

CALYCEAL DIVERTICULUM IN FDG-PET IMAGING

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A 46-year-old female underwent a fluorodeoxyglucose F-18 (FDG) positron emission tomography (PET) whole-body scan for tumor screening after showing no symptoms or signs. The PET images showed a large FDG-avid lesion in the left renal pelvis, with a maximum standard uptake value (SUV) of 10.7 at 1 hour and 3.9 at 3 hours. An abdominal computed tomography (CT) scan showed a 3.7-cm cystic lesion with a slightly irregular wall in the left kidney. The immediate impression was that of a complicated cyst. A histopathologic report after surgery confirmed a calyceal diverticulum. To the best of our knowledge, this is the first report of FDG uptake in a case of calyceal diverticulum.

Key Words: calyceal diverticulum, fluorodeoxyglucose (FDG) F-18, tumor screening, positron emission tomography
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Pyelocalyceal diverticulum, or a pyelogenic cyst, is a urine-containing eventration of the upper collecting system, enclosed within the renal parenchyma, communicating with the main collecting system via a narrow channel, lined by nonsecretory transitional cell epithelium and surrounded by a layer of muscularis mucosae [1,2]. Patients with pyelocalyceal diverticulum are usually asymptomatic but may report hematuria or have symptoms of urinary tract infection, renal colic, pyuria, hypertension, or obstruction due to calculus formation [3].

CASE PRESENTATION

A previously healthy 46-year-old female came to our hospital for a health examination. A fluorodeoxyglucose (FDG) F-18 positron emission tomography (PET) whole-body scan was done on 19 August 2004. The patient fasted for longer than 8 hours before the PET examination. The FDG-PET scan

was performed using a dedicated PET scanner (Siemens Ecat Exact HR plus, Knoxville, TN, USA), 1 hour after intravenous injection of 370 MBq of FDG F-18, and showed an FDG-avid lesion about 4.1 cm in diameter in the left renal pelvis with a standard uptake value (SUV) of 10.7. To accelerate the excretion of the radiotracer from the urinary system, 20 mg of furosemide was given intravenously. A delayed 3-hour image focused on the kidneys, and the lesion was clearly identified, but with a lower SUV of 3.9 (Figure 1). The FDG-avid lesion was thought to be due to benign processes, such as urine stasis in the renal pelvis secondary to obstruction or a benign tumor, because the SUV decreased significantly with time. Urinalysis on 20 August 2004 revealed white blood cells, positive; red blood cells, 0-1; and bacteria, positive. An abdominal sonogram on the same day revealed an anechoic area in the left renal pelvis. Either hydronephrosis or a cyst was considered (Figure 2). An abdominal computed tomography (CT) scan was performed for further evaluation and showed a 3.7-cm lesion over the middle of the left kidney (Figure 3). The immediate impression was that of a complicated cyst with calcification. After discussions with the patient, she strongly favored total nephrectomy because she still feared the lesion might be malignant. She was admitted with a left complicated cyst, and a left nephrectomy via laparoscope was performed on 3 September 2004.

