^{99m}Tc-MDP bone scan guides in the identification of mesenteric vein thrombosis

Case Report

Sahana Adisesh, Smita Chinmay Kulkarni, Palaniswamy Shanmuga Sundaram

Department of Nuclear Medicine and Molecular Imaging,
Amrita Institute of Medical Sciences and Research Center, Cochin, Kerala, India

(Received 6 April 2020, Revised 1 June 2020, Accepted 6 June 2020)

ABSTRACT

A 50-year-old man with postprandial abdominal pain, weight loss, and generalized body ache was referred to Nuclear medicine department for a whole body bone scan to look for any malignancy. Clinical examination did not reveal any specific positive findings. He underwent a Technetium-99m Methylene Diphosphonate (^{99m}Tc-MDP) bone scan which showed no obvious bone pathology. But there was abnormal increased MDP uptake in the entire transverse colon, splenic flexure, and sigmoid colon prompting further evaluation. Contrast-enhanced computed tomography (CECT) was performed and it suggested superior mesenteric vein thrombosis. Thus MDP uptake in bowel loops reflects the extra osseous tracer uptake at the cellular and tissue level due to chronic inflammation and plasma protein binding due to edema. Colonoscopy and segmental biopsy were non-contributory.

Key words: ^{99m}Tc-MDP; Whole body bone scan; SPECT-CT; Abnormal MDP uptake

Iran J Nucl Med 2020;28(2):34-37
Published: July, 2020
http://irjnm.tums.ac.ir

Corresponding author: Dr. Palaniswamy Shanmuga Sundaram, Department of Nuclear Medicine and Molecular Imaging, Amrita Institute of Medical Sciences and Research Center, Cochin, Kerala, India. E-mail: ssundaram@aims.amrita.edu

INTRODUCTION

Chronic mesenteric vein thrombosis is a rare condition that can lead to chronic mesenteric ischemia but may go unrecognised. It is related to thrombophilia, intra-abdominal diseases and less commonly cirrhosis and malignancy. Chronic mesenteric vein thrombosis slows down the blood flow causing edema and congestion of the intestinal loops eventually resulting in complications like necrosis and gangrene.

CASE PRESENTATION

A 50-year-old male presented with intermittent pain abdomen, dull aching type, approximately 30 minutes after food for 2 months. He also had weight loss (around 3-4 kg) and generalized body ache for 2 weeks. On clinical examination, patient was conscious and vital signs were normal. Local examination of abdomen and other organ systems was non-contributory. Blood investigations revealed mild anemia (Hemoglobin 11.5g %), with elevated C-Reactive Protein of 2.44 mg/L (normal range 0-1.0mg/L), elevated serum Alkaline Phosphatase (ALP) 238 IU/L (normal 0-130.0 IU/L) and minimally elevated Prothrombin Time of 16.5/14.0/1.22 secs (normal 11.1-16.0). Liver and renal function tests were within normal limits. Ultrasonography of abdomen was performed to look for any abnormalities in abdominal organs to ascertain the cause for abdominal pain. Findings showed normal echotexture of liver with a well-defined hyperechoic area in segment VII of the liver suggesting haemangioma. In view of raised Serum ALP and body aches, the patient was referred for whole body skeletal scintigraphy.

20 mCi (740 MBq) of ^{99m}Tc-MDP was injected intravenously. Three hours later whole body anterior and posterior images were acquired using GE Optima NM 640 dual head gamma camera. Imaging was performed using the following parameters; feet first supine position in 256 x 256 matrix. Anterior, posterior images whole body sweep images were acquired in continuous scan mode at 13cm/min scan velocity. SPECT CT (non-contrast) of abdomen was also acquired in Head first Supine protocol with angular range of 360 degree (6 degrees per angle) for 60 views at clockwise rotation, direction. Each frame consisted of 20 secs. The image matrix used was 128 x128 in step and shoot mode.

The CT parameters used with SPECT part of imaging consisted of CT tube voltage of 120 kilovolt, with tube current of 30 milliamperes. Each CT slice had a thickness of 2.5mm, and matrix of 512 x 512. SPECTCT images were reconstructed using OSEM (Ordered subset expectation maximisation) with 2 iterations and 10 subsets. Filter used for reconstruction was vendor specified Butterworth filter, Critical Frequency of 0.48 and power 10.

