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^{99m}Tc-MDP Scan in Rhabdomyolysis*

Seok Kil Zeon, M.D., **Hee Jung Lee**, M.D., **Jae Tae Lee**, M.D**.
and **Kyu Bo Lee**, M.D**.

*Department of Diagnostic Radiology, and Nuclear Medicine**, Keimyung University, School of Medicine, Daegu, Korea*

= 국문 초록 =

횡문근융해증의 골스캔

계명대학교 의과대학 방사선과학교실, 핵의학교실*

전석길 · 이희정 · 이재태* · 이규보*

외상, 만성간질환, 화상 및 전신성경련등의 원인으로 발생한 횡문근융해증 9예의 ^{99m}-Tc-MDP 골스캔을 분석하여 다음과 같은 성적을 얻었다. 동통부위보다 넓은 전신성 병변이 44%에서 확인되었으며 나머지 56%는 국소 동통부위의 근육에만 Bone-seeking agent가 침착되는 것이 확인되었고, 골스캔만으로도 44%에서 신부전증이 동반되었음을 확인할 수 있었다. 전신성 병변은 원인과는 관계없이 출현하였고, 신부전증도 원인질환에는 관계없이 발생하였다. 1예에서 실시한 CT는 국소성 병변만을 보여 주었으나 골스캔은 전신성 병변을 나타내어 주었다. 따라서 횡문근융해증의 진단에는 골스캔이 중요함을 확인해주었다.

INTRODUGION

Rhabdomyolysis is a rare disease characterized by necrosis of striated muscle. It can occur as a focal or as a generalized process. Focal rhabdomyolysis is seen most frequently following local muscular injury such as direct physical trauma or unusually vigorous physical exertion. Non-traumatic rhabdomyolysis may be seen as disseminated or focal and occur in a variety of unrelated conditions including generalized seizures, sepsis, viral illness, hyperthermia, shock, exposure to various drugs, chemical toxins, or extreme cold and in association with certain metabolic disorders[1]. Focal necrosis may also occur in individuals of drug addiction or alcoholics.

Nine cases of rhabdomyolysis in variable etiology are presented, with analyses of radionuclide bone scanning findings such as the soft tissue radioactivity and the renal radioactivity.

MATERIALS AND METHOD

Clinical presentation and bone scan of nine rhabdomyolyses were studied retrospectively.

One female and eight male patients showed rhabdomylosis (average age 41 years old) (Table 1).

The proposed causes were three cases of burn,

*이 논문은 1992년 계명대학교 을종연구비 및 의료원 조사연구비로 이루어졌음.
INDEX TERMS: Rhabdomyolysis, etiology.
Rhabdomyolysis, renal failure.
Rhabdomyolysis, CT.
Rhabdomyolysis, radionuclide bone scan.

Table 1. Summary of the Nine Rhabdomyolyses with Bone Scan

Case	Age/Sex	Proposed cause	Bone scan	Renal activity
1	69/female	trauma (bone fx)	fracture site	well
2	63/male	chronic liver disease	disseminated	well
3	48/male	burn	disseminated	non
4	41/male	burn	burn site	well
5	50/male	crushing injury	disseminated	faint
6	49/male	alcohol ingestion	right shoulder	well
7	21/male	burn	burn site	well
8	25/male	seizure	disseminated	faint
9	26/male	crushing injury	injured site	faint

four of trauma including crushing injury, one seizure attack and one chronic liver disease. Bone scan was done with intravenous injection of 20 mCi ^{99m}-Tc MDP, and whole body and spot scannings were performed four hours after.

RESULTS

Disseminated extraskeletal muscular accumulation of bone seeking agents were noted in four cases (44%) of chronic liver disease, seizure, burn, and crushing injury (not consistent with bone fracture sites). The bony radioactivity showed relatively diminished in the areas of muscular accumulation. Five of nine patients (56%) revealed well visualized renal and urinary bladder radioactivity.

Renal and urinary bladder radioactivity was absent in one case of burn injury with clinically acute renal failure, and the hemodialysis was performed. Three cases showed faintly visualized bilateral renal radioactivity, representing the acute renal failure, in which cases hemodialysis and peritoneal dialysis were performed.

REPORT CASES

Case 1

A 69-year-old female was admitted because of left femoral intertrochanteric fracture following to slip down. The fracture site was internally fixed with metal plate and screws. At 10 days after the trauma, bone scanning for the study of left femoral head perfusion was done and showed well perfusion of the left femoral head and neck but there showed irregular intense radioactivity at left thigh (Fig. 1).

Fig. 1. 69-year-old female with splip down trauma. The ^{99m}Tc-MDP bone scan showed increased radionuclide accumulation at previous fracture site of left femoral neck and proximal shaft, and increased radionuclide accumulation at the soft tissues of proximal left thigh.

