



## Case Report

# When an Aortic Prosthesis is Unsuitable: A Rare Case of Prosthetic Aortitis Caused by Clostridium Perfringens

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### Abstract

In the past decade, advancements in endovascular techniques have revolutionized the management of abdominal aortic aneurysms (AAA). However, along with these advancements, clinicians face a rising incidence of complications, notably infections of vascular prostheses. Mycotic aortic aneurysm (MAA) represents a rare yet potentially life-threatening complication characterized by infection-induced damage to the native aorta. While microbiology predominantly implicates skin commensals, various pathogens, including Clostridium perfringens (CP), have been reported. Markedly, no cases of MAA caused by CP involving prosthetic material have been documented. Here, we present a unique case of a 76-year-old patient with MAA and abdominal prosthetic aortitis caused by Clostridium perfringens, accompanied by a comprehensive literature review.

**Keywords:** Abdominal Aortic Aneurysms; Mycotic Aortic Aneurysm; Clostridium Perfringens

### Introduction

Abdominal aortic aneurysm (AAA) poses a significant clinical challenge, with potentially dire consequences if left untreated. Recent decades have witnessed remarkable advancements in surgical and endovascular techniques, enhancing patients' life expectancy [1]. However, these interventions expose clinicians to various complications, notably infectious ones. Mycotic aortic aneurysm (MAA), primarily attributed to bacteria such as staphylococci, streptococci, and salmonellae, occasionally involves less common microorganisms such as Clostridium species [2]. While cases of MAA caused by Clostridium septicum (CS) and difficile (CD) have been documented, occurrences involving

Clostridium perfringens (CP) are exceedingly rare, particularly in association with prosthetic material. This report presents the first documented case of MAA affecting an aortic prosthetic valve attributed to CP, accompanied by a thorough literature review.

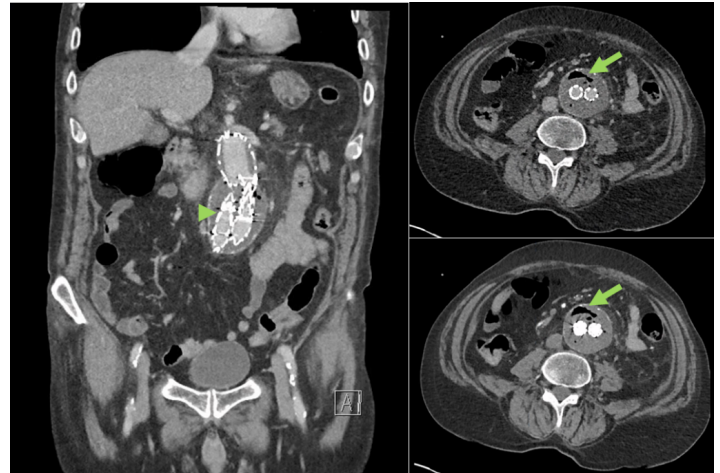
### Case Presentation

A 76-year-old patient was admitted to emergency with diffuse abdominal pain for three days, accompanied by nausea and vomiting. He denied experiencing fever, chills, or any other significant gastrointestinal symptoms. His past medical and surgical history was remarkable for a previously treated sub-renal abdominal aortic aneurysm with an endovascular stent graft (endovascular repair of abdominal aneurysm (EVAR)) in 2020. Additionally, he had a history of bilateral renal artery stenosis, chronic renal failure stage KDIGO G3b (nephroangiosclerosis), seronegative rheumatoid arthritis, COPD GOLD2, and chronic constipation.

