

Emergency CTA Diagnosis and Successful Endovascular Management of Aorto-duodenal Fistula

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Aorto-enteric fistula is defined as a communication between the aorta and the gastrointestinal tract. It is a rare but life-threatening condition associated with almost 100% mortality without prompt surgical intervention. The most common type of aorto-enteric fistula is the aorto-duodenal fistula. Upper gastrointestinal bleeding is the most common presentation, ranging from a minor haemorrhage to massive life-threatening bleeding.

Computed tomography angiography is the first-line modality for imaging evaluation of suspected aorto-enteric fistula. Surgical treatment of this condition may be open aortic repair, in situ graft replacement if present, or placement of an extra-anatomical bypass.

We present our case of a 71-year-old woman with infected aorto-aortic graft complicated by aorto-duodenal fistula. The patient was successfully treated by aortic Zenith Cook cuff endovascular placement in the emergency setting as a life-saving treatment and a bridge solution to elective surgery.

Keywords: *Aorto-Enteric Fistula; Computed Tomography Angiography (CTA); Endovascular Approach; Life-Saving Treatment; Emergency Setting*

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INTRODUCTION

Aorto-enteric fistula (AEF) is defined as a communication between the aorta and the gastrointestinal (GI) tract. It is a rare but life-threatening condition associated with very high mortality rates without prompt surgical intervention [1].

The aetiology is divided into primary and secondary (more common) causes. Primary AEFs occur in the absence of previous aortic surgery and are uncommon

events, with an incidence of 0.04% to 0.07% [2]. Typically, a large untreated aneurysm erodes into the adjacent bowel; pulsatile pressure is transmitted through a weakened aortic wall, causing pressure necrosis and adhesive granulation tissue between the aorta and adjacent bowel wall, leading to a fistula. Rarer causes of primary AEF are infectious aortitis, penetrating peptic ulcer, tumour invasion, vasculitis, collagen-vascular disorders, and radiation-induced changes [3].

Secondary AEFs have a reported prevalence of 0.5–2.3% and generally occur in patients with previous aortic endovascular prosthesis or reconstruction, typically between the suture line of a vascular graft and the bowel. Fistula may develop due to the combination of pulsatile pressure of the aortic graft on the bowel wall and chronic low-grade infection of the graft, with or without pseudoaneurysm formation [1]. The interval between surgery and the development of fistula can range from months to years [4].

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The most common AEF is the aorto-duodenal fistula. The third part of the duodenum is most commonly involved because of its close proximity to the abdominal aorta, followed by the fourth duodenal part, jejunum, ileum and large intestine [5,6].

Upper GI bleeding is the most common presentation, ranging from a minor haemorrhage to massive life-threatening bleeding. Major haemorrhage may be preceded by transient self-limited haemorrhage ('herald bleed'), which results from mucosal ulceration followed by temporary tamponade by coagulation and bowel loops [2,7]. The classic triad of primary AEFs (upper GI bleeding, abdominal pain, and pulsatile abdominal mass) occurs in only 10–25% of patients [7,8]. In patients with previous aortic reconstruction, sepsis and lower extremity ischaemia may indicate secondary AEF even in the absence of GI bleeding, as infectious graft thrombosis may prevent communication between blood flow and the duodenum, and septic emboli may cause leg symptoms [9,10].

Computed tomography angiography (CTA) is the first-line modality for imaging evaluation of suspected AEF, despite its variable sensitivity (40–90%) and specificity (33–100%). Conventional angiography may be helpful for surgical planning in certain cases [1]. The esophagogastroduodenoscopy (EGD) is useful in diagnosis and in management, but it is reported to have a sensitivity of 24% for secondary AEFs [11].

Treatment of AEF may be open aortic repair or endovascular treatments, such as a cuff, prosthesis and device placement. In the case of secondary AEF, it requires excision of the graft, debridement of infected tissue, bowel repair or resection and revascularisation with in situ graft replacement or placement of an extra-anatomic bypass [3].

Here, we present our case of a 71-year-old woman with infected aortic vascular prosthesis complicated by aorto-enteric fistula. The patient was successfully treated by aortic Zenith Cook cuff endovascular placement in the emergency setting as a life-saving treatment.

Ethical Approval and Informed Consent

The Institutional Review Board for this Case Report was waived. Informed consent was not acquired. All the data referring to the patient were anonymized.