The pain and tenderness due to rhabdomyolysis may be concealed by bone fracture and surgical procedure. There showed well visualization of bilateral renal radioactivity and urinary bladder radioactivity representing well preserved renal function.

Case 2

A 63-year-old male was presented with general aching, febrile sensation, and dry coughing. Two months before admission, liver cirrhosis with ascites was diagnosed. Serum creatinine phosphokinase (CPK) on admission was 5576 unit/ml, lactic dehydrogenase (LDH) 694.2 unit/ml. Bone scanning with ^{99m}-Tc MDP showed disseminated increased soft tissue radioactivity at both supraclavicular fossae, upper back muscle, both upper extremities and medial aspects of both lower extremities (Fig. 2). Well visualized bilateral renal radioactivity was presented. The elevated serum level of CPK and LDH was slowly down for next three weeks.

Case 3

A 48-year-old male was admitted because of third degree burn injury to left lower leg following to slip down on flame burn. Just after the admission to local hospital, markedly reduced urine output was noticed and transfered this hospital. The hemodialysis was begun. On the second hospital day the computed tomogram (CT) of lower lumbar spine was done because of severe back pain and showed several localized low density areas on back muscles (Fig. 3A). The radionuclide bone scan revealed diffusely intense extra-skeletal radioactivity throughout whole body such as the chest wall, lower back muscles, bilateral thigh muscles, and both lower legs and decreased skeletal radioactivity (Fig. 3B). There showed lack of bilateral renal radioactivity, compatible with acute renal failure.

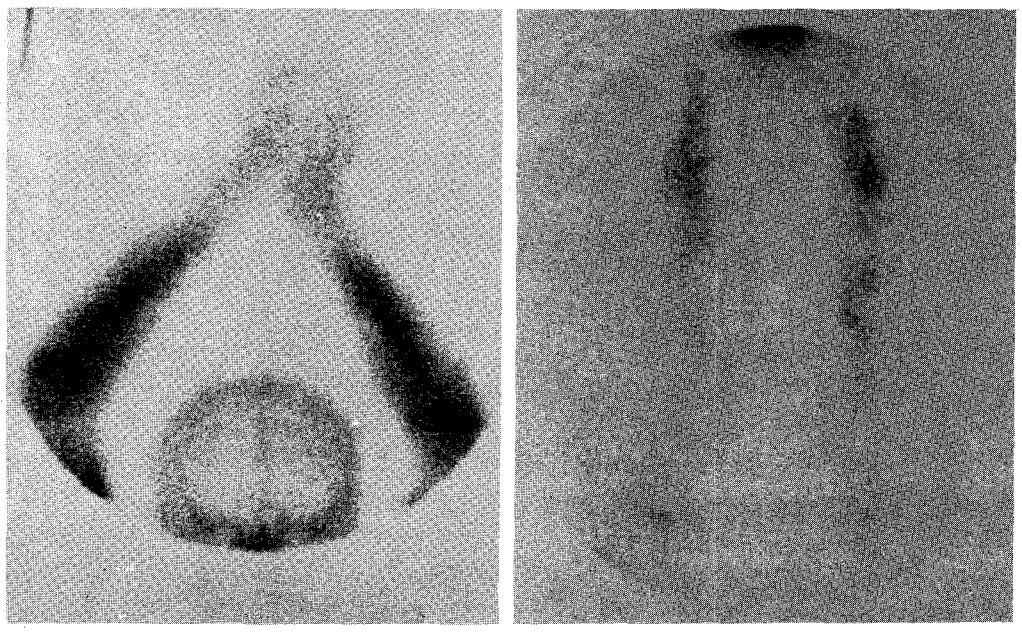

Fig. 2. 63-year-old male with chronic liver disease.
The ^{99m}Tc-MDP bone scan showed increased radionuclide accumulation at soft tissue all of four extremities, but decreased activity at corresponding skeletal systems.

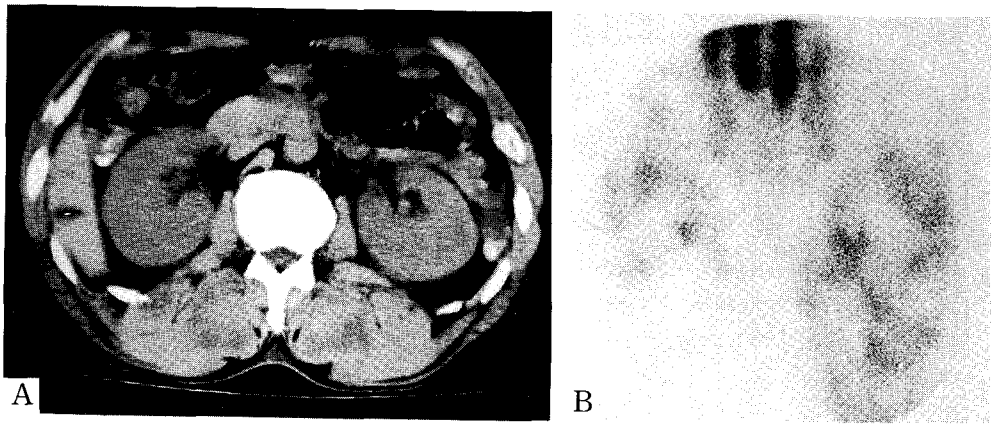

Fig. 3. 48-year-old male with burn at left lower leg.
A: CT showed well-localized low density areas on bilateral back muscles.
B: The ^{99m}-MDP bone scan showed intense accumulation of bone seeking agents on bilateral back muscles and bilateral thigh muscles.

