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CASE REPORT

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Incremental Role of ^{18}FDG PET/CT in Assessment of Testicular Viability

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Abstract

Testicular torsion is a common differential diagnosis of acute scrotal pain along with acute epididymo-orchitis, which may lead to testicular non-viability. Doppler ultrasound and testicular scintigraphy are two routinely used modalities for the assessment of testicular viability. However, in some cases, these investigations may prove inadequate in differentiating between the two entities with widely differing management. Here, we present a case of a 52-year-old male with questionable viability of testis, who was investigated initially using testicular scintigraphy and was further subjected to a regional 18F-FDG PET/CT scan, in view of inconclusive findings with the conventional modalities.

Keywords Testicular infarction · Testicular viability · Acute epididymo-orchitis · Testicular scintigraphy · 18F-FDG PET/CT

Introduction

Testicular torsion is one of the most common causes of acute scrotal pain. Though predominantly seen in childhood and adolescence, there have been multiple cases reported even in adults [1]. In younger age, the rate of salvage of testis is comparatively higher than in adults [2]. The main reasons for poor testicular salvage rate in adults include lack of recognition of the torsion and high severity of spermatic cord twisting in adults [3]. The viability of testis depends on the time to intervention following the occurrence of event with salvage rates of 90% if de-torsion is done within 6 h [4]. Hence, early differentiation from other causes of acute scrotal pain must be done. Diagnosis is based on clinical examination and imaging modalities such as Doppler ultrasound and testicular scintigraphy. Doppler ultrasound shows decreased intratesticular blood flow in case of torsion while it is increased in case of inflammation such as epididymitis, [5] whereas testicular scintigraphy shows peripheral pooling of tracer with central photopenic area in case of missed torsion or non-viable testis. This peri-testicular hyperemic rim or "Halo sign" on radionuclide scrotal scintigraphy might be absent in cases of small testis or severe infection/inflammation of the scrotum due to poor anatomical resolution of the gamma camera [6]. In cases with equivocal findings, 18F-fluorodeoxyglucose positron emission tomography (18F-FDG PET/CT) may help in better characterization of the testicular viability, as 18F-FDG enter the cell by the same transport mechanism as glucose and is phosphorylated by hexokinase to form18F-FDG-6 phosphate, which does not undergo further metabolism. The uptake of 18F-FDG by tissues is a marker for the tissue uptake of glucose, which in turn is closely correlated with tissue metabolism; thus, the glucose analogue 18F-FDG serves as a surrogate marker for viability of tissue.

Case Report

A 52-year-old poorly controlled type II diabetes mellitus man presented with swelling and pain of moderate intensity in the right hemiscrotum for 15 days, which subsided on antibiotic usage. But patient presented again with worsening of pain for the last 3 days with no history of any fever. He had a past history of incision and drainage done for a left-sided scrotal pyocele 11 years back. On examination, right testis was enlarged, hard, and mildly tender while left testis was not palpable. Doppler ultrasonography (USG) of the scrotum showed enlarged right testis with the upper part

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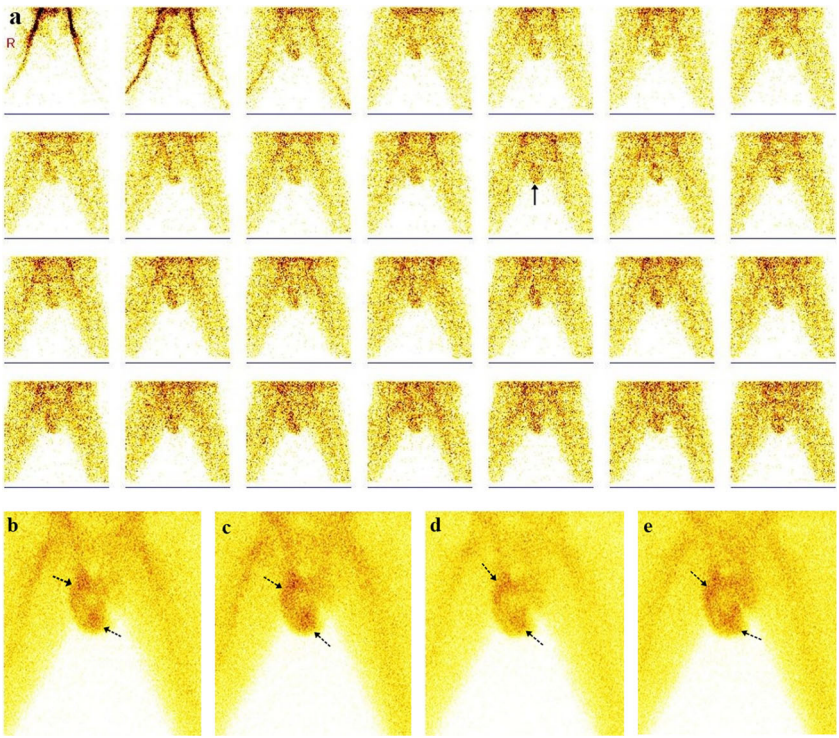

