Demonstration of a congenital urine bladder diverticulum by ^{99m}Tc-MDP SPET/CT scan in a female with bone metastases

Zhaowei Meng MD, PhD,
Jian Tan MD,
Feng Dong MD,
Qiang Jia MD,
Fuhai Zhang MD

Department of Nuclear Medicine, Tianjin Medical University General Hospital, Anshan Road No. 154, Heping District, Tianjin 300052, P.R. China

Keywords: Bladder diverticulum – SPET/CT – Whole-body bone scan

Correspondence address:
Zhaowei Meng MD PhD
Department of Nuclear Medicine, Tianjin Medical University General Hospital,
Anshan Road No. 154,
Heping District,
Tianjin 300052, P.R. China,
Tel: 86-022-85902663
Fax: 86-022-27813550
E-mail: james_mencius@hotmail.com

Received:
22 July 2009
Accepted revised:
29 August 2009

Abstract

Urine bladder diverticula are usually asymptomatic, therefore they are incidentally diagnosed during examinations for other purposes. A Chinese patient, with a history of pulmonary adenocarcinoma first underwent a technetium-99m methylene diphosphonate whole-body bone scan. In addition to multiple skeletal metastases, abnormal shape of the urine bladder was also noted, which overlapped the superior ramus of the right pubic bone. In order to: a) better delineate the shape and structure of the urine bladder; b) visualize the pubic bone and c) detect the exact location and structural changes of skeletal lesions in the lumbosacral region, single photon emission tomography/computerized tomography (SPET/CT) scan of this region was performed immediately, and demonstrated: a) a big urine bladder diverticulum in the right hemipelvis; b) structural changes of skeletal metastases while metastases in the pubic bone were ruled out. An overview of the etiology, histopathology, complications, management and imaging of urine bladder diverticulum is also presented. We consider our case the first to be diagnosed by SPET/CT and differentiated from metastases of the overlapping bone in a 69 years old female.

Hell J Nucl Med 2009; 12(3) : 276-278 • Published on line: 23 October 2009

Introduction

Urine bladder diverticula are congenital or acquired herniations of the urine bladder mucosa and submucosa through the detrusor muscle [1, 2]. Congenital diverticula are due to the weakness of urine bladder musculature, sometimes caused by Ehlers-Danlos syndrome (a group of connective tissue heritable disorders with defect in the organization of collagen), which can lead to laxity of the supporting tissue of the urine bladder and diverticula [3, 4]. Acquired diverticula are frequently caused by chronic obstructions. Most of urine bladder diverticula are acquired and occur in males [1, 2, 5]. They usually have no symptoms and are incidentally discovered during examinations for other reasons [1, 2, 5, 6]. However, some patients develop hematuria, inflammation, calculi, metaplasia, carcinoma, metastasis, ileus, herniation or even spontaneous rupture, which may occur years after pelvic radiation [1, 2, 5-16]. Visualization of urine bladder diverticula can be achieved by ultrasound, excretory urography, cystography, computerized tomography (CT) and magnetic resonance imaging (MRI) [17, 18]. Incidental findings can also appear during technetium-99m methylene diphosphonate (^{99m}Tc-MDP) bone scans [13, 19-23], the appearances of which are usually areas of increased tracer uptake in hemipelvis. Special attention should be paid in these cases in order not to misinterpret the urine bladder abnormality as a metastasis [19-21]. In fact, for the purpose of delineating structural differences between urine bladder diverticula and skeletal metastases, CT [13, 19, 22] or MRI [23] have been reported as necessary for confirming diagnosis besides ^{99m}Tc-MDP bone scans.

Description of the case

A 69 years old Chinese female patient came to our hospital for checking of a progressively enlarging right submandibular lymph nodes. After lymphadenectomy, histopathology revealed a poorly differentiated adenocarcinoma, highly suspected to be of pulmonary cancerous origin. Later, thoracic CT was performed, which showed a mass in the left lower pulmonary lobe with the size of approximate by 5×4×4cm. Multiple enlarged lymph nodes in the mediastinum and left lung hilum were also demonstrated. Hence, the diagnosis of pulmonary adenocarcinoma (stage IV) was made. She was then given two courses of chemo-

therapy with gemcitabine and cisplatin. At the end of the 2nd course of chemotherapy, the patient was referred to our department for a whole body bone scan to determine whether skeletal metastases existed.

Anterior view (Fig. 1a) and posterior view (Fig. 1b) of the whole-body bone scan were performed 3h after intravenous administration of 925MBq of ^{99m}Tc-MDP. Multiple skeletal metastases were found in the vertebrae and the sacrum (Fig. 1). Abnormal shape of urine bladder was also demonstrated which overlapped part of the pubic bone (Fig. 1).

