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CASE REPORT

Feasibility of Intraoperative Fusion Imaging Using Non-Contrast CT Scan for EVAR in Ruptured Abdominal Aortic Aneurysm

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WHAT THIS PAPER ADDS

Fusion imaging often requires contrast computed tomography (CT) as guidance for aortic endovascular treatment. Endovascular aneurysm repair (EVAR) was successfully achieved under image fusion guidance using non-contrast CT with VesselNavigator® in a patient with ruptured abdominal aneurysm and simultaneous acute renal failure.

Introduction: Acute renal failure is a frequent major complication (24%) of endovascular repair for ruptured abdominal aneurysm (rAAA). Iodinated contrast media is known to be nephrotoxic. This report describes a case of endovascular aneurysm repair (EVAR) under fusion imaging guidance in a patient diagnosed with a rAAA after non-contrast CT. Written consent was obtained from the patient.

Report: A 73 year old patient with stage IV chronic kidney failure and contrast-induced nephropathy was diagnosed with rAAA using non-contrast CT. Subsequently, the patient was treated with EVAR using fusion imaging.

Discussion: EVAR with fusion imaging after non-contrast CT was safe in a patient with rAAA. It could represent an option for patients with acute renal failure in emergency settings.

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INTRODUCTION

Acute renal failure is a common major complication (24%) of endovascular repair for ruptured abdominal aneurysm (rAAA).[1] Nephrotoxicity of iodinated contrast media remains a limitation for endovascular procedures. Fusion imaging has already been used in elective endovascular aneurysm repair (EVAR) in patients with non-contrast CT-scan AAA diagnosis.[2] This report describes an EVAR with fusion imaging in a patient diagnosed with rAAA after non-contrast CT.

CASE REPORT

A 73 year old man presented to the emergency room with diarrhoea and syncope while standing. His past medical history included a mild dementia, high blood pressure, dyslipidaemia, and stage IV chronic kidney failure. The first blood test in the emergency room showed haemoglobin of 12.6 g/dL, creatinine of 1.95 mg/dL, and d-dimer of 18473 ng/mL. The patient was haemodynamically stable.

He was admitted in the internal medicine ward and a thoracic contrast CT scan was performed to rule out pulmonary thromboembolism, because this was the first diagnostic consideration. CT revealed a left ventricular hypertrophy and an aortic arch of 47-mm diameter; nevertheless, there were no signs of pulmonary embolism. Two days later the patient's overall condition worsened; a painful abdominal palpation was noted, he suffered a contrast-induced nephropathy, and acute anaemia was detected in blood tests (creatinine of 2.45 mg/dL and haemoglobin of 9.1 g/dL). An abdominal non-contrast CT scan was performed. Given the renal failure, contrast media was avoided. A rAAA with an extensive retroperitoneal collection was found (Fig. 1).

The patient was taken immediately to the operating room. The non-contrast CT scan was analysed using Horos™ (Horos software ver. 2.0.2, Horos Project, Annapolis, MD,

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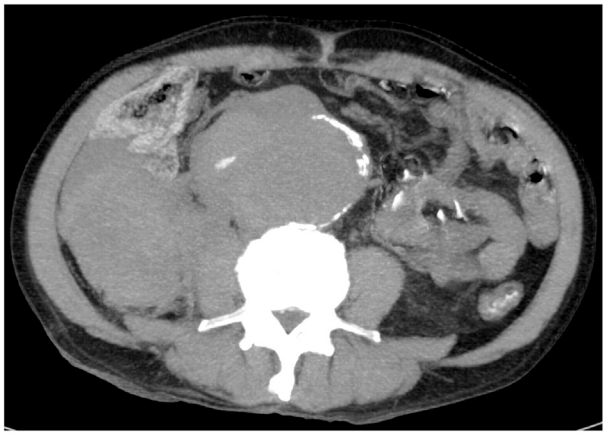

Fig. 1. Non-contrast CT scan showing a ruptured abdominal aortic aneurysm and a right retroperitoneal haematoma.

USA), an open source medical viewer, for aortic measurements and endograft preselection. Then, fusion imaging was prepared using VesselNavigator of Azurion (Philips, Amsterdam, Netherlands). Segmentation of the infrarenal aorta (the process of selection of the pixels corresponding to the region of interest) in this case, because of a lack of contrast media, had to be corrected manually (Fig. 2).[3]