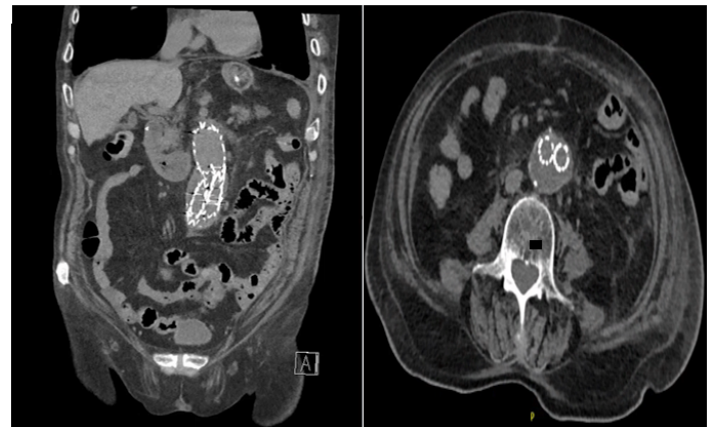
His treatments mainly include aspirin, methylprednisolone, methotrexate, folic acid, amlodipine, bisoprolol, simvastatin, and ipratropium/phenoterol. The parameters on arrival were as follows; a blood pressure of 130/60mm Hg, a heartbeat rate of 100, a temperature of 36.6°C, an oxygen saturation of 97% on room air, and a respiratory rate of 20 per minute. On clinical examination, cardiac auscultation revealed a systolic murmur (2/6) at the aortic focus and pulmonary auscultation was normal. However, an abdominal examination revealed a palpable and tender mass in the hypogastrium, along with a moderate degree of tenderness in the hypochondrium and left flank. Neurological examination findings were reassuring, with a Glasgow Coma Scale score of 15/15. Bearing in mind the patient's condition at the time of consultation, complementary exams were realized.

Arterial blood gas showed a pH of 7.43, pCO<sub>2</sub> of 36mm Hg, PaO<sub>2</sub> of 75mm Hg, and normal lactate of 0.8mmol/L. Laboratory investigations revealed anemia with a hemoglobin level of 9.3 g/dL and a hematocrit of 27.9% (normal > 40%). Thrombocytopenia was noted with a platelet count of 69,000/μL. Additionally, there was leukocytosis with a white blood cell count of 7,870/μL and markedly elevated inflammatory markers, including a C-reactive protein level of 477 mg/dL. Renal function tests indicated severe renal impairment, with a serum creatinine level of 4.15 mg/dL and an estimated glomerular filtration rate (GFR) of 13 mL/min/1.73 m<sup>2</sup>. Additionally, pairs of blank blood cultures were taken.

Given the patient's bi-cytopenia (anemia and hypoplaquetosis), clinical features, and medical and surgical background, an abdominal computed tomography (CT) scan without and then with contrast injection (with significant pre-hydration) was requested despite the patient's severe renal insufficiency. The examination revealed a sub-renal abdominal aortic aneurysm treated by aorto-iliac stent grafting. Importantly, the presence of gas within the aneurysm suggested a potential aorto-digestive fistula. Multiple lateral-aortic lymphadenopathies were also noted, with no evidence of gastrointestinal distension or peritoneal, hepatic, or biliary tract effusion (figure 1). Considering these findings, the patient was referred to the operating room by the vascular surgeon to treat the fistula. An extensive debridement and cleaning procedure was performed, with multiple samples taken from the aneurysmal shell and peritoneum. Blood cultures and intraoperative swabs came back positive for clostridium perfringens. Antibiotic therapy was initiated preoperatively with Aztreonam and clindamycin, then readapted with clindamycin and metronidazole. The clinical-biological and radiological evolution was favorable after a lengthy hospital stay (figure 2), emphasizing the efficacy of the multidisciplinary management of this complex case.



**Figure 1:** Thoracoabdominal computed tomography scan showing abdominal sub-renal aortic aneurysm treated with aorto-iliac stent graft (green arrowhead), with the presence of air in the aneurysm (green arrow).



**Figure 2:** Thoracoabdominal computed tomography scan realized after 1 month showing no more air in the aneurysm.

## Discussion

The most common causes of mycotic aortic aneurysms (MAA) are bacteria such as *Staphylococcus*, *Streptococcus*, and *Salmonella* spp [3]. Among these organisms is the clostridium species, characterized by its gram-positive nature, anaerobic metabolism, and ability to produce spores. Although it is rare to find these species, the literature describes a few cases of MAA caused by clostridium *Septicum* (CS) and *difficile* (CD) [4-5]. To our knowledge, three cases of *Clostridium perfringens* (CP) have been reported [6-8], but this article is the first to describe an MAA due to CP on an aortic prosthesis.