In order to: a) better delineate the shape and structure of the urine bladder and visualize the pubic bone; and b) detect the exact location and structural changes of the metastatic lesions in the 5th lumbar vertebra and the right sacroiliac region, SPET/CT of the lumbosacral region was performed immediately after whole body bone scan. Images were obtained by using a high-resolution low-energy parallel-hole collimator with a dual-detector SPET/CT (Discovery VH; General Electric Medical Systems, USA). Tomographic images showed foci of increased uptake in the pedicles of the 5th lumbar vertebral arch bilaterally (Fig. 2a). Anatomic image demonstrated osseous destruction of the right part of sacrum, which was corresponding to the lesion of decreased radiotracer uptake in the scintigraphic image (Fig. 2b). Therefore, skeletal metastases were confirmed for the lesions in (Fig. 2a) and (Fig. 2b). Meanwhile, no lesion was found in the pubic bone. Figures 2c to 2f showed a diverticulum arising from the right side of the native urine bladder, and extending to the edge of the right hemipelvis.

The patient then went to consult an urologist. The urine bladder diverticulum was confirmed by ultrasound examination and no urinary tract obstruction was indicated. Therefore, congenital urine bladder diverticulum was considered the diagnosis. No immediate intervention was initiated because no obvious urinary symptoms like urge incontinence, irritation or frequency in urination or signs like hematuria, inflammation, calculi, malignancy or potential of rupture exited. Moreover, the advanced stage of pulmonary adenocarcinoma obviously held the priority and the patient's condition deteriorated.

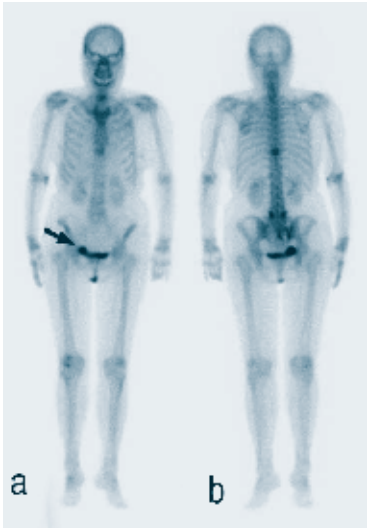

Figure 1. Anterior view (a) and posterior view (b) of ^{99m}Tc-MDP whole-body bone scan demonstrated: a) multiple skeletal metastases in the 9th thoracic vertebra, the 5th lumbar vertebra and the right sacroiliac region; b) abnormal shape of the urine bladder with a protruding area of tracer accumulation in the right hemipelvis (arrow), which overlapped superior ramus of the right pubic bone.

Discussion

Besides congenital urine bladder diverticula, medullary sponge kidney and polycystic kidney disease are also reported in Ehlers-Danlos syndrome and increased distensibility of connective tissues is considered as their cause [3, 4]. Our case had no kidneys disease, besides, no skin laxity, joint hypermobility or easy bruising were found (typical presentations of Ehlers-Danlos syndrome). Therefore, the diagnosis of this syndrome was very unlikely. Acquired diverticula are by far more common, comprise 80% to 90% of all urine bladder diverticula and

