Case Report

Metabolic Imaging as a Novel Strategy in Evaluation of Mycotic Abdominal Aortic Aneurysm: A Case Report and Brief Clinical Review

Abstract

Abdominal aortic aneurysm (AAA) is an uncommon entity with high mortality. Etiologically, they are classified as inflammatory and infective (mycotic), the latter being less common. Clinical presentation, laboratory investigations, and treatment for these may considerably overlap. However, choice of management and the need for surgical intervention depends on factors such as size and progression of aneurysm, persistent symptoms, and presence or absence of distant pathology. Although computed tomography (CT) is the gold standard for AAA, in selected cases, especially in infected AAA, fluorodeoxyglucose positron emission tomography-CT can provide valuable information.

Keywords: *Abdominal aortic aneurysm, contrast-enhanced computed tomography, fluorodeoxyglucose positron emission tomography-computed tomography, mycotic aneurysm*

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Introduction

Aneurysm means segmental full thickness dilatation of blood vessel. Aortic aneurysm is most common symptomatic aneurysm, although the symptoms are nonspecific, such as dull abdominal pain. Contrast-enhanced computed tomography (CECT) is the gold standard for diagnosing and assessing aneurysm. The decision of follow up or surgery is based on size, the rate of growth, and presence of infection in the aneurysm. Although, fluorodeoxyglucose (FDG) positron emission tomography (PET)/CT scan has no established role in abdominal aortic aneurysm (AAA), it can be selectively used to rule out infection in sero/culture negative cases, to establish inflammatory activity, to predict the progression of aneurysm, and to monitor antibiotic course in cases of infected aneurysms.

Case Report

A 65-year-old male patient presented with fever and dull abdominal pain for the past 1 month. Ultrasound abdomen and chest radiograph were unremarkable. There was leukocytosis with increased erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP). Blood culture was negative. He was started on the empirical antibiotic course. CECT abdomen detected saccular aneurysm involving infra renal aorta with 1 cm diameter and peri-aortic soft tissue with central necrosis [Figure 1]. In view of negative blood culture, difficult biopsy site and persistent symptoms with increased CRP and ESR in spite of broad spectrum antibiotics course, FDG PET-CT study was advised to detect occult focus of infection and inflammatory activity around the aneurysm.

Contrast-enhanced FDG PET-CT revealed intense FDG avidity in soft tissue involving aneurysmal segment, with an increase in necrotic component and diameter, now measuring 1.9 cm [Figure 2]. Rapid progression, increased necrosis and high FDG avidity were suggestive of infective etiology and high risk of rupture. The patient underwent extra-anatomic reconstruction (EAR) of the diseased aortic segment with synthetic graft placement and debridement of surrounding soft tissue.

Histopathology was suggestive of ruptured calcified atheroma with thrombosis. Sections of the soft tissue showed neutrophil rich infiltrate with scattered Gram-positive forms, concluding infective etiology. However, culture could not grow the organism, possibly due to prolonged antibiotic treatment. The patient was kept on the prolonged oral antibiotic course.

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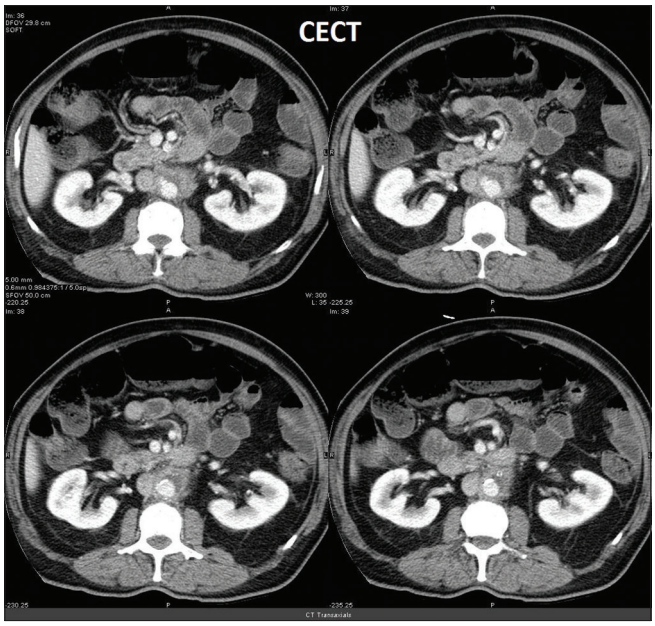

