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Surgical management of ruptured mycotic aortic aneurysm induced by *Klebsiella pneumoniae*

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To the Editor: A 63-year-old male patient was referred from a local clinic for diffuse abdominal pain for 1 day and ruptured abdominal aortic aneurysm (rAAA) in computed tomography (CT). He denied any medical history of hypertension, diabetes mellitus, hepatitis or pneumonia. The patient's blood pressure was 100/70 mmHg with a pulse rate of 105 beats/min and a body temperature of 37.1 °C. The Abdomen was mildly distended with diffuse pain and tenderness. A 5 cm × 5 cm-sized pulsatile mass could be palpated in mid-abdomen. Laboratory findings included a white blood cell (WBC) count of 10,600/μL, hemoglobin (Hb) of 92 g/L, hematocrit of 26.7%, serum creatinine (Cr) of 0.9 mg/dl, and C-reactive protein (CRP) of 10.24 mg/L. On initial chest radiography, there was no pathological lung lesion. Abdominal CT showed the 5 cm × 5 cm-sized ruptured infrarenal abdominal aortic pseudoaneurysm with focally enhanced bulging contour [Figure 1A and 1B]. A decision was made to undergo emergency surgery. Under general anesthesia, we approached the retroperitoneal rAAA and hematoma via midline skin incision. After clamping the infrarenal aorta and both iliac arteries, we found a significant amount of infectious substances in the perianeurysmal area and the aneurysmal wall [Figure 1C]. We performed culture tests for various microorganisms in the perianeurysmal area tissue, thrombus, and aneurysmal wall. Subsequently, we did careful extensive local debridement and resection of the perianeurysmal area tissue and aneurysmal sac, along with massive irrigation [Figure 1D]. We completed an aorto-biiliac artery interposition with bifurcated polytetrafluoroethylene (PTFE) graft with omental flap [Figure 1E]. According to our rAAA management protocol, we had administered the third generation cephalosporin as preoperative and postoperative preventive antibiotics until causative microorganisms and sensitivity to antibiotics were identified. We added metronidazole for the first 5 postoperative days. Culture tests of perianeurysmal area tissue, thrombus, and aneurysmal wall showed a heavy growth of *Klebsiella pneumoniae* alone, and showed sensitivity to most antibiotics except ampicillin. The result of tissue-Gram stain (the Brown-Brenn stain) of the aorta wall was negative [Figure 1F]. Also, serologic and tissue tests for species of *Salmonella* were negative. We continued daily injection of a third generation cephalosporin intravenously for 4 weeks. At 3 weeks postoperatively, we performed a serologic culture test which was negative. At 4 weeks postoperatively, the patient was discharged without complications with a prescription for an oral third generation cephalosporin for 2 weeks. Subsequent clinical course has been uneventful. At 6 months postoperatively, CT showed that PTFE was patent and there was no recurrence of infection [Figure 1G and 1H].

Mycotic aortic aneurysm (MAA) is a rare but severe disease representing less than 1% of all aortic aneurysms.[1,2] Although MAAs have decreased gradually owing to the development and popularization of antibiotics, its rapid development and high rupture rate have resulted in a very poor prognosis.[1,2] Recently, the most common cause of MAAs reported worldwide has been *Staphylococcus aureus*, followed by *Salmonella* which is more common in East Asia.[1,2]*Klebsiella* and *Mycobacterium* have also been reported as rarer causes of MAAs.[2-4] Our authors have already reported a rare case of MAA induced by *Mycobacterium*.[4] Gram-negative microorganisms are thought by many to exhibit a more virulent course because of their ability to invade the normal intima and cause early aneurysm rupture.[3] We identified *Klebsiella pneumoniae* as the only cause of the ruptured MAA in this patient without other clinical infection. We successfully performed proper surgical and medical management. Therefore, our authors are reporting a case of ruptured MAA induced by *Klebsiella*. In current theory,[2] the important mechanism of MAA is necrosis and rupture of the atherosclerotic vascular wall, which causes adhesion of microorganisms. Both embolization of microorganisms and iatrogenic factors might cause vascular endothelial damage, providing an opportunity to microorganisms to invade the