DISCUSSION

Imaging with ^{99m}-Tc labeled phosphate compound is very sensitive to demonstrate rhabdomyolysis.

There was 13 case reports of rhabdomyolysis studied by radionclide imaging until a review of the literature in 1982 by Cornelius[4].

After then a few cases of rhabdomyolysis detected by radionuclide scanning were added. In Korean literature, several case reports of rhabdomyolysis with bone scintigraphy could be found[6,7,8].

The exact mechanism to explain the phosphate localization in injured muscle is not clearly understood. Many theories have been proposed including binding of the radiopharmaceutical to soft tissue calcium deposits, iron deposits, denatured proteins, enzymes or immatured collagen deposition secondary to altered tissue perfusion or capillary permeability[1,2]. But no one can exactly explain the mechanism.

As with these cases, there is traumatic and non-traumatic causes. Focal rhabdomyolysis was due to traumatic and non-traumatic, and the cases associated with chronic liver disease and seizure attack showed disseminated pattern. Surprisingly two cases of rhabdomyolysis following to snake bite is reported in Korean literature[7]. As with case 3, disseminated pattern could be followed by the small areas of burn.

Any symptoms could be consistent with extraskeletal bone-seeking agent accumulation area. Bone scan can be helpful in cases where the localization of muscle injury is not apparent clinically or where the extent of the injury may not be apparent on examination. In case 3, the scan pointed to additional areas of injury that were not apparent on examination and not related patient's complaints of severe back pain. The CT scan is an imaging method of limited area and could not evaluate the exact extend of rhabdomyolysis in the case of disseminated pattern.

Few reports mentioned the association of renal failure in rhabdomyolysis[10,11]. With these cases well functioning kidneys on bone scan showed in five of nine patients (56%).

We propose that the bone scan should be done with whole body procedure, even though localized pain is noted in the cases of suspicion of rhabdomyolysis by any causes. Renal and urinary bladder radioactivity should be studied, because there would be well fun-

ctioning kidney although disseminated rhabdomyolysis. The CT scan with intravenous contrast medium injection (contrast enhancement) would be harmful to the patients of rhabdomyolysis because of frequent association with renal failure.

REFERENCES

1) Sanders J: *Rhabdomyolysis detected by bone imaging. Clin Nucl Med 14:431-432, 1989*
2) Haseman MK, Kriss JP: *Selective, symmetric, skeletal muscle uptake of ^{99m}Tc-pyrophosphate in rhabdomyolysis. Clin Nucl Med 10:180-183, 1985*
3) Frymoyer PA, Giammarco R, Farrar FM, Schroeder ET: *Technetium Tc 99m metronate bone scanning in rhabdomyolysis. Arch Intern Med 145:1991-1995, 1985*
4) Cornelius EA: *Nuclear medicine imaging in rhabdomyolysis. Clin Nucl Med 7:462, 1982*
5) Moichizuki T, Tauxe WN, Perper JA: *^{99m}Tc-MDP scintigraphy of rhabdomyolysis induced by exertional heat stroke: a case report. Ann Nucl Med 4:111-3, 1990*
6) Cho BY, Han JS, Kim SY, et al: *^{99m}Tc-MDP bone scan in the cases of of muscle necrosis associated with acute renal failure. Korean J Nucl Med 14:61-66, 1980*
7) Park JK, Lee HB, Cha SJ, Lee MJ: *Two cases of bone scan in snake bite. Korean J Nucl Med 19:105-107, 1985*
8) Koh EM, Lee TW, Ihm CG, Kim KW, Kim MJ, Choi YK: *A case of rhabdomyolysis induced by lipid lowering agent. Korean J Nucl Med 24:145-148, 1989*
9) Lee MH, Park SK, Hoing CK: *Two cases of rhabdomyolysis demonstrated by Tc-99m MDP bone scintigraphy. Korean J Nucl Med 23:242-243, 1989*
10) Gross RA, et al: *Non-traumatic rhabdomyolysis and acute renal failure. N Engl J Med 291:807, 1974*
11) Koffler A: *Acute renal failure due to non-traumatic rhabdomyolysis. Ann Intern Med 85:23, 1976*