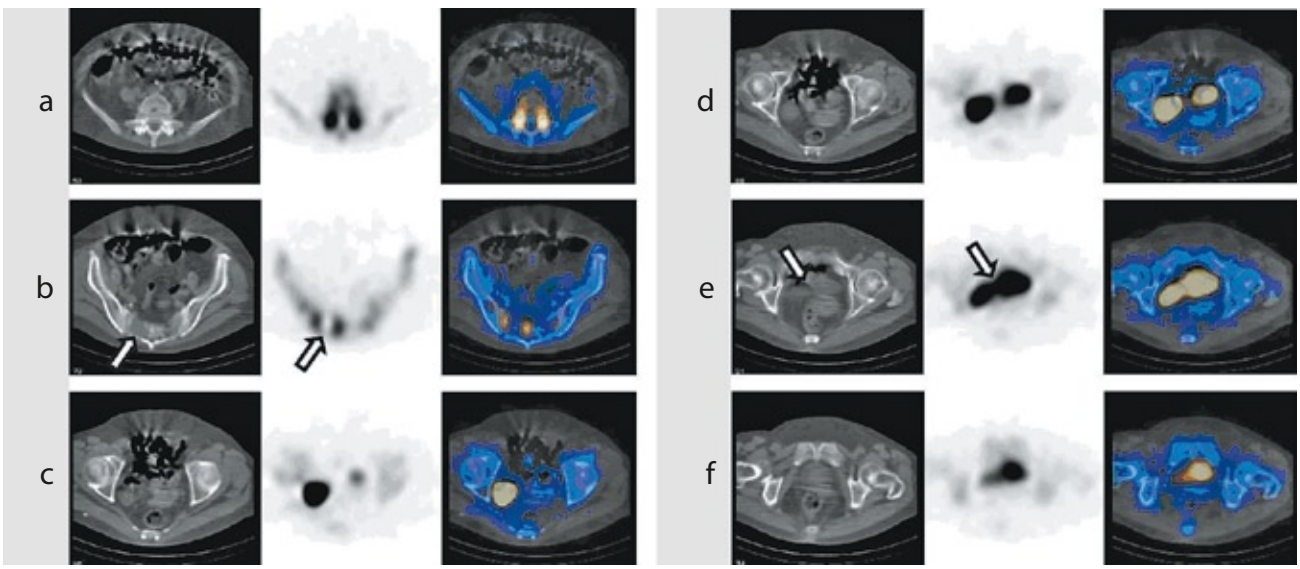

Figure 2. The SPET/CT of the lumbosacral region was performed immediately. Series of tomographic images showed: a) foci of increased tracer uptake in the bilateral pedicles of the 5th lumbar vertebral arch (a); b) osseous destruction of the right part of sacrum, corresponding to the related lesion seen in the scintigraphic image (arrow in b); c) a diverticulum arising from the right side of the native urine bladder, and extending to the edge of the right hemipelvis (c to f), the conjunction between them was demonstrated in (e); d) no lesion was found in the pubic bone.

are secondary to increased intravesical pressure due to obstruction from urethral stricture, prostatic hyperplasia, long-term urethral catheterization or neurogenic dysfunction [1, 5, 10, 19, 24]. Although congenital urine bladder diverticula are often diagnosed in children, when no obstruction factors can be identified, incidentally in adult patients, congenital etiology should be considered [1, 5, 6]. In our case, although multiple metastases existed due to pulmonary carcinoma, no obstruction factors of the lower urinary tract or iatrogenic causes were identified. Therefore, congenital etiology was diagnosed.

Although related studies are few [2, 5], reports showed that neoplastic changes could occur in approximately 0.8% to 13% of all urine bladder diverticula congenital and acquired [5]. A recent paper reported that neoplasms were present in 36 out of 71 cases in a clinic from 1981 to 2006 [2]. Neoplastic features included noninvasive lesions of low-grade papillary urothelial carcinoma, invasive lesions of urothelial carcinoma, small cell carcinoma, squamous cell carcinoma etc [2]. Other authors have pointed out that the number of 36/71 cases of cancer is falsely high because it is very difficult to accurately determine all asymptomatic or small diverticula that remain undetected in the general population [2, 5, 7].

The management of urine bladder diverticula depends upon the nature of the lesion and its complications. When surgery is indicated, there is a trend of adopting laparoscopic urine bladder diverticulectomy rather than performing radical cystectomy [25, 26]. Indications for diverticulectomy include [2, 6-9, 11, 15, 16, 25-27]: a) very large diverticula; b) calculi; c) complication of recurrent urinary tract infection; d) hematuria; e) spontaneous rupture; f) vesico-ureteral reflux; g) suspicion of neoplasm. In most cases, no symptoms or complications exist and a prophylactic diverticulectomy is usually not justified [6] as in our case.

We retrieved only six early reports, which demonstrated that incidental findings of urine bladder diverticulum were diagnosed during ^{99m}Tc-MDP bone scans [13, 19-23]. These articles report that the appearances of the lesions are usually areas of increased radiotracer uptake in hemipelvis and special attention should be paid in order not to misinterpret the tracer accumulation in the urine bladder diverticulum as a metastasis. In our case, although the abnormal shape of the urine bladder was obvious in the planar whole body bone scan, yet it overlapped the superior ramus of the right pubic bone. Other reports have also shown that for the diagnosis of urine bladder diverticulum, ^{99m}Tc-MDP whole body bone scan alone, including lateral views was inconclusive [22]. Bone scan can demonstrate the abnormal shape of the urine bladder, which will alert us to perform other imaging procedures [13, 19, 22, 23] to show the structural changes for setting the confirmative diagnosis. Some authors also suggest to void the urine bladder and take another scan, which will better indicate the urine bladder diverticulum. However, there are no other reports that adopted the methodology of SPET/CT for diagnosing urine bladder diverticulum. Our case demonstrated, for the first time, that SPET/CT fusion imaging could provide enough data for a reliable diagnosis of both, skeletal metastases and urine bladder diverticulum.

