# Successful endovascular treatment in a COVID-19 patient with mycotic aortoiliac aneurysm due to *Salmonella typhi*: a case report

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This article was published on 8 Feb 2024 at www.hkmj.org.

Hong Kong Med J 2024;30:72–4
https://doi.org/10.12809/hkmj2210531

## Introduction

Conventional surgical options for mycotic aneurysm include ligation or excision with in situ or extra-anatomical reconstruction. Endovascular stenting in the presence of sepsis is controversial but may be the preferred management for critically ill patients who are deemed very high risk for open intervention.[1] Mycotic aneurysms due to *Salmonella typhi* are extremely rare, with only two cases described in the literature.[2]

We report a coronavirus disease 2019 (COVID-19)–positive patient who presented with severe abdominal pain and back pain and who was subsequently diagnosed with a mycotic aortoiliac aneurysm. Repeated blood and stool cultures yielded *S typhi*. He was successfully treated with endovascular stent graft repair and by postoperative long-term antibiotics.

## Case presentation

A 56-year-old frail malnourished man with a history of diabetes mellitus presented with a 3-week history of progressively worsening malaise and abdominal and back pain. He had a fever of 38.1°C. Clinical examination revealed tenderness over the central and left lower quadrant of the abdomen. Initial blood tests noted a haemoglobin level of 13.5 g/dL and an elevated total white cell count at $13.58 \times 10^9$. Chest radiograph was unremarkable, but emergency computed tomography scan demonstrated a saccular aortoiliac aneurysm involving the distal aorta and the left common iliac artery (Fig a and b). Blood cultures were repeatedly positive for *S typhi*. The patient was also tested positive for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) on admission screening necessitating patient isolation.

Infection control specialists and microbiologists were consulted for multidisciplinary management. The patient was started on intravenous meropenem, and fever resolved after 24 hours. Nonetheless in view of persistent symptoms, emergent endovascular intervention was performed 3 days following admission. Angiogram confirmed the position and extent of the mycotic aneurysm (Fig c). The aortic bifurcation was narrow (14.6 mm × 10.8 mm) and the aortic diameter was small at 16 mm. Thus, we opted to use an aorto-uni-iliac stent graft (Endurant II; Medtronic, Galway, Ireland). The distal end of the stent graft was deployed at the distal right common iliac artery. The left internal iliac artery was embolised with a 6 mm × 20 mm coil (Interlock detachable coils; Boston Scientific, Marlborough [MA], US), and the left external iliac artery with an Amplatzer vascular plug (Abbott, Abbott Park [IL], US). The left lower limb was revascularised with a femoral-femoral bypass using a 7-mm ringed polytetrafluoroethylene vascular graft (Advanta VXT; Getinge, Gothenburg, Sweden). Completion angiogram showed successful exclusion of the aortic and left common iliac artery aneurysm (Fig d). The patient's discomfort improved. He was prescribed intravenous meropenem for 6 weeks followed by lifelong oral azithromycin based on culture sensitivity results and the recommendation of microbiologists. Follow-up computed tomography scan at 1 month (Fig e) and 3 months (Fig f) postoperatively showed thrombosis and successful endovascular exclusion of the mycotic aneurysm.

## Discussion

To the best of our knowledge this is the first published case of a COVID-19–positive patient with *S typhi* aortoiliac mycotic aneurysm. *Salmonella typhi* is responsible for typhoid fever that is still endemic in some South Asian and African countries. Symptoms are primarily gastrointestinal with nausea and diarrhoea but extraintestinal complications such as aortitis and endocarditis may occur in the elderly or immunocompromised individuals.[3]

*Salmonella typhi* is an exceedingly rare cause of mycotic aneurysm. Only one previous report has suggested the bacteria as a culprit. Guo et al[2] showed that most *Salmonella* mycotic aneurysms were caused by non-typhoidal *Salmonella* species such as *Salmonella enteritidis* (30%) and *Salmonella choleraesuis* (20%) with *S typhi* responsible for only 2% of cases in this cohort. The exact mechanism of