CASE REPORT

We report the case of a 71-year-old woman who presented at the emergency department (ED) of our centre (Ospedale del Mare, ASL Napoli 1 centro, Naples, Italy) in severe haemorrhagic and septic shock, with profuse melena. The patient had undergone aorto-aortic graft placement in a different centre 17 months earlier and had missed the postoperative follow-up.

Laboratory examinations and complete blood count (CBC) revealed:

- Haemoglobin: 9 g/dl,
- Red blood cells: $3.30 \times 10^6/\text{mm}^3$,
- Haematocrit: 29.4%,
- White blood cells: $20.33 \times 10^3/\text{mm}^3$,
- Platelets: $82 \times 10^3/\text{mm}^3$,
- Activated partial thromboplastin time ratio: 0.72,
- C-reactive protein: 5.3 mg/dl.

The patient immediately (<30 minutes) underwent CTA for suspected infection of the aortic prosthesis and active bleeding due to the state of severe haemorrhagic and septic shock. CTA showed a direct connection between the abdominal aorta and the III duodenal portion in the context of severe periaortic adipose tissue thickening due to infection of the previous aorto-aortic graft (Figure 1a). CTA also showed profuse bleeding in the duodenal and jejunal loops lumen (Figure 2), causing profuse melena on admission to the ED, and aerial nuclei in the aortic lumen and periaortic adipose tissue adjacent to the fistula (Figure 1b).

After the CTA diagnosis, the patient urgently (1 hour) underwent life-saving surgical and interventional

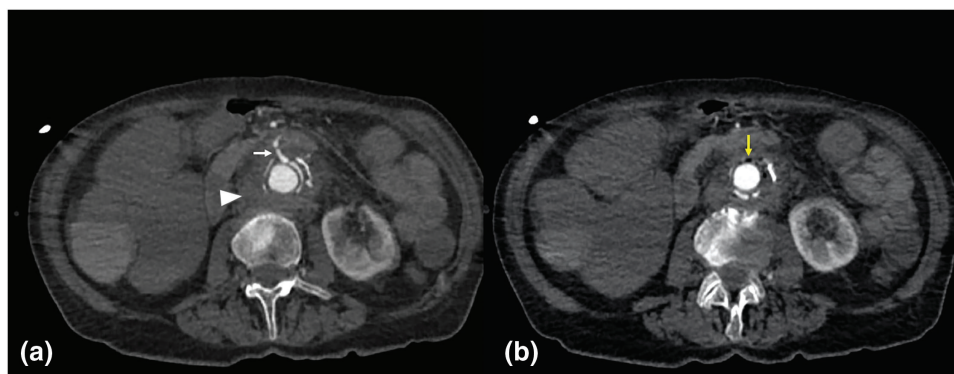


Figure 1 Computed tomography angiography (CTA), axial planes, arterial phase: in (a) a direct connection between the abdominal aorta and the III duodenal portion can be noted (white arrow) in the context of severe periaortic adipose tissue thickening (arrowhead) due to infection of the previous aorto-aortic graft. (b) Aerial nuclei in the aortic lumen can be seen (yellow arrow).

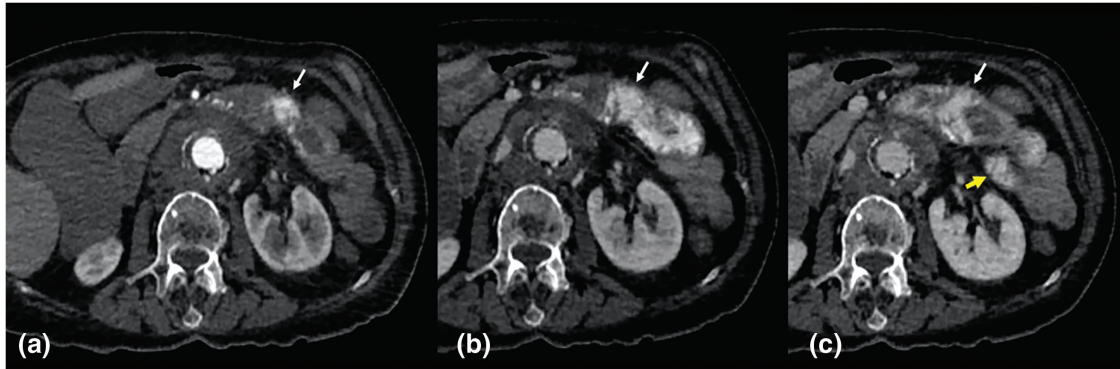


Figure 2 Computed tomography angiography (CTA), axial planes, arterial (a), portal (b) and venous (c) phase: profuse bleeding in the duodenal loops lumen can be seen in (a), (b) and (c) (white arrow). In the venous late phase, the bleeding can be noted also in the jejunal loops lumen (yellow arrow).

