

# Mycotic Pseudoaneurysm of Thoracic Aortic Caused by Salmonella Paratyphi A: A Case Report

Ying Han <sup>1,\*</sup>, Yue Zhang <sup>1,\*</sup>, Gege Gong<sup>2</sup>, Cehua Ou <sup>1</sup>, Fubo Li <sup>1</sup>

<sup>1</sup>Department of Pain Management, The Affiliated Hospital of Southwest Medical University, Luzhou, People's Republic of China; <sup>2</sup>Department of Physical Diagnosis, The Affiliated Hospital of Southwest Medical University, Luzhou, People's Republic of China

\*These authors contributed equally to this work

Correspondence: Fubo Li; Cehua Ou, Email [xuxu0016@swmu.edu.cn](mailto:xuxu0016@swmu.edu.cn); [oucehua@swmu.edu.cn](mailto:oucehua@swmu.edu.cn)

**Background:** Mycotic pseudoaneurysm, also known as infectious pseudoaneurysm, is a severe disease with a high mortality rate. Although Salmonella infection is a common etiological factor for mycotic pseudoaneurysm, Salmonella paratyphi A infection causing mycotic pseudoaneurysm is extremely rare. Endovascular therapy has been described as a feasible treatment for mycotic pseudoaneurysm.

**Case Presentation:** A 63-year-old female patient had a thoracic aortic pseudoaneurysm caused by Salmonella paratyphi A infection. The patient associated with diabetes had a fever, abdominal pain, and low back pain, who was successfully treated using endovascular stents treatment and antibiotics.

**Conclusion:** Salmonella paratyphi A is a bloodstream infection bacterium with the ability to cause mycotic pseudoaneurysm. To treat mycotic pseudoaneurysms of the thoracic aorta, endovascular stent-graft treatment combined with antibiotics is an alternative treatment for patients who cannot tolerate open surgery.

**Keywords:** infectious pseudoaneurysm, bloodstream infection, endovascular treatment, antibiotic

## Background

Salmonella paratyphi consists of Salmonella paratyphi A, Salmonella paratyphi B and Salmonella paratyphi C. Salmonella paratyphi strains are human host-restricted organisms that cause para-typhoid fever and patients can have symptoms such as fever, headache, diarrhea. Salmonella species has a strong affinity for large blood vessels and can easily adhere to the damaged vascular wall, which can cause the rare disease—mycotic aneurysm.<sup>1</sup> Thirteen out of 76 carotid artery pseudoaneurysm cases due to Salmonella species has been reported in the literature.<sup>2</sup> Although Salmonella species is the second most common isolated organism in mycotic aneurysms, Salmonella paratyphi A infection causing mycotic pseudoaneurysm is extremely rare.<sup>3</sup>

Mycotic aneurysm is a rare and fatal disease that can be divided into a true aneurysm or a pseudoaneurysm.<sup>4</sup> After the artery is damaged, blood flows out of the arterial wall, forming a local hematoma on the arterial wall. The local fibrous tissue wraps around it to form a false lumen, which is clinically called a pseudoaneurysm. The normal arterial wall can resist bacteria, thus the incidence of native arterial infectious pseudoaneurysm is very low. Infected aortic aneurysms account for approximately 1% of all aortic aneurysms.<sup>5</sup> It often occurs in immunocompromised patients, such as those with AIDS, diabetes mellitus, or active cancer.<sup>6</sup> Salmonella infection is a common cause of mycotic aneurysms, second only to Staphylococcus aureus.<sup>1</sup> Mycotic aneurysm develops rapidly, and the incidence of its rupture is higher than that of arteriosclerotic aneurysms. Mycotic aneurysm requires early diagnosis and treatment.<sup>7,8</sup>

The standard treatment is usually surgery combined with long-term antibiotics therapy.<sup>9</sup> However, traditional surgery is quite traumatic, causing severe bleeding and complications.<sup>10</sup> As for Infectious aortic pseudoaneurysm, performing traditional surgery is quite risky. In high-risk patients, endovascular treatment appears to be a feasible and durable treatment alternative.<sup>10</sup>

Here, we report a case of a thoracic aortic pseudoaneurysm caused by *Salmonella paratyphi A* infection, which was successfully treated by endovascular stent-graft treatment and antibiotic therapy. We hope that this report provides some reference for future clinical cases.