 

typhoid-related aortic infection is unknown, but possibilities include bacteraemia following bacterial invasion of the gut mucosa, with seeding to the aortic wall and subsequent aneurysmal degeneration. Gallstones may provide a nidus for persistent infection with possible contiguous spread to nearby vasculature. The persistence of *S typhi* in mesenteric lymph nodes may contribute to relapsing typhoid fever, resulting in disseminated infection long after the initial presentation.[4] Presumably, the presence of *S typhi* in the para-aortic and para-iliac lymph nodes could erode to the surrounding blood vessels with subsequent aneurysm development.

Our patient was noted to be positive for SARS-CoV-2 (ie, COVID-19 positive) during routine admission screening. This may have important implications in the pathogenesis, diagnosis and subsequent management of many diseases. Due to the ubiquitous spread of the virus, there have been increasing reports of concurrent infection of SARS-CoV-2 with local endemic pathogens. A case report in 2021[5] documented co-infection with both SARS-CoV-2 and *S typhi* in a 14-year-old boy returning to Canada from Pakistan. This case report concluded that since the potential presentation of both disease entities would include fever and gastrointestinal disturbance, the presence of COVID-19 may have confounded the diagnosis of other infections for clinicians unfamiliar with typhoid fever. This diagnostic bias has also been observed in countries where typhoid fever is endemic with cases of early typhoid fever initially treated as COVID-19 infection. This resulted in a delay in prescribing appropriate antibiotic treatment and possible progression to life-threatening complications such as intestinal perforation.[6] The co-epidemic of COVID-19 and *S typhi* in some Asian countries placed a heavy burden on local health care resources. Insufficient medical resources combined with delayed diagnosis and treatment contributed to increased mortality from typhoid fever in patients who may previously have made an uneventful recovery.

Co-infection with SARS-CoV-2 and *S typhi* may contribute to the pathogenesis and progression of mycotic aneurysm. The relationship between SARS-CoV-2 and mycotic aneurysms may be explained by the immunosuppressive as well as pro-inflammatory effects of COVID-19 infection. Tian et al[7] demonstrated that SARS-CoV-2 caused immunosuppression in the early stages of infection via suppression of chemokine signalling and immune cell response. In our patient, immunosuppression due to diabetes mellitus and recent COVID-19 infection may have resulted in increased risk of bacterial seeding and colonisation of the aorta. Contemporary literature also suggests that COVID-19 may contribute to aneurysmal development by upregulation and elaboration of proinflammatory mediators and chemokines by binding to angiotensin-converting enzyme 2 receptors on host cells.[8] Current concepts of SARS-CoV-2 infection and aneurysm pathogenicity suggest that COVID-19 may theoretically augment

