

Original Article

***Erysipelothrix rhusiopathiae*-induced aortic valve endocarditis: case report and literature review**

Ping Hua^{1*}, Jialiang Liu², Jun Tao¹, Jianyang Liu¹, Yanqi Yang¹, Songran Yang^{3*}

¹Department of Cardiovascular Surgery, Sun Yat-Sen Memorial Hospital, Sun Yat-Sen University, Guangzhou 510120, China; ²Department of Cardiothoracic Surgery, Chengdu Fifth People's Hospital, Chengdu 611130, China; ³Department of Experimental Psychology, University of Oxford, Oxford OX1 3UD, United Kingdom. *Equal contributors.

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Abstract: *Erysipelothrix rhusiopathiae* is a pathogen of zoonosis often associated with occupational exposure. Although *Erysipelothrix rhusiopathiae* infection has high mortality, the heart valves in humans are rarely involved. The clinical data of a case of a 65-year-old male with *Erysipelothrix rhusiopathiae*-induced aortic valve endocarditis was summarized retrospectively and analyzed with a literature review. Based on a literature review and our experience, cases of *E. rhusiopathiae*-induced aortic valve endocarditis are extremely rare and surgical treatment for this condition is useful and recommended.

Keywords: *Erysipelothrix rhusiopathiae*, infective endocarditis, heart valve, surgical treatment

Introduction

Under the majority of conditions, infective endocarditis is caused by common pathogens such as *Staphylococcus aureus* and *Streptococcus viridans*. *Erysipelothrix rhusiopathiae*-induced endocarditis is rarely reported. Infection with *Erysipelothrix rhusiopathiae* can spread in animals and humans and is associated with occupational exposure [1]. Endocarditis is the most severe form of *Erysipelothrix rhusiopathiae* infection in humans and has a high mortality [2]. To date, *Erysipelothrix rhusiopathiae*-induced endocarditis has rarely been reported in the literature; such cases have been described fewer than 10 reports. As part of this review article, we report a case of *Erysipelothrix rhusiopathiae*-induced endocarditis with involvement of the aortic valve.

Case report

A 65-year old man was admitted to our hospital because of recurrent chest tightness, palpitation, and shortness of breath for 2 months. Two months prior to this admission, the patient developed chest tightness and discomfort with-

out incentives, accompanied by palpitation and shortness of breath. These symptoms were aggravated following activity. He was treated with traditional Chinese herbal medicine (identity of which was unknown) after which the symptoms partially resolved (i. e., he had no chills, fever, chest and back pain, edema, or limb pain). In a local hospital, he was diagnosed with heart failure and hospitalized, but the treatment protocol was unclear. His symptoms improved and he was discharged. One month prior to admission, the patient experienced an increase in symptoms, and developed chest tightness and shortness of breath after minor activities. Shortness of breath was present in the supine position at night, which occasionally led to night awakening and dyspnea. These symptoms disappeared after sitting. He was referred to our hospital, and echocardiography showed prolapse, excrescence formation, and severe regurgitation of the aortic valve. Since the return of the above-mentioned symptoms, he had no cough, expectoration, headache, abdominal pain, diarrhea, poor mental state, or poor appetite. Urination and defecation were normal and body weight remained unchanged. Three months prior to admission, the patient