Whole body images showed no focal abnormal increased MDP uptake in axial and appendicular skeleton including all the large and small joints. Incidentally there was abnormal diffuse MDP uptake in the entire transverse colon, splenic flexure and sigmoid colon in the whole body and static image of abdomen which was confirmed on SPECT CT images (Figure 1).

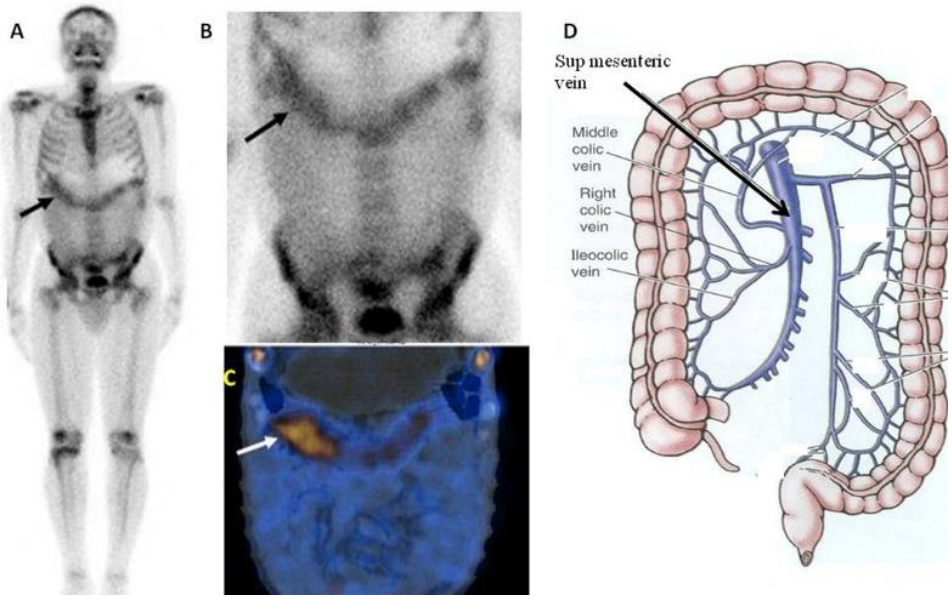

Fig 1. (A) Whole body ^{99m}Tc-MDP bone scan in anterior projection showing no hot spots in axial and appendicular skeleton. There is incidental detection of abnormal diffuse MDP uptake in the entire transverse colon (arrow), splenic flexure and sigmoid colon. (B) Static image and fused SPECTCT (C) images of anterior abdomen highlighting the MDP uptake in transverse colon (D) Anatomical illustration of Superior mesenteric vein drainage to intestinal loops.

Later, the patient underwent a contrast-enhanced CT abdomen imaging. Images showed occlusion of a short stump of the superior mesenteric vein with numerous engorged mesenteric and retroperitoneal collaterals. There was associated diffuse small bowel wall edema and thickening with diffuse omental and peritoneal fat stranding - likely due to chronic mesenteric vein thrombosis and mesenteric inflammation (Figure 2).

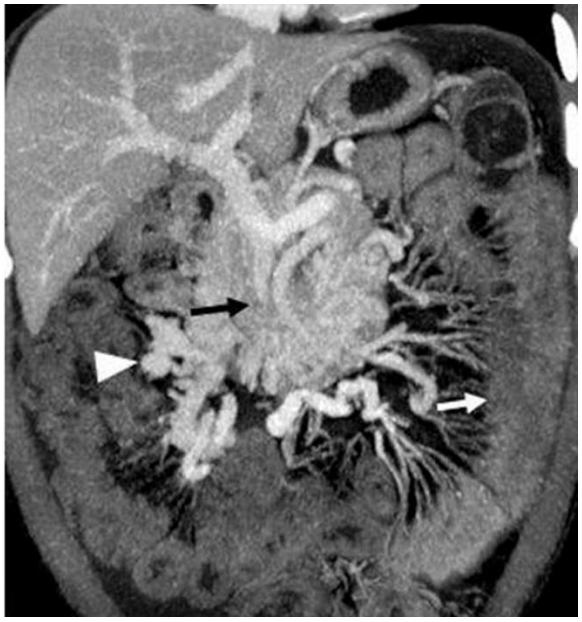

Fig 2. CT abdomen coronal image shows occluded superior mesenteric vein (black arrow), with multiple collaterals (arrow head) and secondary bowel edema (white arrow).