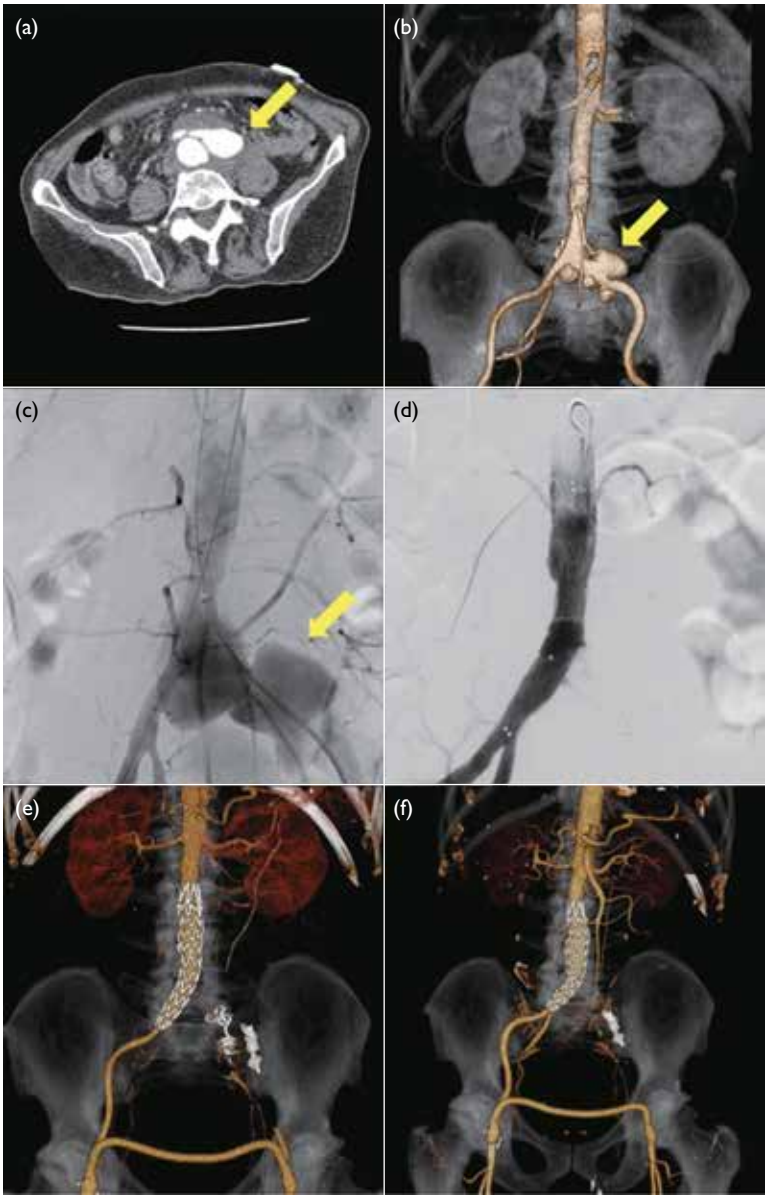


FIG. (a and b) Emergency computed tomography (CT) showing the mycotic aneurysm involving the aortoiliac arteries (arrows). (c) Intraoperative angiogram showing the enlarging aortoiliac aneurysm (arrow), successfully excluded following embolisation of the left internal iliac artery and external iliac artery, with deployment of an aorto-uni-iliac stent graft (d). Follow-up CT at 1 month (e) and 3 months (f) postoperatively showing successful thrombosis and endovascular exclusion of the mycotic aneurysm

progression of aneurysms, the impact of which may become clearer as the pandemic progresses.

Open operative management of mycotic aneurysm has been gradually replaced by endovascular options, with many studies demonstrating effectiveness and durability of the latter.[9] Riley and Teixeira[10] documented long-term durability of endovascular intervention in infected pseudoaneurysms. In our patient, we were able to successfully exclude the aneurysm with an endovascular approach, but long-term follow-up and surveillance imaging is essential to guarantee durability. In terms of his COVID-19 infection, the patient did not develop any respiratory symptoms nor were any abnormalities noted on chest radiographs, and no specific therapy was provided.

In conclusion, typhoid fever remains a major worldwide public health concern. This is the first case in the world's contemporary literature of a *S typhi* mycotic aortoiliac aneurysm in a patient infected with COVID-19. This report emphasises the importance of early tertiary vascular referral and prompt multidisciplinary management involving microbiologists, infection control specialists, and vascular surgeons. We were able to control the sepsis with timely endovascular treatment yielding good mid-term results. Although the global situation regarding COVID-19 is improving and our understanding of COVID-19 is increasingly well developed, this case report aims to raise awareness among readers about the possible impact of COVID-19 on the diagnosis, presentation, and development of other pathologies.

## Author contributions

Concept or design: YC Chan.
Acquisition of data: SE So.
Analysis or interpretation of data: SE So.
Drafting of the manuscript: SE So.
Critical revision of the manuscript for important intellectual content: YC Chan, SW Cheng.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

## Conflicts of interest

All authors have declared no conflicts of interests.

## Funding/support

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## Ethics approval

The patient was treated in accordance with the Declaration of Helsinki and provided informed written consent to publication of this report.

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