abdominal wall and gluteus minimus muscles (asterisk) in left side. The density of involved muscles is isodense to that of normal muscles.

B. Contrast enhanced CT scan shows slightly hyperdense muscles (asterisk) involved by lymphoma. Permeative bone destruction and cortical disruption are noted at the left ilium.



A



B

Fig. 4. Metastatic lymphoma from the tongue (Stage IV, case 8).

A. The left 10th rib shows pathologic fracture. Extension into adjacent muscles is demonstrated by enlargement and mild contrast enhancement (asterisk).

B. At the CT scan 4cm below to A, the left 11th rib and adjacent muscles (asterisk) are involved by lymphoma. Metastatic lesions are also found in the spleen (arrowhead) and left kidney (not shown).

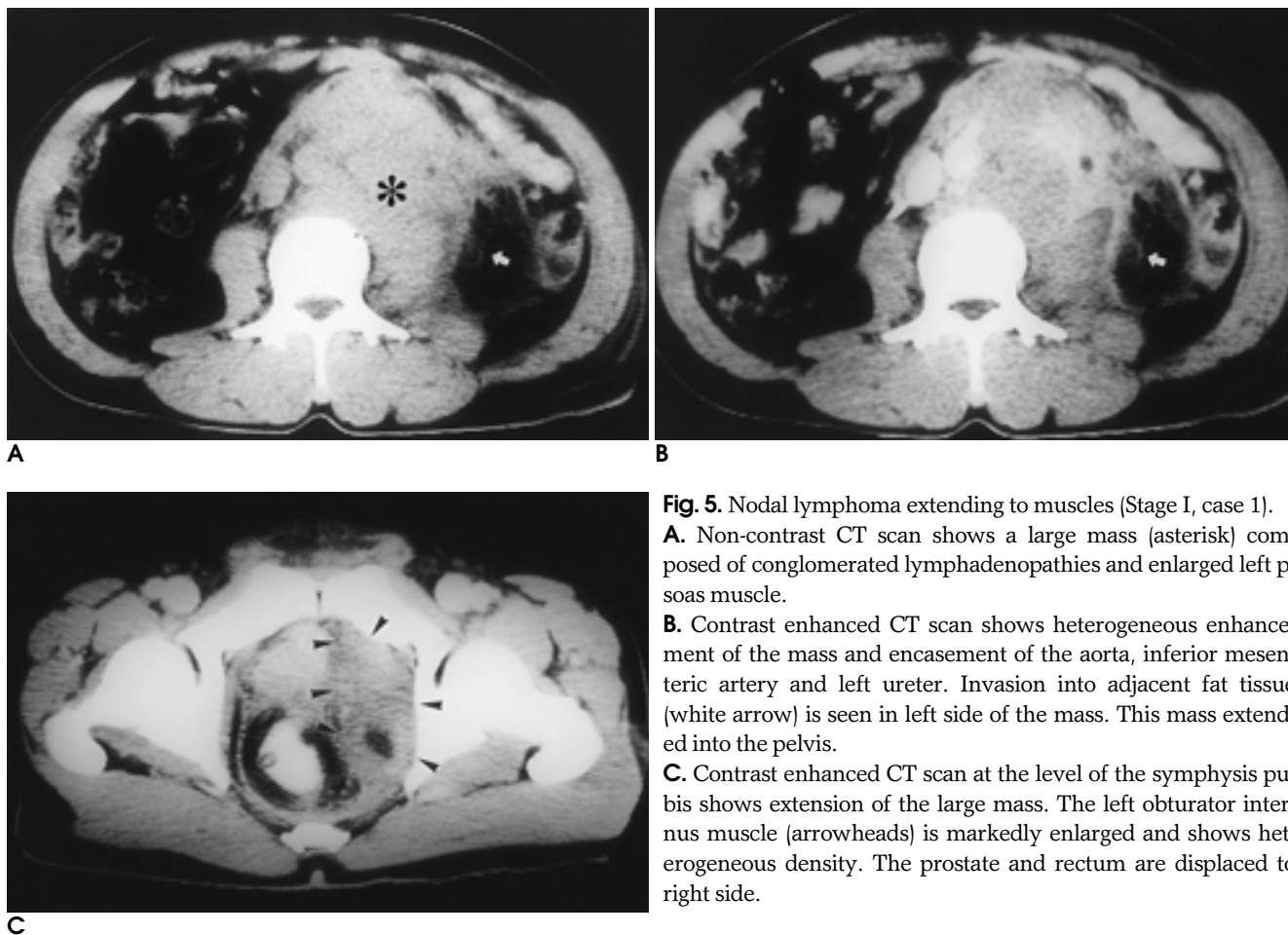


Fig. 5. Nodal lymphoma extending to muscles (Stage I, case 1).

A. Non-contrast CT scan shows a large mass (asterisk) composed of conglomerated lymphadenopathies and enlarged left psoas muscle.

B. Contrast enhanced CT scan shows heterogeneous enhancement of the mass and encasement of the aorta, inferior mesenteric artery and left ureter. Invasion into adjacent fat tissue (white arrow) is seen in left side of the mass. This mass extended into the pelvis.

C. Contrast enhanced CT scan at the level of the symphysis pubis shows extension of the large mass. The left obturator internus muscle (arrowheads) is markedly enlarged and shows heterogeneous density. The prostate and rectum are displaced to right side.