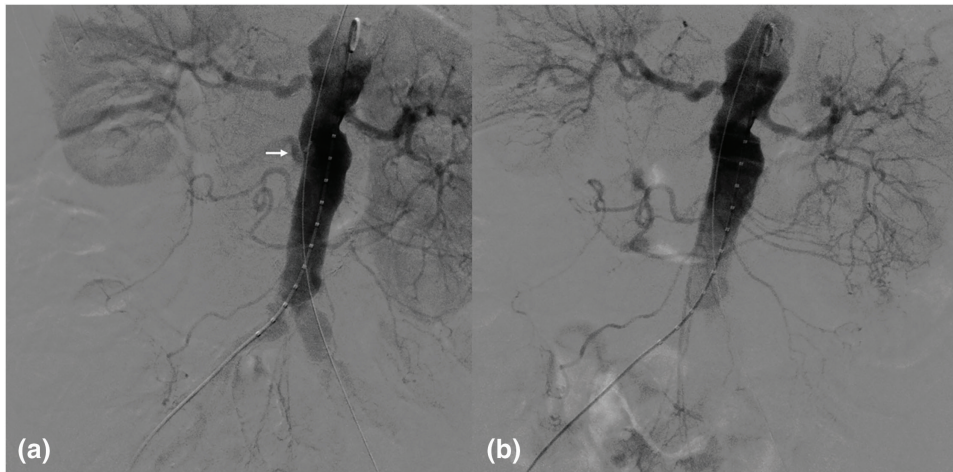


Figure 3 Angiography performed for the endovascular procedure by a vascular surgeon and an interventional radiologist. (a) Extra-aortic bleeding can be seen (white arrow), not visible after Zenith Cook cuff positioning (b).

radiologist treatment by Zenith Cook (ZLBE 28-45) cuff endovascular placement (Figures 3 and 4) as a bridge solution to elective surgery. The treatment was successful.

We chose to use a shorter aortic cuff to simplify the elective surgical approach. In cases such as the one presented, it is critical to resolve the sepsis state and lead the patient in the best possible condition to elective surgery.

The patient's laboratory examinations and CBC gradually improved the day after, with initial restoration to normal values. The same day the patient underwent a follow-up CTA that showed no active bleeding, endoleaks, or blood in the lumen of the bowel loops (Figure 5).

At the physical examination on the second postoperative day, blood pressure values were 140/60 mmHg, heart rate 120 bpm and saturation (SpO₂) 99%.

The patient also underwent blood culture and targeted antibiotic therapy for resolution of the aorto-aortic graft infection.

DISCUSSION

The AEF is a life-threatening condition, with the mortality rate reaching almost 100% in the case of no prompt surgical or endovascular treatment.

Secondary forms of AEF are more frequent than primary forms and may occur in patients with previous aortic interventions, and more frequently in the case of open aortic reconstruction. In the case we presented, the AEF was determined by the complication of the infection of an aorto-aortic graft placed 17 months earlier. Notably, the interval between surgery and the development of fistula can range from months to years [4].

