We report here on a case of popliteal aneurysm and rupture that occurred over a 10-day period and this was all secondary to salmonella infection. Computed tomography (CT) angiography of the extremity that was performed before and after aneurysmal rupture showed the aneurysm’s rapid evolution to rupture over a short period of time. We also review the pathogenesis, clinical presentation, diagnostic approach and management of salmonella aneurysms.

**Index words**: Aneurysm, rupture  
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Vascular complications that occur with salmonella bacteremia are not common. However, salmonella can involve the thoracic and abdominal aorta, as well as the coronary arteries and peripheral arteries, or it can involve vascular grafts and prosthetic valves [1, 2]. Benenson et al. [3] reported that adult patients over the age of 50 with nontyphoidal salmonella bacteremia developed life-threatening vascular complications. In humans, typhoidal and nontyphoidal salmonella infections are most often associated with contaminated foods, and such infections may be divided into four groups: gastroenteritis, enteric fever, bacteremia with or without localized extraintestinal infection, and an asymptomatic chronic carrier state. CT is considered useful for the diagnosis and follow-up of salmonella aneurysms before surgery [4].

Some reports have presented findings on aortic aneurysms that were already established at the time of diagnosis, and relatively few of these aneurysms showed progression from a normal or dilated aorta to marked dilatation or rupture [2, 3, 5]. Rupture of a salmonella aneurysm, like the one seen in our case, demonstrates the dynamic course of this pathology in the popliteal artery and how rapid its evolution can be, and this has not been previously reported on.

**Case Report**

A 62-year-old male, who had experienced diarrhea for 2 weeks before presentation and who had no other relevant personal background, was admitted with a 3-day history of diffuse swelling of the left leg without any varicose or ischemic findings [Fig. 1A]. The physical examination revealed a blood pressure of 120/70 mmHg, a pulse of 78 beats/min, a respiration rate of 26 breaths/min and a body temperature of 38.7°C. The lung and cardiac sounds were normal. During the first 24h blood, the chemistry profile showed an elevated
erythrocyte sedimentation rate (ESR: 23 mm/hr) and C-reactive protein level (CRP: 11.3 mg/dL). The other laboratory data on admission, including the coagulation studies, complete blood count and urine analysis, revealed no abnormalities.

CT angiography of the extremity was performed under the clinical impression of deep vein thrombosis. CT showed aneurysmal dilatation of the left popliteal artery with atherosclerosis and swelling of the adjacent soft tissues (Fig. 1B, C). Conservative treatment was administered. However, the left leg swelling worsened, and 7 days after admission, his blood count showed slight leukocytosis (10,500 cells/mL) and elevation of the lactate dehydrogenase (LDH, 584 U/L) and creatine phosphokinase (CPK, 3807 U/L) levels. Repeat CT angiography demonstrated rupture of a popliteal arterial aneurysm that was associated with a soft tissue mass surrounding the ruptured aneurysmal wall, which contained air bubbles (Fig. 1D, E).

Surgery was performed on the eight day, and an inflammatory popliteal aneurysm was found to have ruptured at its posterior wall, and there was necrosis of the

Fig. 1. A. Photography showing the diffuse swelling of the left leg and a bruise-like discoloration in the calf. Varicose veins or other ischemic changes were absent. Extremity CT axial scan (B) and angiography (C) showed aneurysmal dilatation of the left popliteal artery with the luminal irregularity (arrows) and swelling of the adjacent soft tissues. In Fig. 1B, the upper image was acquired at the popliteal fossa level and the lower image was acquired at the proximal tibial level. The CT axial image (D) obtained 7 days after the first extremity CT showed a rapidly growing aneurysm of the popliteal artery (asterisk) that was associated with a soft tissue mass surrounding the aneurysm. The presence of periarterial air bubbles is indicated (arrows). The CT angiograph (E) demonstrated aneurysmal dilatation of the popliteal artery. In Fig. 1D, the upper image was acquired at the popliteal fossa level and the lower image was acquired at the proximal tibia level.
adjacent muscle and purulent material in the wall. Pathologically, there were no septic emboli affecting the vasa vasorum. We performed resection of the aneurysm and of the greater saphenous vein to provide a posterior tibial artery autograft. A culture of the purulent material grew nontyphoidal salmonella. His postoperative course was eventful, i.e., re-rupture of the graft, active bleeding from the repaired popliteal artery and progression of the muscular necrosis, which finally resulted in amputation above the knee. The patient was discharged 30 days after the initial surgery. At the time of writing, 2 months after surgery, he has been symptom free.