Colonoscopy was performed and revealed prominent rectal veins. Segmental biopsies were obtained and histopathological examination showed no specific pathology. The patient was diagnosed as a case of superior mesenteric vein occlusion. Subsequently, the patient was treated with low molecular weight intravenous heparin and later was maintained on Tablet warfarin 4mg once daily. Patient was on regular follow-up. He was symptomatically better and there was an improvement in his weight at 6 weeks.

DISCUSSION

Several studies have demonstrated the reliability of scintigraphic imaging using various radioisotopes in the diagnosis and assessment of disease activity in bowel diseases. It has been found extremely useful in inflammatory bowel disease, identification of occult infections with SPECT and PETCT [1]. In comparison with other modalities, they are non-invasive techniques and produce no patient discomfort related to instrumentation and preparation, they are not contraindicated in the acute phase and can visualize active disease both in the small and the large bowel.

^{99m}Tc-MDP skeletal scintigraphy is one of the most commonly used imaging techniques in the evaluation of benign and malignant skeletal pathologies. Methylene diphosphonate is a phosphate analog which complexes with the crystalline hydroxyapatite in the inorganic bone matrix by a process of chemisorption, thereby characterizing the osteoblastic process. Physiological uptake of ^{99m}Tc-MDP is seen in kidneys and urinary bladder due to its genitourinary route of excretion. However, there are several extra osseous pathologies (benign as well as malignant conditions) where ^{99m}Tc-MDP has been described [2].

Ergün et al. [3] showed that in 1% of all their skeletal scintigraphies, bowel loops were visualised. McCarthy et al. have reported intestinal uptake of ^{99m}Tc-MDP in two neuroblastoma patients, most probably due to microscopic tumor involvement or local tumor invasion [4]. In a case report by Lee et al., abnormal intestinal accumulation of MDP was seen in primary intestinal lymphangiectasia [5]. They attributed the uptake to significant binding of ^{99m}Tc MDP to plasma protein, interstitial extravasation, reabsorption by the local lymphatics and intraluminal excretion of the protein-bound tracer through dilated lymphatics. The same mechanism holds good for intestinal visualization in the case of protein-losing enteropathy [6]. Sundaram et al. reported abnormal intestinal uptake of ^{99m}Tc-MDP in a nine-month-old infant with protein-losing enteropathy [7]. Other possible causes of abnormal bowel visualization in ^{99m}Tc-MDP bone scan that have been reported in the literature are enterovesical fistula [8], increased soft tissue calcium deposition due to intestinal infarction [9] gastrointestinal bleeding [10], neonatal necrotizing enterocolitis [11], and systemic amyloidosis [12].

Technical causes that can attribute to abnormal extraosseous MDP uptake may be related to improper radiopharmaceutical instability [13]. The presence of oxygen in the MDP vial can cause oxidation of the stannous ions to stannic ions, decreasing the amount of stannous ions available for the reduction of the pertechnetate. Thus the final ^{99m}Tc-MDP preparation can contain some free pertechnetate, a radiochemical impurity, which may also be present as a result of incomplete reduction of the added pertechnetate. This can result in free pertechnetate in the gastrointestinal tract, excreted by salivary glands and stomach mucosa.

In our patient incidental visualization of the large bowel loops on ^{99m}Tc-MDP skeletal scintigraphy led to further evaluation of the patient and chronic mesenteric vein thrombosis was later identified. The patient was started on anticoagulants, thereby avoiding serious complications such as bowel necrosis and gangrene.

The mechanism of MDP uptake in intestinal loops in the case of venous thrombosis can be explained by compartmental sequestration. In chronic mesenteric vein thrombosis, the radiopharmaceutical accumulates in the extracellular space due to its reduced clearance resulting from impaired venous drainage hence the intestinal loops will be visualized in the delayed phase of bone scan [14].