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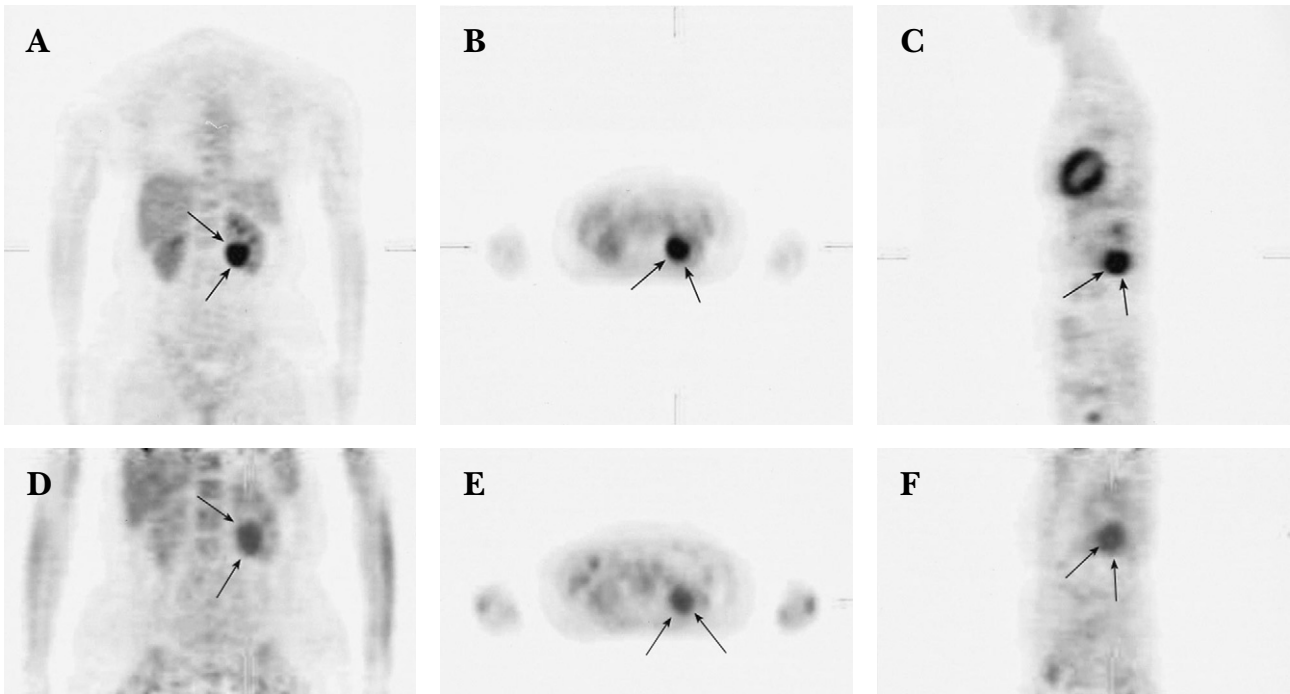


Figure 1. Upper row: Fluorodeoxyglucose F-18 (FDG) positron emission tomography (PET) FDG-PET scanning 1 hour after intravenous injection of 370 MBq of FDG F-18. The coronary (A), transverse (B) and sagittal sections (C) of the scan show one large area of increased FDG uptake in the right renal pelvis (arrows). The maximum standard uptake value (SUV) of the lesion is 10.7. Lower row: FDG-PET scanning 3 hours after injection of FDG F-18. The FDG-avid lesion is still demonstrated even after administration of furosemide but with lower intensity (SUV = 3.9) on the coronary (D), transverse (E), and sagittal sections (F).

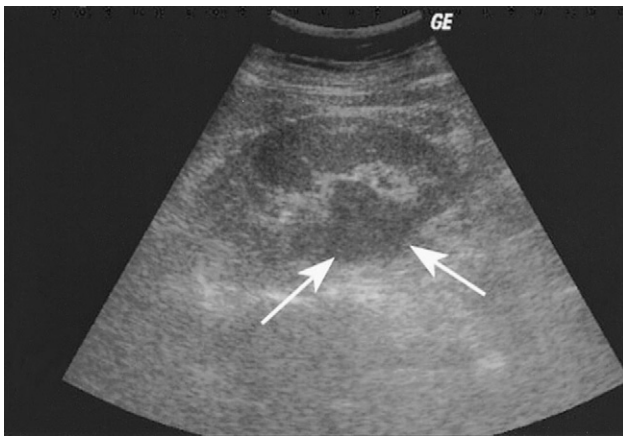


Figure 2. Abdominal sonogram reveals an anechoic area in the left kidney (arrows). Either hydronephrosis or a cyst should be considered.

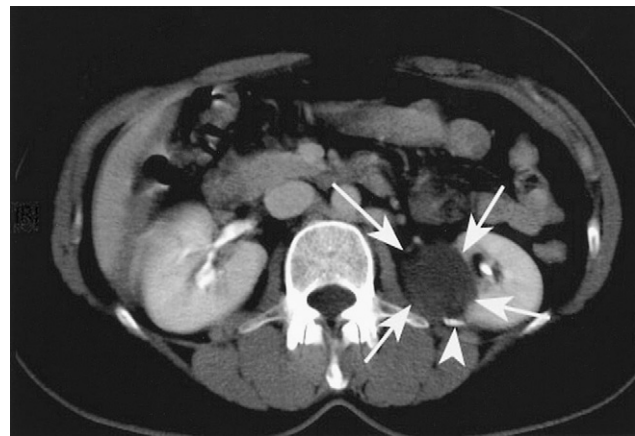


Figure 3. An abdominal computed tomography image with contrast shows a 3.7-cm cystic lesion (arrows) with a slightly irregular wall and calcification (arrowhead) in the left kidney. No enhancement is noted in the lesion after contrast medium injection. Complicated cyst should be considered.