**Discussion**

Salmonella infection usually occurs after the ingestion of contaminated foodstuffs, and it usually has four clinical manifestations (6): (a) gastroenteritis (68% cases); (b) enteric fever (9%); (c) bacteremia with or without focal extraintestinal infections (7%); and (d) an asymptomatic chronic carrier state (15%). After invading the bloodstream, the salmonella species can cause a variety of focal infections (6), which include osteomyelitis, pyelonephritis, pneumonia, endocarditis, meningitis, and arteritis with or without subsequent aneurysm formation. Artery infection may occur due to septic emboli that are the result of infective endocarditis, an extension from an adjacent suppurative process or the attachment of circulating organisms to an arterial wall. Almost every arterial site in the body may become involved (1), although infection of the aorta appears to be the most frequent (4), and the abdominal aorta and femoral arteries are most commonly affected. Limited involvement of the popliteal artery, as was seen in our case, has not been previously described.

Salmonella is the most frequent etiologic agent and it is responsible for 33–50% of infectious aneurysms of the abdominal aorta (7). The elderly and immunocompromised patients are at the highest risk for aortitis (1). However, our present case involved a non-immunocompromised 62-year-old male.

Aortitis is caused by either direct intimal invasion, by septic emboli that affect the vasa vasorum or by extension from a nearby septic focus (7), and we thought that the mechanism of developing popliteal arterial aneurysm may be similar. In the present case, progressive transmural sepsis with wall destruction, aneurysmal development and rupture occurred over a 1 week period without any septic focus, so direct intimal invasion or septic emboli affecting the vasa vasorum might be the main pathophysiologic mechanism.

Clinically, the process usually begins with fever and pain at the involved site in 25% of cases (7). Oskoui R et al. (8) reported that most patients present with a subacute course that was, on average, 6.5 weeks long before the diagnosis was made. However, there was usually not much clinical suspicion of an aneurysm, which delayed the subsequent diagnosis. The CT features of aortic aneurysms are known (4, 5), i.e., findings of an abnormal aorta with/without atherosclerotic changes, but with an adjacent, irregular soft tissue mass that’s indistinguishable from the aorta. Abnormal periaortic soft tissue due to leaking blood or inflammation may also be associated with an enhancing rim that can be seen on contrast-enhanced scans. After some days or months, the periaortic soft tissue mass increases and becomes more irregular. Given the aortic wall destruction and an irregular aortic contour, a non-calcified saccular aneurysm will form and this is prone to rupture if not promptly treated (4). The rapid expansion or appearance of an aneurysm in a septic patient should also lead the observer to a prompt diagnosis. Air bubbles are uncommon in the periaortic mass, but when they are present, they indicate infection (4), and these air bubbles were detected in our case. Due to its ability to define soft tissue components, CT is presently the diagnostic method of choice to detect and follow-up this dynamic process. CT examinations should be performed during the early stage because this allows confirmation of aortitis and the presence of an aneurysm, and CT also provides information on its size and origin.

The mainstay of treatment is surgery and the procedure of choice is resection of the aneurysm with a vascular bypass through a non-septic tissue plane, and this should be combined with antibiotics for at least six weeks (8). For salmonella arteritis, early detection and prompt surgical intervention with using careful debridement, irrigation and resection of the involved aorta, followed by the re-establishment of anatomic continuity by grafting and adequate antibiotic therapy, should yield good results.

Several factors appear to be responsible for improved survival among the patients suffering with aortitis and arteritis due to salmonella. First, earlier diagnosis is now possible because of the increased awareness of this syndrome and the availability of contrast-enhanced CT. Second, prompt antibacterial therapy has also improved survival.
Based on this case report, we emphasize the short period of time that's required for septic arteritis to progress to catastrophic aneurysmal rupture when salmonella arteritis occurs in a peripheral artery such as the popliteal artery.

References