Visceral Mycotic Aneurysm: Superior Mesenteric Artery Aneurysm Caused by *K. pneumoniae*

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Abstract

We herein report a rare case of mycotic aneurysm of the superior mesenteric artery caused by *Klebsiella pneumoniae*. A 66-year-old man, a known case of hypertension and aorto-oesophageal fistula with stented aorta in 2010 and 2018, presented to the emergency department multiple times over 2 months with severe postprandial abdominal pain associated with vomiting and fever. On his last presentation, the obtained blood cultures grew ESBL positive *K. pneumoniae* and a repeated computed tomography (CT) showed a growing aneurysm at the origin of the ileocecal branch of the superior mesenteric artery measuring 17 × 10 mm (the aneurysm was 8 × 7.5 mm in the CT angiography on the previous admission). Extensive workup did not reveal the underlying cause of the mycotic aneurysm, thus we believe the cause to be the infected aortic stent, leading to bacteraemia and vegetations to the mesenteric artery causing the aneurysm. The management plan was placed by a multidisciplinary

team consisting of vascular surgeons and infectious disease specialists along with review from a dietician to evaluate the patient's nutritional status. The patient was started on total parenteral nutrition due to his postprandial pain and on antibiotic therapy according to the infectious disease team's recommendation. He underwent surgical resection of the mycotic aneurysm, which showed a thrombosed aneurysm in the jejunoileal mesenteric area. The histopathology of the resected tissue demonstrated inflammatory aneurysm of the mesenteric artery. Following the surgery, the patient continued his antibiotic therapy and was discharged on the 13th post-operative day with follow-up appointments in the vascular surgery and infectious disease clinic.

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Introduction

The incidence of superior mesenteric artery (SMA) aneurysms is quite rare [1], and most of the cases reported are caused by an infectious aetiology. Due to the vague and nonspecific presentation of visceral mycotic aneu-

rysms, a high index of suspicion is required for their diagnosis. In this case report, we present a case of SMA aneurysm caused by *Klebsiella pneumonia*, an organism rarely reported to be a cause of mycotic aneurysms, that was successfully treated with surgical resection of the aneurysm along with long-term antibiotic therapy.

Case Presentation

A 66-year-old man presented to the emergency for the third time over the past month with severe abdominal pain. He is hypertensive and a known case of aorto-oesophageal fistula of an unknown cause. His aorta was stented twice: first in 2010 (with a 5 cm stent) and again in 2018 where the covered aortic stent was extended proximally and distally due to re-bleeding in the oesophagus (with a 10 cm stent-in-stent). After the re-stenting, he was discharged on levofloxacin for 28 days and lifelong plavix.

On his first admission, his abdominal pain was of 2 days duration and was postprandial. A computed tomography (CT) angiography showed thrombotic occlusion and inflammation of the ileocolic branch of the SMA with no sign of bowel necrosis. His blood culture did not grow any organisms. On clinical examination, the patient had a surgical abdomen, thus he underwent an exploratory laparoscopy which was negative for bowel ischemia. He was discharged after 10 days on warfarin and plavix in view of his thoracic aortic stent.

His second admission took place 2 days after his discharge, with the same episodes of abdominal pain. CT angiogram showed inflammatory changes in the mesentery with the development of aneurysms at the origin of the ileocolic branch of the SMA (measuring 8×7.5 mm). The blood culture was positive for *Streptococcus constellatus*, and he was started on vancomycin and meropenem. He had good dental hygiene and further search for the source of septic emboli was negative. A blood culture done after 2 days showed no growth, and he was discharged on the 11th day on levofloxacin and warfarin.

On his last presentation 1 week later, he had severe abdominal pain along with nausea, vomiting, and fever. On examination, his temperature was 39.1°C , heart rate was 133, and blood pressure was 148/102. He had periumbilical tenderness relieved almost completely after analgesia, and no guarding or rigidity was noted.

His laboratory data showed normocytic anaemia (haemoglobin 9.7 h/L) and raised inflammatory markers (white blood cell count $21.5 \times 10^9/\text{L}$, C-reactive protein 326.2 mg/L, procalcitonin 98.28 ng/mL). His INR was 3.94, therefore his warfarin was held till INR reached a therapeutic level. Follow-up CT angiogram showed an interval increase in the size of previously visualized aneurysm, now measuring 17×10 mm, shown in Figures 1 and 2, and the blood culture was positive for ESBL positive *K. pneumoniae* which was sensitive to Meropenem. His urine culture was negative, and his transthoracic echo showed no vegetations.

The patient was started on total parenteral nutrition due to his postprandial pain and on Meropenem (for 7 days) then Vancomycin (for 7 days) and Ertapenem (for 14 days). He underwent resection of mesenteric mycotic aneurysm that showed a thrombosed aneurysm in the jejunoileal mesenteric area, shown in Figures 3 and 4. The surgery was done through a midline laparotomy inci-

Fig. 1. Coronal view of repeated CT angiography demonstrating a SMA aneurysm measuring 17×10 mm in size. SMA, superior mesenteric artery; CT, computed tomography.

Fig. 2. Axial view of the repeated CT angiography. CT, computed tomography.

sion. Careful dissection of the aneurysm was performed to preserve the intestinal vascular arcades. Delta shaped resection of the mass was done, and bowel viability was confirmed by careful inspection of the bowel along with intraoperative Doppler. The histopathology of the resected tissue demonstrated inflammatory aneurysm of the mesenteric artery, and the sent tissue cultures showed no growth.