CONCLUSION

There is literature evidence of intestinal ^{99m}Tc-MDP uptake in 1% of cases; however, the cause of abnormal visualization of intestinal loops remains unidentified in most of them. It is noteworthy that chronic mesenteric vein thrombosis is a rare pathology that can result in incidental visualization of intestinal loops on the ^{99m}Tc-MDP bone scan. Hence the incidental bowel visualization on the bone scan may need further clinical and imaging correlation to rule out causes like venous thrombosis, to avoid complications resulting from it.

Mesenteric ischemia/thrombosis is an uncommon medical condition with a high mortality rate was detected by a simple easy to perform a bone scan. Because of the lack of specific signs, a bone scan was incremental in identification in our case.

REFERENCES

1. Györke T, Duffek L, Bártfai K, Makó E, Karlinger K, Mester A, Tarján Z. The role of nuclear medicine in inflammatory bowel disease. A review with experiences of aspecific bowel activity using immunoscintigraphy with 99mTc anti-granulocyte antibodies. Eur J Radiol. 2000 Sep;35(3):183-92.
2. Wale DJ, Wong KK, Savas H, Kandathil A, Piert M, Brown RK. Extraosseous Findings on bone scintigraphy using fusion SPECT/CT and correlative imaging. AJR Am J Roentgenol. 2015;205(1):160-72.
3. Ergün EL, Kiratli PO, Günay EC, Erbaş B. A report on the incidence of intestinal 99mTc-methylene diphosphonate uptake of bone scans and a review of the literature. Nucl Med Commun. 2006 Nov;27(11):877-85.
4. McCarthy KE, Heyman S. Diphosphonate intestinal activity seen on two bone images in neuroblastoma. Clin Nucl Med.1986;11:501-502.
5. Lee KH, Chung JK, Lee DS, Lee MC, Song IS, Koh CS. Intestinal leakage of technetium-99m-MDP in primary intestinal lymphangiectasia. J Nucl Med. 1996;37:639-641.
6. Roach PJ, Itrato D, Treves ST. Bowel visualization on bone scan because of protein losing enteropathy. Clin Nucl Med. 1994;19:1114-16.
7. Sundaram P, Padma S. 99mTc-MDP abdominal scintigraphy in a paediatric case of GI protein loss - A viable and simple alternate to HSA imaging. Iran J Nucl Med. 2013;21(1):40-43.
8. Suga K, Ohono Y, Yoneshiro S, Fujita T, Nakanishi T, Utsumi H, Yamada N, Shimabukuro T. A case of squamous cell carcinoma of urinary bladder with an ileo-vesical fistula detected on bone scintigraphy. Kaku Igaku. 1992 Jan;29(1):105-10.
9. Barth KH, Alderson PO, Strandberg JD, Strauss HW, White RI Jr. ^{99m}Tc-pyrophosphate imaging in experimental mesenteric infarction: relationship of tracer uptake to the degree of ischemic injury. Radiology. 1978;129:491-495.
10. Lee VW, Leiter BE, Weitzman F, Shapiro JH. Occult gastric bleeding demonstrated by bone scan and Tc-99m-DTPA renal scan. Clin Nucl Med. 1981;6:470–473.
11. Safakianakis G, Ortiz VN, Haase GM. 99m Tc-diphosphonate abdominal imaging in necrotizing enterocolitis: a prospective study. J Nucl Med 1978;19:691–692.
12. Janssen S, van Rijswijk MH, Piers DA, de Jong GM. Soft-tissue uptake of ^{99m}Tc-diphosphonate in systemic AL amyloidosis. Eur J Nucl Med. 1984;9(12):538-41.
13. Zuckier LS, Martineau P. Altered Biodistribution of Radiopharmaceuticals Used in Bone Scintigraphy. Semin Nucl Med. 2015 Jan;45(1):81-96.
14. Wale DJ, Wong KK, Savas H, Kandathil A, Piert M, Brown RK. Extraosseous findings on bone scintigraphy using fusion SPECT/CT and correlative imaging. AJR Am J Roentgenol. 2015 Jul;205(1):160-72.