Figure 1: Contrast-enhanced computed tomography abdomen showing saccular aneurysm involving infra renal aorta (diameter of 1 cm), and peri-aortic soft tissue with central necrosis extending proximally and distally to aneurysm, encasing origin of inferior mesenteric artery

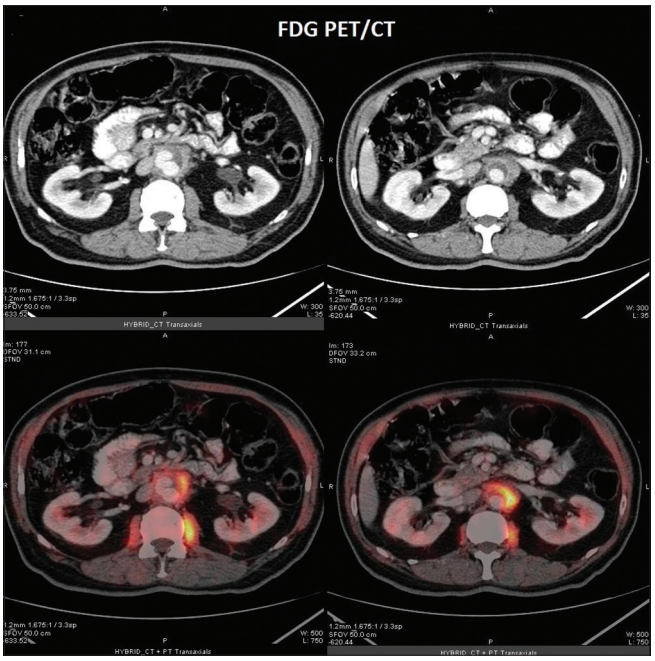

Figure 2: F-18 fluorodeoxyglucose positron emission tomography/computed tomography scan showing intense fluorodeoxyglucose avidity in soft tissue involving aneurysmal segment of infra-renal abdominal aorta, with increase in central photopenic necrotic component as compared to previous computed tomography scan [Figure 1], and with increase in diameter, now measuring 1.9 cm

CT scan after 1 month revealed no abnormality. The symptoms were ameliorated, and CRP levels were normal.

Discussion

AAA is segmental full thickness dilatation of abdominal aorta exceeding the normal vessel diameter by 50%.[1] Supra renal segment is involved in 80% of cases.[2] Mycotic aneurysms are more frequently pseudo aneurysms involving only adventitia and accounts for 0.7%–2.6% of AAAs.[3] Associated risk factors are older age (>60 years), smoking, atherosclerosis, dyslipidemia, chronic hypertension, immunodeficiency, prolonged steroids, prior vascular, or cardiac surgeries.[4]

Pathogenesis involves four events: Leukocytic infiltration of the vessel wall; destruction of elastin and collagen by proteases; smooth muscle cell loss causing thinning of the wall; and neovascularization.[1] Mycotic aneurysm starts this process due to seeding of the vessel wall by septic emboli. They are of four types: (1) True, (2) secondary to bacterial arteritis, (3) infecting preexisting aneurysms, and (4) posttraumatic pseudo-aneurysm.[5]

AAAs are commonly diagnosed late due to vague symptoms such as mild abdominal pain, malaise, and fever.[4] They are usually detected on ultrasonography or CT scan. The initial search for infection is usually negative, and hence, they are an important differential of pyrexia of unknown origin (PUO). *Staphylococcus aureus* (45%), enteric derived bacteria, commonly *Salmonella* (30%–40%), and streptococci (10%) are the most common culprits. Laboratory work-up shows leukocytosis, increased CRP and ESR. However, cultures are positive in only 50%–75% of cases with further reduced rates postantibiotics or anaerobic bacterial infection.[6]

CECT is the modality of choice for assessing AAA, with sensitivity of 92%–96% and specificity of 93%–100%.[7] It provides probable etiology, valuable preoperative information, and follow-up tool. CECT features of mycotic and inflammatory AAA can overlap, but following signs can reliably identify infection: Saccular shape (most inflammatory AAA are fusiform), globular contours, peri-aortic necrosis/abscess, and soft tissue component. Rapid change in diameter over a short period should arouse suspicion of mycotic AAA.[3]