Bibliography

1. Gerridzen RG, Futter NG. Ten-year review of vesical diverticula. *Urology* 1982; 20: 33-35.
2. Tamas EF, Stephenson AJ, Campbell SC et al. Histopathologic features and clinical outcomes in 71 cases of bladder diverticula. *Arch Pathol Lab Med* 2009; 133: 791-796.
3. Handa S, Sethuraman G, Mohan A et al. Ehlers-Danlos syndrome with bladder diverticula. *Br J Dermatol* 2001; 144: 1084-1085.
4. Cuckow PM, Blackhall RJ, Mouriquand PD. Huge bladder diverticula associated with Ehlers-Danlos syndrome. *J R Soc Med* 1994; 87: 290-291.
5. Fox M, Power RF, Bruce AW. Diverticulum of the bladder--presentation and evaluation of treatment of 115 cases. *Br J Urol* 1962; 34: 286-298.
6. Pace AM, Powell C. Congenital vesical diverticulum in a 38-year-old female. *Int Urol Nephrol* 2005; 37: 473-475.
7. Haecker A, Riedasch G, Langbein S et al. Diverticular carcinoma of the urinary bladder: diagnosis and treatment problems. A case report. *Med Princ Pract* 2005; 14: 121-124.
8. Shigehara K, Taya T, Hisazumi H. Primary adenocarcinoma in the bladder diverticulum. *Scand J Urol Nephrol* 2008; 42: 481-483.
9. Matsuhashi N, Yamaguchi K, Tamura T et al. Adenocarcinoma in bladder diverticulum, metastatic from gastric cancer. *World J Surg Oncol* 2005; 3: 55.
10. Shaked G, Czeiger D. Distended urinary bladder and diverticulum-a rare cause of large-bowel obstruction. *Am J Surg* 2009; 197: 23-24.
11. Mirow L, Brugge A, Fischer F et al. Giant bladder diverticulum as a rare cause of intestinal obstruction: report of a case. *Surg Today* 2007; 37: 702-703.
12. Hinojosa D, Joseph UA, Wan DQ et al. Inguinal herniation of a bladder diverticulum on PET/CT and associated complications. *Clin Imaging* 2008; 32: 483-486.
13. Iagaru A, Siegel ME. Demonstration of a right inguinal hernia containing urinary bladder diverticulum on whole-body bone scan and pelvic CT. *Eur J Nucl Med Mol Imaging* 2006; 33: 234.
14. Fuerxer F, Brunner P, Cucchi JM et al. Inguinal herniation of a bladder diverticulum. *Clin Imaging* 2006; 30: 354-356.
15. Kato A, Yoshida K, Tsuru N et al. Spontaneous rupture of the urinary bladder presenting as oliguric acute renal failure. *Intern Med* 2006; 45: 815-818.
16. Nishimura T, Suzuki K, Iijima M et al. Spontaneous rupture of bladder diverticulum after postoperative radiotherapy for carcinoma of the uterine cervix: a case report. *Radiat Med* 2000; 18: 261-265.
17. Blane CE, Zerin JM, Bloom DA. Bladder diverticula in children. *Radiology* 1994; 190: 695-697.
18. Dondalski M, White EM, Ghahremani GG et al. Carcinoma arising in urinary bladder diverticula: imaging findings in six patients. *AJR Am J Roentgenol* 1993; 161: 817-820.
19. Farmer KD, Gellett LR, Vivian GC et al. Bladder diverticulum simulating a pelvic metastasis on a Tc-99m HDP bone scan. *Clin Nucl Med* 2001; 26: 60-61.
20. Silberstein EB, Volarich D. Bladder diverticula masquerading as pubic metastases. *Clin Nucl Med* 1982; 7: 229-230.
21. Schutte HE. Some special views in bone scanning. *Clin Nucl Med* 1980; 5: 172-173.
22. Wong C, Smith A, Mansberg R. Massive bladder diverticula demonstrated on skeletal scintigraphy. *Clin Nucl Med* 2004; 29: 517-518.
23. Chang CP, Tsai CH, Chen JH et al. Demonstration of large bladder diverticulum on bone scan. *Clin Nucl Med* 2005; 30: 276-277.
24. Yovchevski P, Kostov K. Acquired nonobstructive urinary bladder diverticulum: a case report. *Cases J* 2009; 2: 36.
25. Thwaini A, McLeod A, Nambirajan T. Laparoscopic bladder diverticulectomy. *J Laparoendosc Adv Surg Tech A* 2008; 18: 849-851.
26. Abdel-Hakim AM, El-Feel A, Abouel-Fettouh H et al. Laparoscopic vesical diverticulectomy. *J Endourol* 2007; 21: 85-89.
27. Das S, Amar AD. Vesical diverticulum associated with bladder carcinoma: therapeutic implications. *J Urol* 1986; 136: 1013-1014.