The endograft implantation was performed in a hybrid operating room. Live fluoroscopic images were matched with previous aortic segmentation images. After locating renal arteries with 10 mL of contrast media, a 36 mm Endurant IIs (Medtronic, Santa Rosa, CA, USA) was implanted. The bifurcated graft was completed with a 16 × 16 × 124 mm limb for the left common iliac artery, and 16 × 13 × 124 mm and 16 × 13 × 93 mm limbs for the right external iliac artery. Manual injections of 5 mL of contrast media were employed to locate internal iliac arteries. A left internal iliac occlusion and a right common iliac aneurysm were found. Nester coils (Cook Medical, Bloomington, IN, USA) were deployed in the aortic aneurysm sac and right iliac aneurysm through a parallel catheter. This procedure required 7 mL of contrast media. Remodelling of the endograft was done using a Reliant balloon (Medtronic). Postprocedural control was verified using 15 mL of contrast media: no endoleaks were found and both renal arteries remained patent. A residual dissection was fixed in the left external iliac artery with an Astron Pulsar 8 × 60 mm stent (Biotronik, Berlin, Germany). A total amount of 47 mL of contrast media was used for the whole procedure. The patient remained in the hospital for two weeks because of social concerns; finally he was discharged with a creatinine of 2.05 mg/dL and a haemoglobin of 8.9 g/dL.

One month later, the patient had already recovered his basal renal function (creatinine of 1.85 mg/dL) and from the anaemia (haemoglobin of 11.4 g/dL). Under nephroprotection, a surveillance contrast CT revealed complete aneurysm exclusion with partial resolution of the retroperitoneal collection (Fig. 3).

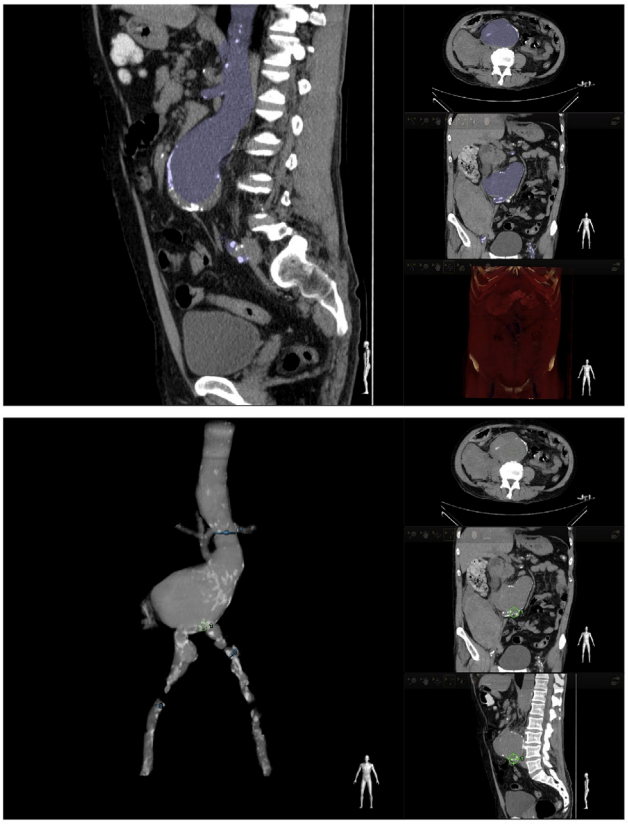

Fig. 2. Manually achieved fusion images using VesselNavigator of Azurion platform (Philips®).

DISCUSSION

An aortic abdominal aneurysm rupture is a life-threatening surgical emergency. A quick process from diagnosis to treatment is essential; nevertheless, an atypical presentation may result in diagnostic delay.[4] Currently, EVAR is the first-line treatment for these patients, when feasible.[5]

High-resolution contrast CT scan provides a reliable diagnosis as well as providing anatomical requirements for EVAR (neck length and diameter, suprarenal and infrarenal angulations, distal fixation site length and diameter, and circumferential calcification and thrombus). Although some thrombus could appear to have higher density than blood (especially in patients with anaemia), a non-contrast CT is limited in this regard.

It is not uncommon to deal with rAAA diagnosed using non-contrast CT in an emergency setting. In the present case, internists were reluctant to use iodinated contrast because the patient suffered from contrast-induced nephropathy. It was decided to use fusion imaging to reduce the iodinated contrast dose during the procedure. Non-contrast CT was used for this purpose in an attempt to avoid another time-consuming contrast CT in a patient with a rAAA and a renal failure.[6–9]

The use of CO_2 instead of iodinated contrast agents for arterial and venous angiography has been reported in many studies.[10,11] CO_2-EVAR is technically feasible and demonstrates a prominent protective effect on renal function.[12]

Fig. 3. Surveillance contrast CT scan.

However, it demands careful consideration of the status of the aortic lumen, which cannot be determined by CO_2 angiography and simple CT alone. Also, IVUS can be employed, during aneurysmal aorta procedures, not only to properly size the aortic stent graft but also to reduce the amount of medium contrast and radiation exposure.[13] Regrettably, these tools are not available at the study centre.

Conclusion

EVAR with fusion imaging after non-contrast CT was safe in a patient with a rAAA. It could be an option in the emergency setting.

CONFLICTS OF INTEREST

None.

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