## Case Presentation

A 63-year-old female patient with a medical history of type 2 diabetes, hypertension, and hyperlipidemia visited our hospital complaining of chest, waist, and back pain radiating to both groin for 15 days. It aggravated on bending over, but there was no obvious cause. No nausea, vomiting, diarrhea, or discomfort, such as numbness or fatigue of the lower limbs, was reported. The initial treatment administered was for back pain. After admission, the patient developed a fever and abdominal pain. Peripheral leukocyte count was  $12.92 \times 10^9/L$  (normal range,  $3.5\text{--}9.5 \times 10^9/L$ ) with  $11.51 \times 10^9/L$  neutrophils (normal range,  $1.8\text{--}6.3 \times 10^9/L$ ) and an elevated C-reactive protein of 101.59 mg/L, and Erythrocyte sedimentation rate was 120 mm/hour. The computed tomography angiography (CTA) examination revealed a thoracic aortic pseudoaneurysm. Abdominal CTA confirmed the formation of a pseudoaneurysm in the aorta, approximately in the T10-T11 vertebral body plane (Figure 1).

Blood was drawn during fever, gram-negative bacilli were Gram-stained, and *Salmonella paratyphi A* was cultured. Susceptibility testing by the minimum inhibitory concentration (MIC) gradient method revealed that the isolate was susceptible to piperacillin/Tazobactam, Imipenem, ampicillin, and gentamicin based on the Antimicrobial Susceptibility Testing criteria (piperacillin/Tazobactam MIC  $\leq 8 \mu\text{g/mL}$ ; Imipenem MIC  $\leq 1 \mu\text{g/mL}$ ; Ampicillin MIC  $\leq 2 \mu\text{g/mL}$ ). Furthermore, susceptibility testing by Kirby-Bauer drug-sensitivity test showed that the isolate was susceptible to Cefotaxime, Ceftriaxone, Ciprofloxacin, and Levofloxacin based on the Antimicrobial Susceptibility Testing criteria (Cefotaxime inhibition zone diameter = 28 mm; Ceftriaxone inhibition zone diameter = 30 mm; Ciprofloxacin inhibition zone diameter = 26 mm; Levofloxacin inhibition zone diameter = 28 mm).

The endovascular stent-graft treatment was performed immediately. After inducing local anesthesia, the left femoral artery was punctured using the Seldinger's method. 5F arterial sheath was implanted, and a pigtail catheter was inserted in descending aorta for aortography, which showed signs of a thoracic aortic pseudoaneurysm. An oval-shaped soft tissue-density mass measuring  $2.5 \times 2.1$  cm was detected in the descending thoracic aorta at the level of the T10-T11



**Figure 1** Three-dimensional computed tomography angiography shows the formation of a pseudoaneurysm in the aorta.



**Figure 2** Three-dimensional computed tomography angiography shows the total exclusion of the aneurysm and the absence of endoleaks.

vertebral body. The right femoral artery was then exposed, and Ultra Stiff Wire (ASAHI, Japan) was put in. After that Hercules™ Sterile Thoracic Stent-Graft System (Microport, Shanghai) was put in along Wire and then released to cover pseudoaneurysm. The procedure lasted 45 min. Aortography was conducted again, which revealed that the pseudoaneurysm had almost disappeared without leakage.

Moreover, piperacillin sulbactam sodium 5 g was administered once every 8 h intravenously for 14 days in combination with levofloxacin 0.4 g once a day intravenously for 7 days. Abdominal pain was relieved, and the body temperature returned to normal. The treatment was well tolerated by the patient, and she was discharged on postoperative Day 10.

At the 2-month follow-up, the patient was asymptomatic, and CTA confirmed the total exclusion of the pseudoaneurysm with no signs of endoleaks (Figure 2). After discussion with the institutional research office, formal ethical approval was deemed unnecessary if written informed consent was obtained from the patient. Verbal and written informed consent were obtained from the patient for publishing the report.