Jeffery (13) 가 , 1 2 (2/13, 15.4%) ,
15 8 , 11 (11/13, 84.6%) (3.1)
(thigh)가 가 (calf),
(psoas), (deltoid), (paraspinal muscle)
CT MR
(4 - 7, 16).
9:4 , 13 CT (5, 6, 16),
5 3 9
1 가 (4, 6). CT Grunshaw (5)
(Table 1) Jeffery 2
(axial skele - Hosono (4) Panicek (6)
ton) 가
CT
(Table 2).
Lee (16) MR
T1
, T2
, Hosono (4) T1
MR , T2
1

12, T2, T1

(7) 8, T1, T2

MR Lee (16) Hosono (4) (7) 가

MR 가

T1, T2

Hosono (4) 2 T1 4 1 2

(16, 17)가

Lee (16) 57% (4/7), Beggs (17)

67%

58% (7/12) (16, 17) Lee (16)

(inflammation) 가

4 Hosono

(4) MR 75% (3/4), CT 67% (2/3)

53.8% (7/13)

가

75% (3/4)

CT CT T1

1. Komatsuda M, Nagao T, Arimori S. An autopsy case of malignant lymphoma associated with remarkable infiltration in skeletal muscles. *Rinsho Ketsueki* 1981;22:891-895
2. Travis WD, Banks PM, Reiman HM. Primary extranodal soft tissue lymphoma of the extremities. *Am J Pathol* 1987;11:359-366
3. Lee JKT, Glazler HS. Psoas muscle disorders: MR imaging. *Radiology* 1986;160:683-687
4. Hosono M, Kobayashi H, Kotoura Y, Tsuboyama T, Tsutsui K, Konishi J. Involvement of muscle by malignant lymphoma: MR and CT appearances. *J Comput Assist Tomogr* 1995;19(3):455-459
5. Grunshaw ND, Chalmers AG. Skeletal muscle lymphoma. *Clin Radiol* 1992;45:399-400
6. Panicek DM, Lautin JL, Schwartz LH, Castellino RA. Non-Hodgkin lymphoma in skeletal muscle manifesting as homogeneous masses with CT attenuation similar to muscle. *Skeletal Radiol* 1997;26:633-635
7. 2000;42:341-347
8. Kandel RA, Bedard YC, Pritzker KP, Luk SC. Lymphoma. Presenting as an intramuscular small cell malignant tumor. *Cancer* 1984;53:1586-1589
9. Pilepich MV, Carter B. Muscle enlargement in lymphoma patients. *Radiology* 1980;134:521-523
10. Rosenberg SA, Diamond HD, Taslowitz B, Craver CF. Lymphosarcoma: Review of 1269 cases. *Medicine* 1961;40:31-84
11. Boston HC Jr, Dahlin DC, Ivins JC, Cupps RE. Malignant lymphoma (so-called reticulum cell sarcoma) of bone. *Cancer* 1974;34:1131-1137
12. Mulligan ME, McRae GA, Murphey MD. Imaging features of primary lymphoma of bone. *AJR Am J Roentgenol* 1999;173:1691-1697
13. Jeffery GM, Golding PF, Mead GM. Non-Hodgkin's lymphoma arising in skeletal muscle. *Ann Oncol* 1991;2:501-504
14. Metzler JP, Fleckenstein JL, Vuitch F, Frenkel EP. Skeletal muscle lymphoma: MRI evaluation. *Magn Reson Imaging* 1992;10:491-494
15. Press GA, Glazer HS, Wasserman TH, Aronberg DJ, Lee JK, Sagel SS. Thoracic wall involvement by Hodgkin disease and non-Hodgkin lymphoma: CT evaluation. *Radiology* 1985;157(1):195-198
16. Lee VS, Martinez S, Coleman RE. Primary muscle lymphoma: clinical and imaging findings. *Radiology* 1997;203:237-244
17. Beggs I. Primary muscle lymphoma. *Clin Radiol* 1997;52:203-212

Muscular involvement by Malignant Lymphoma: CT and MR Findings¹

Baek Hyun Kim, M.D.

¹Department of Diagnostic Radiology, College of Medicine, Korea University

Purpose: To investigate the CT and MR findings of muscular involvement by malignant lymphoma.

Materials and Methods: Thirteen patients with biopsy-proved muscular involvement by malignant lymphoma were included in this study. Two patients were primary muscle lymphoma and 11 patients were muscle lymphoma by secondary involvement of malignant lymphoma. CT of 10 patients (6 pre-contrast CT and 9 post-contrast CT) and MRI of 6 patients (all with pre- and post-contrast studies) were retrospectively analyzed.

Results: In the majority of patients (84.6%, 11/13), the appearance of muscular involvement was the diffuse enlargement of several muscles as like as a group. The muscles involved by malignant lymphoma showed iso-attenuation (5/6) and homogeneity (6/6) on pre-contrast CT scan, and high attenuation (5/9) or iso-attenuation (4/9) and homogeneity (7/9) on post-contrast CT scan. The signal intensity of involved muscle showed slightly hyper- (4/6) or iso-intense (2/6) and homogeneous (6/6) on T1-weighted images, and hyper-intense (6/6) and homogeneous (4/6) on T2- and Gadolinium-enhanced T1-weighted images. Adjacent bone change was demonstrated in 69.2% (9/13), subcutaneous fat change in 61.5% (8/13), and neurovascular encasement within involved muscle in 53.8% (7/13).

Conclusion: The CT and MR findings of muscular involvement by malignant lymphoma were diffuse enlargement of several muscles with homogeneous attenuation or signal intensity, and frequent changes in adjacent bones and subcutaneous fat, or neurovascular encasement.

Index words : Muscles, CT
Muscles, MR
Muscles, neoplasms
Lymphoma

Address reprint requests to : Baek Hyun Kim, M.D., Department of Diagnostic Radiology, Korea University Ansan Hospital
516 Gojan-dong, Ansan City, Kyunggi-do 425-020, Korea.
Tel. 82-31-412-5228 Fax. 82-31-412-5224 E-mail: kimbaekh@hanmail.net