
Pentavalent Technetium-99m-DMSA Uptake in a Patient Having Multiple Myeloma Without Amyloidosis

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A pentavalent ^{99m}Tc-dimercaptosuccinic acid (DMSA) scan was performed on a patient with multiple myeloma without amyloidosis. A high accumulation of the tracer was found in numerous tumors. We believe that the accumulation of DMSA is unrelated to amyloidosis and that the DMSA scan may have potential for the staging of tumors in patients presenting with multiple myeloma.

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A new tumor detecting agent, pentavalent ^{99m}Tc-dimercaptosuccinic acid (DMSA) has been developed by Yokoyama et al. (1,2). Many reports have described its clinical usefulness in imaging malignant tumors (3-9). Most studies report that DMSA accumulates in a variety of head and neck tumors, such as squamous-cell carcinoma, medullary carcinoma of the thyroid, as well as soft-tissue and bone tumors (3-9). Ohta et al. have documented DMSA uptake in cases of plasmacytoma with amyloidosis (9). We recently performed scintigraphic studies of multiple myeloma without amyloidosis using ^{99m}Tc-DMSA and ^{99m}Tc-methylene diphosphonate (MDP).

CASE REPORT

A 61-yr-old woman who presented with tumors in the clavicular and sternal regions was readmitted to our hospital. Eight months prior she presented with multiple myeloma and was treated with Vincristine, Melpharan, Endoxan, and Predonine. She remained in remission for 4 mo, then suddenly developed symptoms 3 wk before readmission. Our preliminary assessment was relapse of the clavicular and sternal tumors. A whole-body bone scan was performed using 740 MBq ^{99m}Tc-MDP. Using a large field of view gamma camera, bone scan images were acquired 4 hr after intravenous injection. The scans revealed high

accumulation in the right clavicle, sternum, ribs, lumbar spine, right iliac region, right hip, skull, and bones of the lower extremities (Fig. 1). Five days later ^{99m}Tc-DMSA imaging was performed. DMSA was prepared by adding 4.4 mg DMSA, 120 mg dextrose, and 5.04 mg sodium bicarbonate to a standard DMSA vial (Daiichi Radioisotope), which contained 1.4 mg DMSA and 0.5 mg stannous chloride. These powders were dissolved in 0.4 ml of 7% sodium bicarbonate solution. Of this solution, 0.1 ml was added to 2.5 ml containing 550 MBq [^{99m}Tc]pertechnetate. Prior to use, the solution was filtered through a 0.22- μ m filter. DMSA (370 MBq) was injected intravenously within 10 min of the preparation. Using a large field of view gamma camera, images were acquired 2 hr after intravenous injection.

The DMSA scan detected accumulation in the right clavicular tumors, sternum, left ribs, thoracic vertebral region, lumbar vertebral regions, right iliac, and hip region (Fig. 2). Accumulation in the left anterior 2,3 ribs, right anterior 3,4,5 ribs, posterior ribs, skull, and lower extremities, which were clearly detected in the bone scan were not, however, observed in the DMSA images. Biopsy of the sternal tumor stained with hematoxylin and eosin and observed through a polarizing microscope revealed both normal plasma cells and myeloma cells (Fig. 3a). The same tumor stained with Congo red and observed through a polarizing microscope exhibited no amyloid deposits (Fig. 3b).

DISCUSSION

The clinical usefulness of DMSA in patients with malignant head and neck tumors, soft-tissue, and bone tumors has been well documented (3-9). Attention has been primarily given to patients presenting with medullary carcinoma of the thyroid (MCT) (4-7). It has been postulated that pentavalent DMSA resembles phosphate ion in its distribution pattern, and that this is the mechanism by which pentavalent DMSA accumulates in tumors, particularly MCT where calcification and amyloidosis are a well-recognized phenomenon (3,9). The precise mechanism for uptake of DMSA into tumors, however, is yet to be clarified. Recently, Watkinson et al. reported that DMSA accumulates at the site of squamous-cell carcinoma; the localization process being nonspecific (10). Ohta et al. reported two cases of amyloidosis associated with plas-