Smaller aneurysms are followed up, provided they are symptomless, sterile, with normal inflammatory biomarkers. Current CECT follow-up recommendations based on aneurysm diameter are 3 yearly for 3–3.4 cm, yearly for 3.5–4 cm and 6 monthly for 4–5 cm.[1] Annual risk of rupture of AAA <5 cm is <1%.[2] These aneurysms can be medically managed with beta-blockers, antibiotics and controlling risk factors. Surgical intervention is indicated if: (a) Diameter >5 cm, as risk of rupture dramatically increase thereafter,[8] (b) increase in diameter by >0.5 cm within 6 months on follow up; (c) persistent symptoms; (d) saccular pattern, or positive family history of aneurysm; and (e) hyper-attenuating crescent sign on CECT due to internal aortic dissection.[1,3] It is important to detect these signs as rupture has a high mortality (85%–90%).

EAR and endovascular aortic repair (EVAR) are two available surgical approaches for AAA. In multiple trials,

EVAR has shown initial survival benefit over EAR, but this disappears over 1–3 years. Furthermore, chances of endoleaks were more with EVAR and frequent follow-up was suggested. In a mycotic aneurysm, EVAR can leave infective nidi behind. EAR ensures complete debridement with less chances of leaks, and a longer follow-up (5 yearly) can be accepted;[1,3] confirming it as the choice of surgery in mycotic AAAs.

Conventional imaging, although important for the operative decision, may not reliably establish the diagnosis of infection, nor predict progression of an aneurysm or possibility of rupture, due to inherent inability to gauge tissue metabolism. Although FDG PET-CT does not have established a role in AAAs, it is often used as inflammation marker in large vessel vasculitis with reliable sensitivity and good correlation with serum markers, especially CRP.[9] It has an established role in PUO in detecting possible foci of infection/inflammation, with sensitivity ranging from 60% to 77% in various studies.[10] Murakami *et al*. studied 11 FDG PET-CT scans with suspected infected aneurysm. Patients with confirmed infection had standardized uptake value (SUV) max >4.46 and those without infection had <2.59, reliably establishing infective etiology.[11] Sporadic case reports have reproduced the utility of FDG PET-CT in the diagnosis of bacterial aortic aneurysms due to *Staphylococcus and Salmonella* and monitoring antibiotic treatment.[12-14]

Moreover, some studies have considered the prognostic role of FDG PET-CT. In a study on 53 patients of an aortic aneurysm performed by Nchimi *et al*., a positive correlation was observed between clinical events rupture, dissection and growth >1 cm, and increased FDG uptake of the lesion.[15] Two studies involving a series of patients proved the direct correlation of quantitative parameters on FDG PET-CT scan, with preoperative CRP, as well as histological characteristics such as macrophage and polymorphonuclear infiltrate and expression of matrix metalloproteinases. However, there was an inverse correlation with collagen fibers and vascular smooth muscles cells, associating weakening of the vessel wall and risk of rupture with increasing FDG uptake.[16] These studies point towards the predictive and prognostic role of FDG PET-CT. In a case report by Fisk *et al*., FDG PET-CT had been useful to monitor response to antibiotics and to detect postoperative peri-stent infection in mycotic AAA.[4]

In our case, FDG PET-CECT helped to raise infective suspicion, and ruling out the distant focus of infection and multiple aneurysms, in clinical scenario of persistent symptoms and raised CRP. High SUV max also predicted a rapid increase in size, as detected by serial CECT. Moreover, high FDG uptake correlated with rich neutrophilic infiltrate, as detected on the postoperative specimen.

Conclusion

Mycotic AAAs are rare, but fatal disease if left untreated or undiagnosed, due to nonspecific symptoms and rapid progression. CECT is currently the imaging modality of choice for detection, follow up, and operative decisions, but may not have a predictive role if conservative management is thought of. As demonstrated in this case, the addition of FDG-PET can increase the diagnostic sensitivity of infective etiology, establish ongoing inflammation and predict the progression of aneurysm/risk of rupture, assisting decision making in the close-set clinical scenario. In selective cases, it can be used to monitor long-term antibiotic treatment.

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Conflicts of interest

There are no conflicts of interest.

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