Fig. 1 Testicular scintigraphy performed with ^{99m}Tc-pertechnetate shows increased perfusion (**a**) in the right hemiscrotum. Blood pool images acquired at 2, 5, 10, and 15 min (**b**–**e**; respectively) show focal increased radiotracer pooling in the upper and lower parts of right testis with no definite central photopenia. Left hemiscrotum shows no tracer activity during the study

showing no vascularity and the lower part showing focal vascularity while left testis was atrophic. With this equivocal report on USG, testicular scintigraphy performed 370 MBq of ^{99m}Tc-pertechnetate, to look for the viability of right testis showed increased perfusion in the right hemiscrotum (Fig. 1a; arrow) with focal increased blood pool activity in the upper and lower poles (Fig. 1b–e; dotted arrow). The left hemiscrotum showed no tracer activity in the perfusion and subsequent blood pool images. Due to disparity in the Doppler ultrasound and testicular scintigraphy, a regional 18F-FDG PET/CT was done using a hybrid PET/CT scanner (low-dose 40 mA CT). It showed the absence of 18F-FDG uptake in the right testis (Fig. 2; arrow) while the surrounding scrotum showed mild 18F-FDG avidity (dotted arrow). Presence of air between the testis and the scrotum was also noticed suggestive of infection. Based on these findings, a diagnosis of non-viable testis likely due to old infection/infarction was made. Subsequently, patient underwent high orchiectomy; intra-operatively, the right testicle was dark-brown to black color, suggesting hemorrhagic and necrotic component. Histopathological analysis showed the presence of infarction and necrosis in the non-viable testicular tissue with bacterial colonies, thereby confirming the diagnosis.

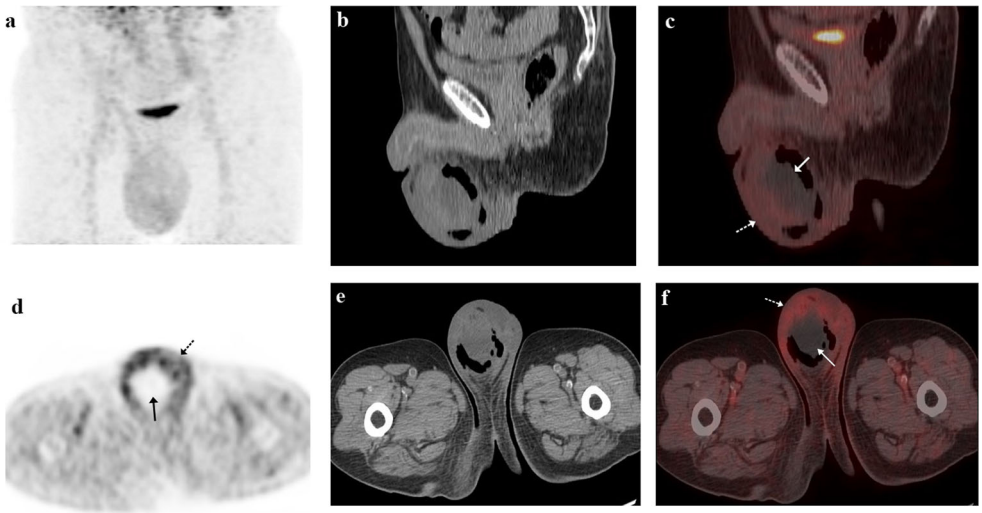

Fig. 2 ^{18}FDG PET/CT scan of the patient (maximum intensity projection images; **a** shows absent FDG uptake in the right testis (sagittal CT and fused PET/CT image; **b**, **c**). Transaxial PET, CT, and fused PET/CT images (**d**–**f**) respectively revealed mild FDG uptake confined to the thickened scrotal wall (dotted arrows) and no FDG uptake in right testis suggestive of non-viable testis (arrow)

Discussion

Acute scrotal pain with or without testicular swelling may be due to testicular ischemia and infarction or acute inflammatory conditions such as epididymo-orchitis [1]. The differentiation rests on careful physical examination and appropriate investigations. Acute epididymitis by itself may cause secondary testicular infarction [7]. Sudden onset of testicular pain in a patient, who was initially treated with antibiotics and showed relief of pain, should raise the possibility of a testicular infarction. Testicular infarction in this scenario may occur due to edema of epididymitis or spermatic cord, which may cause vascular compromise, or may be secondary to infective vascular thrombi causing infarction. Global and segmental testicular infarctions are recognized consequences of torsion of the spermatic cord, incarcerated hernia, infection, trauma, and hypercoagulable states [8].

Doppler USG is commonly used to differentiate between the two conditions. However, USG had a lower rate of accuracy in the diagnosis and differentiation of acute testicular torsion from inflammation and accurate results are highly dependent on operator skill [9]. On radionuclide scrotal scintigraphy, non-viable testis appears as an area of photopenia in the region of the testis; sometimes there may be presence of surrounding rim of hyper-perfusion around the photopenia in cases where infarction is due to missed torsion [6]. However, this rim of activity is non-specific and may also be seen in cases of inflammation with super imposed features such as hydrocele [10]. In such cases, use of regional ^{18}FDG PET with low-dose CT of the pelvis may show incremental value in better characterization of the disease process and for assessing the viability of testis like in the index case. The 18F-FDG being a surrogate marker of tissue viability and PET/CT scan having higher sensitivity, image contrast and spatial resolution compared to testicular scintigraphy provides significant advantages in evaluation of testicular viability in equivocal cases.

Compliance with Ethical Standards

Conflict of Interest Venkata Subramanian Krishnaraju, Dharmender Malik, Rajender Kumar Basher, Giridhar S Bora, Bhagwant Rai Mittal, and Anish Bhattacharya declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study, formal consent is not required.

Informed Consent The institutional review board of our institute approved this retrospective study, and the requirement to obtain informed consent was waived.

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