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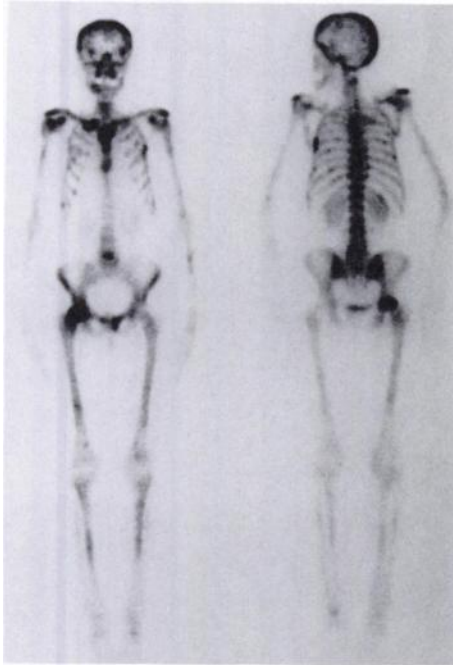


FIGURE 1. Technetium-99m-MDP whole-body bone scan reveals the high accumulation in the right clavicle, sternum, bilateral ribs, thoracic spine, lumbar vertebral 5, right hip and iliac region, skull, and bones of the lower extremities.

macytoma, which showed accumulation of DMSA in the deposited amyloid (9). They concluded that DMSA scans could be useful in determining the appropriate region of biopsy in patients with amyloidosis associated with plasmacytoma (9). Unlike Ohta's study, in our case DMSA images revealed accumulation in multiple myeloma without amyloidosis. We therefore consider that DMSA can accumulate in tumor cells unrelated to amyloidosis. Technetium-99m-MDP, on the other hand, was observed to accumulate into more sites than the DMSA scan could

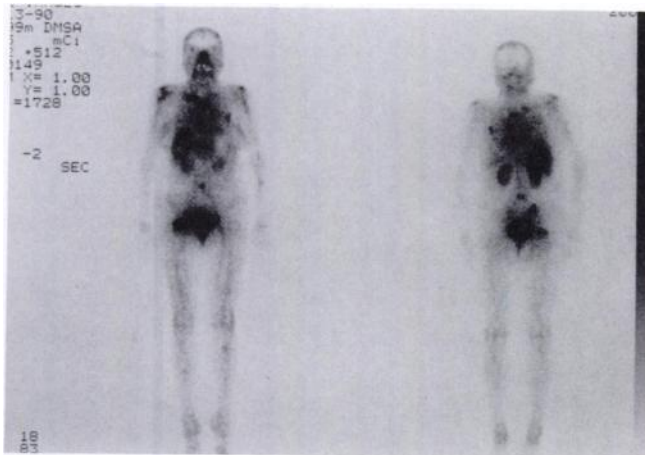


FIGURE 2. Pentavalent DMSA whole-body scan reveals accumulation in the right clavicular and sternal regions, left ribs region, mid- and lower-spinal regions, and right hip area.

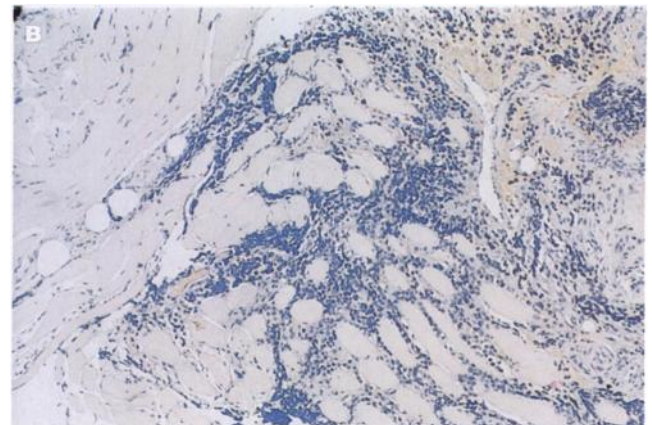
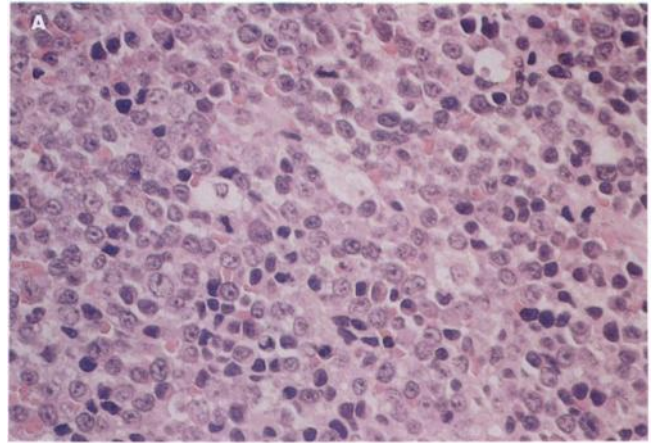


FIGURE 3. (A) Biopsy of the sternal tumor stained with hematoxylin and eosin and observed through a polarizing microscope shows normal plasma cells and myeloma cells. (B) Biopsy of the same sternal tumor stained with Congo red exhibits no amyloid deposits.

visualize. This variance is most probably due to an abnormal uptake of ^{99m}Tc -MDP, as it is not restricted to tumors and can accumulate in lesions which are traumatized or in the process of healing, etc. We consider that the accumulation of DMSA indicates staging and size of the multiple myeloma.