## Discussion

The infectious aortic pseudoaneurysm is one of the mycotic aneurysms commonly accompanied by abdominal and/or back pain.<sup>11</sup> Our patient also requested medical help for back pain. After admission, the patient developed a fever and abdominal pain, and the other main clinical feature of the mycotic aneurysms was fever. Arterial infection is more likely to occur in immunosuppressive patients, and our patient had poorly controlled diabetes mellitus. Mycotic pseudoaneurysm diagnoses were based on the imaging findings of the pseudoaneurysm and positive bacterial culture results.

Therefore, based on the typical clinical symptoms, blood culture isolate of *Salmonella paratyphi A* and CTA confirmation of a pseudoaneurysm in the aorta, a diagnosis of *Salmonella paratyphi A*-infected aortic pseudoaneurysm was made.

Infectious pseudoaneurysms caused by *Salmonella paratyphi A* infection are very rare in clinical practice. We searched the literature on cases of mycotic aneurysms caused by *Salmonella paratyphi A* published on PubMed. A case of mycotic aneurysm of the left common iliac artery due to *Salmonella paratyphi A* has been reported previously.<sup>12</sup> However, to the best of our knowledge, no case report of mycotic pseudoaneurysm of the thoracic aortic secondary to *Salmonella paratyphi A* infection has been described. Thus, our treatment plan for the pseudoaneurysm caused by *Salmonella paratyphi A* infection may provide some reference for future clinical cases.

Once infectious aortic pseudoaneurysm was diagnosed, the treatment consideration began. The gold standard management strategy remains surgical resection and debridement of the infected aorta and the surrounding tissues followed by long-term antibiotic therapy. Traditional surgical methods generally require arterial repair,<sup>13,14</sup> vascular ligation,<sup>15</sup> vascular anastomosis, vascular transplantation,<sup>7,16</sup> and pseudoaneurysm resection. However, traditional surgery has some disadvantages, including substantial surgical trauma, difficult technique, long procedure time, and several complications. Consideration of patient's age and medical history of type 2 diabetes, hypertension, and hyperlipidemia, we chose endovascular treatment combined with appropriate antibiotic therapy after sensitivity testing.

Endovascular stent-graft treatment has the advantages of easy treatment, less trauma, less bleeding, short procedure time, quick recovery after surgery, and easier acceptance by patients.<sup>14</sup> It also overcomes the limitation of inaccessibility of some parts during the operation and has many benefits. Early endovascular treatment of pseudoaneurysms uses detachable balloons or coils to embolize the tumor-bearing artery.<sup>17</sup> Endovascular repair is suitable for patients who cannot tolerate open surgery or need urgent control bleeding.<sup>13</sup> Additionally, it was a suitable treatment for our case.

Luo et al<sup>18</sup> reported that pseudoaneurysms caused by tuberculosis infection were repaired in the cavity and proved safe during the long-term follow-up. However, as the infected foci were not cleared, its postoperative infection recurrence and graft infection rates were significantly higher than those of the other treatments. Therefore, appropriate sensitive antibiotics need to be administered before and after surgery.<sup>14</sup> Although there is no definitive agreement on the course of antibiotic treatment, researchers suggest that the administration of sufficient preoperative antibiotics and prolonged postoperative antibiotics for infection control will improve the surgical results.

Therefore, we administered appropriate sensitivity-tested antibiotics for 3 weeks until the infection was controlled. No surgical complications were reported 12 months after administration of the endovascular treatment combined with antibiotic therapy.

## Conclusions

We reported a case of thoracic aortic pseudoaneurysm caused by *Salmonella paratyphi A* infection, which is extremely rare. Endovascular treatment combined with adjuvant antibiotic therapy seem to be a practical approach for the *Salmonella paratyphi A*-infected pseudoaneurysms. But more appropriate approaches need further research in future work.

## Abbreviations

WBC, White blood cell count; CRP, C-reactive protein; ESR, Erythrocyte sedimentation rate; CSF, Cerebrospinal fluid; CT, Computed tomography; CTA, Computed tomography angiography; MIC, Minimum inhibitory concentration; AIDS, Acquired immunodeficiency syndrome.

## Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

## Patient Consent and Ethics Statement

The study was carried out in accordance with the recommendations of the Ethics Committee of the Affiliated Hospital of Southwest Medical University. A written permission for the use of patient data for publication of this cases report and accompanying images was obtained.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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