Given our case, the presence of gas surrounding the abdominal aortic prosthesis or peripheral arteries is typical of MAA, which can even lead to aorto-digestive fistulas [9]. A particular feature of the clostridium spectrum is the ability to induce the proliferation of clostridia in tissues under low acidic pH and reduced oxidation-reduction conditions, such as in cases of vascular damage, necrosis, or tissue hypoxia with lactic acid accumulation [9]. Furthermore, microbiological genetics are sometimes astonishing, and we know that certain subtypes of the same bacterial spectrum share similar genetic characteristics, as in the *Clostridium* genus. According to the literature, clostridia infections are often reported to be associated with malignant tumors of the gastrointestinal or hematopoietic system, especially CS and CD subtypes [10-11]. Therefore, CP could also be implicated in the risk of developing colonic neoplasia. In our case, the patient underwent a follow-up colonoscopy three months later, which fortunately revealed no tumors. Accordingly, we believe it might be advisable to recommend a follow-up colonoscopy for this type of case. To date, there is a considerable lack of data and cases concerning the link between CP found in MAA and the risk of developing neoplasia. A larger number of cases would be needed to assess this correlation.

Several risk factors are associated with forming MAA, and the underlying pathophysiology is not fully elucidated. Bacteria may invade the abdominal aorta by penetrating the aortic wall via several pathways, including the hematogenous one, as in our patient. Additionally, MAA tends more likely to arise in people with risk factors such as atherosclerosis, pre-existing aneurysms, previous infections such as endocarditis, purulent pericarditis, soft tissue infection, sepsis, or even compromised immunity due to conditions such as chronic glucocorticoid therapy, post-transplantation, chemotherapy, acquired immunodeficiency, surgical complications, aortic prosthesis, and malignancy which may also enhance the risk [8,12]. Among the aforementioned risk factors, our patient had a long history of cardiovascular disease and autoimmune rheumatic disease treated with long-term immunosuppressants and corticosteroids, all of which may have contributed to the development of CP and our aneurysm on the abdominal aortic prosthesis.

In general, MAAs are treated with rapid surgery and prolonged antibiotic therapy. Surgical strategies include open or endovascular repair with the placement of a prosthesis [13]. No randomized controlled trials comparing the different surgical methods have been published to date, and an individualized approach is recommended for each patient based on a consensus recommendation [14]. Additionally, a recent retrospective study published by Ljungquist et al. has shown that in the majority of patients, it has been found that infections of aortic vascular grafts

and endografts can be effectively handled by rigorous identification of the microbiological etiology, the use of targeted antibiotics, most often on the biofilm to eradicate the infection, without surgical removal of the graft [15]. Nevertheless, it is worth emphasizing that in surgically suitable patients, management without surgical removal of the graft or stent is not in line with current commonly accepted guidelines. Thus, this therapeutic protocol may only be considered in specific cases such as elderly patients and those with severe co-morbidities, as in our case.

A final important point is the rapid administration of antibiotics in treating clostridia infections. Previous studies have emphasized the need for rapid administration of antibiotics to treat clostridia infections. Penicillin is often considered the primary antibiotic of choice, while meropenem, imipenem, third- and fourth-generation cephalosporins, metronidazole, and vancomycin are considered secondary options. Prolonged antibiotic therapy is recommended for at least 6 to 8 weeks after surgery [6].

## Conclusion

We reported the first case of mycotic prosthetic aortitis caused by *Clostridium perfringens* and the difficulties encountered in its management, which requires a multidisciplinary approach involving emergency, internists, infectiologists, intensive care specialists, and vascular surgeons. It is an uncommon but relatively life-threatening condition associated with very high mortality rates if not caught early. The mortality rate may be lowered by early diagnosis and comprehensive management strategies, including surgery and prompt administration of appropriate antibiotics.

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**Data Availability Statement:** The data used and analyzed in this study are available from the corresponding author on reasonable request.

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