In conclusion, we found DMSA to accumulate in myeloma cells unrelated with amyloidosis. The Pentavalent DMSA scan seems to have potential for determining and evaluating relapse of disease and staging of tumors in patients with multiple myeloma.

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SELF-STUDY TEST

Gastrointestinal Nuclear Medicine

Questions are taken from the *Nuclear Medicine Self-Study Program I*, published by The Society of Nuclear Medicine

DIRECTIONS

The following items consist of a heading followed by numbered options related to that heading. Select those options you think are true and those that you think are false. Answers may be found on page 1807.

A 43-yr-old man has paroxysmal coughing, which frequently leads to vomiting. Single-swallow (Fig. 1) and multiple-swallow (Fig. 2) esophageal transit studies and a reflux study (Fig. 3, see p. 1807) are shown. An upper gastrointestinal series showed a small hiatal hernia. Which of the following conditions are documented by these studies?

1. gastroesophageal reflux
2. distal esophagitis with stricture
3. esophageal dysmotility secondary to esophagitis
4. pulmonary aspiration

Gastroesophageal scintigraphy, when employed to evaluate children, has proved to be a reliable test for demonstrating

5. gastroesophageal reflux.
6. esophageal motility abnormalities.
7. pulmonary aspiration.
8. gastric emptying abnormalities.

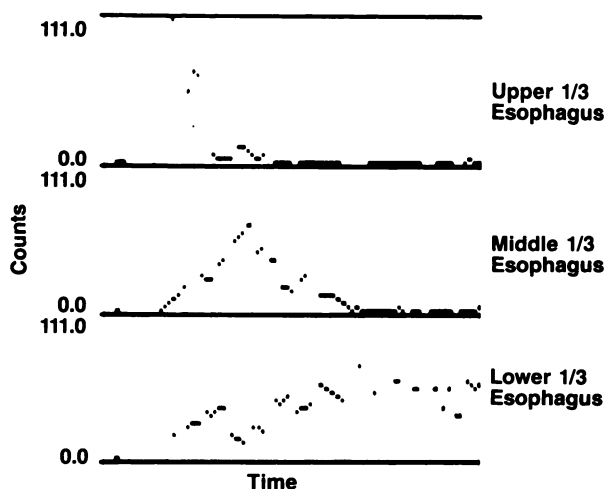


Figure 1

Esophageal Emptying

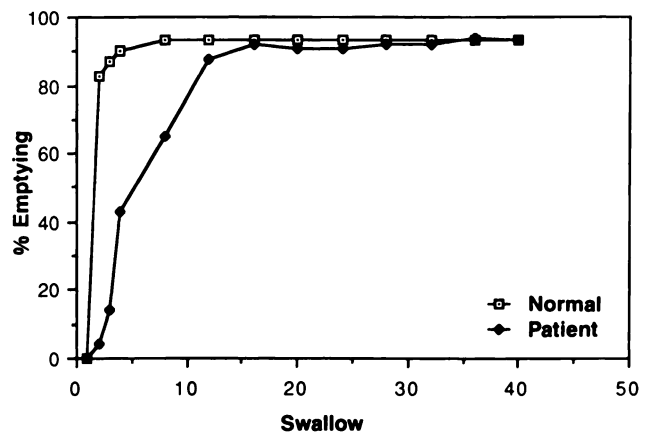


Figure 2

True statements regarding Meckel's diverticulum in children include which of the following?

9. It is the most frequent cause of severe lower gastrointestinal bleeding in infants and small children who otherwise appear well.
10. It contains ectopic gastric mucosa in less than 20% of patients.
11. Before [^{99m}Tc]pertechnetate imaging, potassium perchlorate should be given to decrease radiation exposure to the thyroid gland.
12. Technetium-99m-pertechnetate imaging should detect between 80% and 90% of symptomatic Meckel's diverticula.
13. A negative [^{99m}Tc]pertechnetate study excludes the presence of a Meckel's diverticulum in about 90% of symptomatic patients.

(continued on page 1807)