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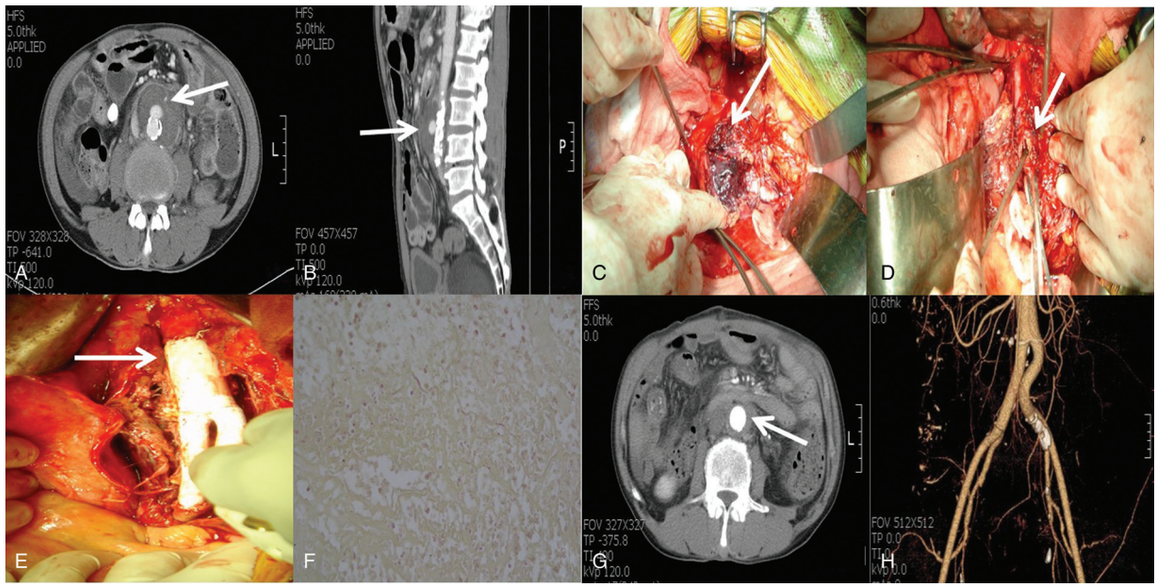

Figure 1: The surgical management with aorto-biiliac artery interposition with bifurcated PTFE graft followed by omental flap for MAA were performed successfully. (A) and (B) Preoperative CT. Arrows indicate pseudoaneurysm with focally enhanced bulging contour. (C) to (E) Intraoperative findings. (C) An arrow indicates infectious tissues of perianeurysmal area tissue and aneurysmal wall. (D) An arrow indicates proximal opening of MAA. (E) An arrow indicates a patent graft after aorto-biiliac artery interposition. (F) Microscopic finding with tissue-Gram stain (Brown-Brenn staining, original magnification × 400). (G) and (H) Postoperative CT. An arrow indicates patent graft. CT: computed tomography; PTFE: polytetrafluoroethylene; MAA: Mycotic aortic aneurysm.

arterial wall.[1,2] Once the arterial wall has been damaged by an infection, it becomes fragile.[1] The damaged wall cannot sustain systemic arterial pressure, which might lead to a pseudoaneurysm and rupture.[1,2] Therefore, early diagnosis and prompt treatment are essential for the improvement of survival.[2] The gold standard for MAA treatment has been to combine adequate antibiotic therapy with active surgical resection and graft replacement.[1-3,5] Postoperatively, important problems in the surgical treatment of MAAs are recurrence of infection and graft infection.[5] Therefore, active antibiotic therapy for at least 6 weeks postoperatively has been recommended.[2,5] Several strategies to avoid recurrent infection have been proposed.[3,5] They include the use of a pedicled omental flap, a silver-coated or antibiotic-soaked graft, a cryopreserved aortic allograft, a bovine pericardial roll and a vein graft.[3,5] Although there is still controversy, cryopreserved aortic allografts have been reported with lower rates of reinfection.[3] However, in our case, such alternative grafts were unavailable to us. We performed an extensive resection of infected tissues, and aorto-biiliac artery interposition with classical graft followed by omental flap. Among classical grafts, we have preferred PTFE in rAAA because we thought that although it was controversial, PTFE was superior to Dacron in terms of postoperative remodeling, enlargement and reinfection rate. We postoperatively administered antibiotics for 6 weeks. Fortunately, the patient was uneventful postoperatively. In our case, we did not preoperatively confirm that the rAAA was accompanied by infection. In our hospital, we have commonly performed open surgery for rAAA, as we did with this patient. But, we are currently trying to perform more endovascular therapy if the patient's status and aortic anatomy are available and there is no infection. We think that we need to do more endovascular therapy for rAAA without infection. Except in patients requiring emergency surgeries, the preoperative antibiotic treatment is recommended for reducing the intraoperative risks and postoperative recurrence of infection.[2] Although it is controversial, the duration of preoperative antibiotic treatment is suggested to be in a range of 1–6 weeks.[2,5] And, emergency surgery is indicated for uncontrolled infection or evidence of rupture.[5] We need to do close observation for that during preoperative antibiotic treatment.

In conclusion, to improve the prognosis of MAA, we should try to do early detection and appropriate surgical treatment as soon as possible. We need to continue the administration of antibiotics for at least 6 weeks postoperatively to avoid recurrent infection.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initial will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Conflicts of interest

No potential conflict of interest relevant to this article was reported.

Author contributions

Sang Dong Kim: data collection, write manuscript (1st author); Jeong Kye Hwang: data mining; In Sung Moon: data quality control; Sun Cheol Park: study designation, data quality control (corresponding author).

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