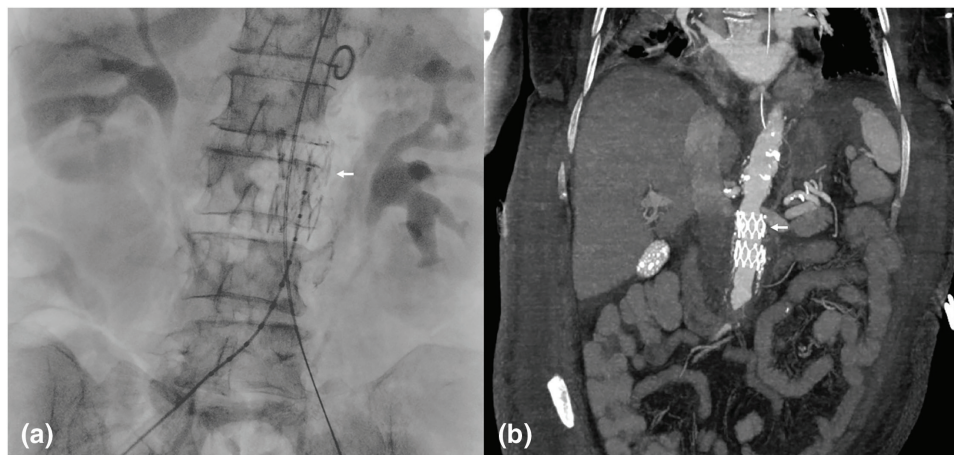


Figure 4 Angiography (a) and computed tomography angiography (CTA) with maximum intensity projection (MIP) reconstructions in the coronal plane (b) in the immediate postoperative follow-up after Zenith Cook cuff placement (white arrows).

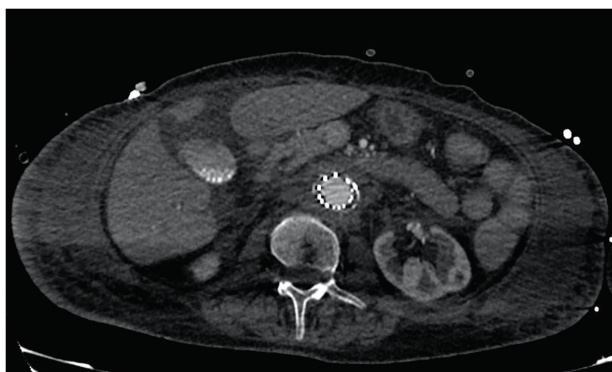


Figure 5 Postoperative follow-up computed tomography angiography (CTA), axial plane: correct cuff position, no active bleeding, endoleaks, or blood in the bowel loops lumen.

Our patient developed aortitis resulting in infection and inflammation of the periaortic adipose tissue up to the walls of the III duodenal portion, leading to the formation of an aorto-duodenal fistula and massive upper GI bleeding. The most common AEF is the aorto-duodenal fistula, especially involving the third part of the duodenum due to its close proximity to the abdominal aorta [5], as in our case.

The clinical presentation of our patient was already advanced, with massive upper GI bleeding at the time of presentation in the ED, probably due to the severe pre-existing infection. Moreover, in our case, the patient was already in septic shock, another common symptom in advanced stage AEF cases [9].

In our case, the diagnosis was made exclusively by CTA, which promptly – less than 30 minutes after the ED admission – showed the direct connection between the abdominal aorta and the III duodenal portion, the

presence of aerial nuclei in the aortic lumen and in the periaortic adipose tissue adjacent to the fistula, and the massive active bleeding in the duodenal and jejunal loops lumen (Figures 1 and 2).

CTA also allowed prompt and correct operative planning, and conventional angiography during the endovascular treatment was helpful to confirm the diagnosis.

In our case, due to the patient's very serious clinical presentation, surgery was performed in an emergency setting by Zenith Cook cuff endovascular placement by the vascular surgeon and the interventional radiologist as a life-saving treatment and a bridge solution to elective surgery. We decided to use this cuff specifically for the patient's surgical needs, but there are a variety of additional devices suitable for temporarily endovascular treatments, such as stent grafts usable without suprarenal fixation.

CONCLUSIONS

AEF is a rare pathological entity that most commonly involves the duodenum.

Upper GI bleeding is the most common presentation, ranging from a minor haemorrhage to massive life-threatening bleeding, followed by sepsis and lower extremity ischaemia in the case of secondary AEF. CTA is considered the first-line imaging modality in the diagnosis of AEF. Conventional angiography and EGD may be useful in the diagnosis and management. Treatment of AEF is generally an open aortic repair.

Here we presented our case of a 71-year-old woman with infected aorto-aortic graft complicated by aorto-duodenal fistula, successfully treated by aortic Zenith Cook cuff placement as a bridge solution to elective surgery.

Ethics Statement

- (1) All the authors mentioned in the manuscript have agreed to authorship, read and approved the manuscript, and given consent for submission and subsequent publication of the manuscript.
- (2) The authors declare that they have read and abided by the JEVTM statement of ethical standards including rules of informed consent and ethical committee approval as stated in the article.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Author Contributions

All the authors made a substantial contribution to the manuscript and participated sufficiently in submission to take public responsibility for its content. Publication was seen and approved by all authors and by the responsible authorities where the work was carried out.

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