The patient tolerated the surgery well and the post-operative period was uneventful. He was kept on total parenteral nutrition for 5 days post-operatively, then on an overlap of parenteral and oral nutrition for 2 days before resuming an oral liquid diet.

He was discharged on the 13th post-operative day with warfarin 5 mg (target INR of 2.5) and cilostazol as per vascular surgery recommendation as well as intravenous ertapenem continuation for 1 week in the clinic as per IDU recommendation. He was seen in both vascular surgery and infectious disease clinic 2 weeks after

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Fig. 3. SMA aneurysm intraoperatively.

Fig. 4. The excised SMA aneurysm. SMA, superior mesenteric artery.

his discharge. He denied postprandial pain, thus his diet was advanced to a mashed diet. His warfarin dose was kept as it is as his INR level was within the target range. His repeat blood cultures were negative thus his antibiotics were discontinued by the infectious disease team, and he was discharged from their clinic. He did not show up for further clinic appointments with vascular surgery due to the COVID-19 pandemic, but the team will be contacting the patient to continue his follow-up.

Discussion

It is difficult to estimate the true incidence rate of visceral aneurysms as there is a high rate of asymptomatic cases; however, it is thought that they account for 0.1–0.2% of aneurysms [1–3]. Splenic artery aneurysms make up the majority of visceral aneurysms, while SMA aneurysms make up just 5.5% [1, 3]. Unlike other visceral aneurysms, many cases of SMA aneurysms are symptomatic [3], presenting with nonspecific symptoms such as abdominal pain, fever, weight loss, nausea, and vomiting [4]. Our patient presented with fever and postprandial pain due to mesenteric angina caused by SMA aneurysm. The median age of development of SMA aneurysms is 36 years. Most of these aneurysms are secondary to other medical conditions, with males having a significantly higher risk than females [4].

Direct inoculation of bacteria occurs in vessels with abnormal intima [2]: either by a preceding infection, atherosclerosis, or a pre-existing aneurysm [3]. Mycotic or infectious causes are the most common aetiologies for the

development of SMA aneurysms, with *Streptococci* being the most reported cause followed by *Staphylococci* [4]. *Klebsiella*, the organism grown in the blood culture of our patient, has been reported in literature as a much rarer cause [5, 6]. *K. pneumoniae* is a gram negative, encapsulated, non-motile bacterium [7] normally found as a part of the normal flora of human intestinal tract, but it is also an opportunistic pathogen [8] causing pneumonia, bacteraemia, and intra-abdominal infections [6]. Most cases of mycotic SMA aneurysms have diabetes mellitus as a risk factor [6]; however, our patient was not diabetic. The term “cryptogenic aneurysm” describes cases where no identifiable primary or secondary cause is found [2].

As the presentation of such cases is nonspecific, you need a high index of suspicion for diagnosis [2]. Diagnosis relies on detecting the aneurysm via imaging modalities and identifying the causative microorganism with blood cultures [4]. Imaging of choice is CT angiography [2, 4] and suggestive features of an infective cause include localized oedema, soft tissue stranding, perivascular or intravascular gas, and disruption of calcification or extravasation of dye in ruptured cases [4]. USS has less sensitivity compared to CT as overlying bowel obscures imaging [3]. If no local source of infection is detected, further workup including echocardiography should be done to rule out emboli from infective endocarditis [4], which was negative in our patient.

Owing to the high rupture rate of SMA aneurysms compared to other visceral aneurysms (38–50%, with an overall mortality of 30% in cases of rupture) [3], it is gen-

erally advised to treat all diagnosed infected aneurysms. The treatment of choice is antibiotics -generally started before intervention [3] along with surgical resection of the infected aneurysm [1, 4]. This is followed by a prolonged course of antibiotics for a minimum duration of 6 weeks [9]. The surgical resection may also include bowel resection depending on the collateralization of the bowel [1]. In cases requiring bypass, an autologous graft, for example, from the saphenous vein [9] is recommended over prosthetic conduits as they have a lower risk of secondary infection and need for further re-intervention [2]. During the surgical resection for our patient, an intraoperative Doppler confirmed the viability of the bowel, so all the bowel was preserved.

Conclusion

Mycotic aneurysms in the SMA are rare and a high index of suspicion is required for their diagnosis as their presentation is nonspecific. It is of most importance to obtain blood cultures early and to look for a source of the infection. Surgical resection should always be considered as a retained mycotic aneurysm is a source of dissemination, sepsis, and possible rupture. In addition, antibiotics should be administered prior to resection of the aneurysm and for a duration no <6 weeks after the operative management. The management of mycotic aneurysms requires a multidisciplinary team involving vascular surgeons and infectious disease specialists for the resection and optimization of the antibiotic therapy.

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Statement of Ethics

Ethical approval was not required for this case report in accordance with the Dubai Scientific Research Ethics Committee policies. Written informed consent for publication of the case report and images was obtained from the patient.

Conflict of Interest Statement

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Author Contributions

All the authors were involved in the acquisition and interpretation of the data, and the article's conception and design, and the final approval of the version to be published.

Data Availability Statement

All data and images related to this case report are included in this study. Further requests may be addressed to the correspondence author.