Pathologic examination

A specimen of the left kidney showed calyceal diverticulum. The renal parenchyma, pelvis, and ureter revealed nothing remarkable. The cyst was lined by either single or multiple-layer urothelium, with a

smooth muscular wall. No inflammation was seen in the cystic wall. The cyst was located in the medullary area, adjacent to the pelvis. On the basis of the histology and location of the cyst, calyceal diverticulum was diagnosed.

DISCUSSION

Pooling of the tracer in the renal calices or pelvis, dilated or redundant ureters, calyceal diverticulum, or bladder diverticula could be a confusing finding [4]. Such focal FDG activity could be mistaken for an upper-pole renal neoplasm or confused with a primary or metastatic neoplasm of the pancreatic tail or adrenal gland because of the proximity of these structures. Hydration and the use of furosemide have been advocated to facilitate clearance of the urinary tracer from the intrarenal collecting systems and ureters [5]; however, these methods are not uniformly effective. Thus, even with these considerations, focal FDG activity in the expected locations of the renal calices, renal pelvis, or ureters must be considered nonspecific. To reduce image reconstruction artifacts from the intense tracer activity encountered in the bladder, some investigators advocate catheterization and lavage of the bladder [4–6]. In our case, we administered furosemide to the patient after 1 hour of imaging to reduce the effect of urine stasis in the urinary collecting system; the FDG-avid lesion remained, while the SUV decreased significantly (from 10.7 at 1 hour, to 3.9 at 3 hours).

Recently, delayed imaging using FDG F-18 has been reported to be useful in the differentiation between benign and malignant lesions [7–9]. Most malignant lesions show higher FDG F-18 uptake on the delayed image than on the early image, whereas most benign lesions show the opposite. However, in a study by Dobert et al the value of the dual time point FDG-PET imaging was reportedly limited in the evaluation of focal abdominal lesions [10]. In their study, the SUV increased by 64% and decreased by 36% in the malignant lesions, with an initial SUV of 2.5 or higher ($n = 11$). In benign lesions with an initial SUV of 2.5 or higher ($n = 31$), the uptake increased in 17 patients (55%) and decreased in 14 patients (45%). Therefore, the change in SUV is suitable as a criterion for differentiating between benign and malignant lesions. In our case, the SUV of the left renal lesion clearly decreased on the delayed image. A benign lesion was the preferable conclusion, but a malignant tumor with prompt washout of FDG F-18 could not be ruled out completely.

Increased FDG F-18 uptake by renal cell carcinoma is usually mild. Detection of malignant renal neoplasms appears to depend on tumor grade, whereas smaller, low-grade tumors are most frequently missed [11]. According to the literature, the detection rate of FDG-PET scan for primary

renal cell carcinoma varied from 32 to 94% [12–13]. It is not unusual to have false-negative findings as a result of relatively low FDG uptake, or false-positive studies due to urine stasis. We conclude that, although it is rare, calyceal diverticulum should be taken into consideration when evaluating FDG-avid lesions in the kidneys.

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葡萄糖正子造影 (FDG-PET) 在腎盞憩室的表現

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一位四十六歲婦女接受正子造影腫瘤篩檢健康檢查。此婦女並無任何不適症狀。正子造影顯示左腎有一葡萄糖積聚之區域，其標準攝取值 (standard uptake value, SUV) 最大值為 10.7。腹部電腦斷層掃描顯示左腎有一直徑 3.7 公分的囊腫，此囊腫壁略顯不規則。複雜性囊腫為第一考量。此病人後來接受手術移除，病理報告為一腎盞憩室。據我們所知，這是正子造影所報導的第一個腎盞憩室的病例。

關鍵詞：腎盞憩室，氟-18 去氧葡萄糖，腫瘤篩選，葡萄糖正子造影
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