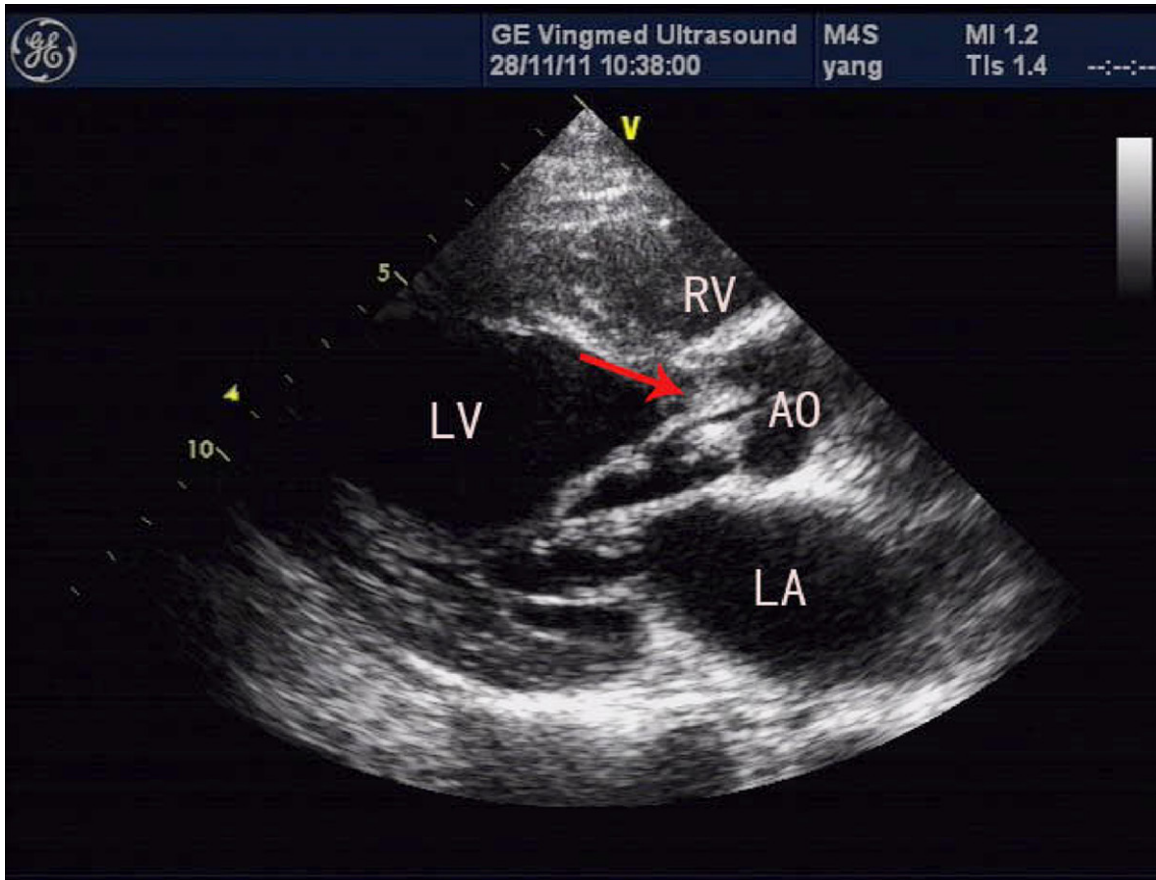


Figure 1. Findings in preoperative echocardiography (left ventricular long axis). We observed enlargement of the left ventricle, thickness of the aortic valve, loosening of valves, valve shedding into the left ventricular outflow tract in the diastolic phase, and incomplete closure. The left coronary cusp and non-coronary cusp presented with abnormal echoes with a maximal diameter of 20 × 16 mm, which moved with the movement of valves.



Figure 2. Microscopic findings of *Erysipelothrix rhusiopathiae*. Under microscopy, *E. rhusiopathiae* was a gram-negative, straight or curved, rod-shaped bacterium with a single or cluster-like arrangement (×1000).

was bitten by a mosquito of unknown species and developed erythema and rashes on the left

upper arm and forearm, which were approximately 3 mm in diameter, and were accompanied by mild pain and itching. Two days later, blisters of different sizes appeared at the site of the rashes. He had a history of smoking for 20 years but did not drink.

On physical examination, his body temperature was 36°C, pulse rate was 105 beats/min, respiratory rate was 20 breathes/min, and blood pressure was 122/55 mmHg. Breath sounds in both lungs were normal, and dry and moist rales were absent. On palpation, the heart border was extended leftward and downward, and the liver and spleen were normal. The heart rhythm was normal. Diastolic murmur of grade 3/6 was present at the third to fourth intercostal space at the left of the sternum. Pigmentation spots were noted on the left upper arm and forearm and both lower limbs had pitting edema.

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Laboratory and imaging examinations showed the following: white blood cell count, $10.04 \times 10^9/L$; hemoglobin, 84 g/L, platelet count, $87 \times 10^9/L$; albumin level, 28.5 g/L; C-reactive protein level, 82.6 mg/L; rheumatoid factor, 30.3 IU/mL; erythrocyte sedimentation rate, 79 mm/h; lactate dehydrogenase level, 446 U/L; anti-neutrophil cytoplasmic protease antibody > 300 U/ml; complement C3, 588 mg/L; and troponin I was weakly positive. A chest X-ray revealed that markings in both lungs were increased and thickened, and a slightly enlarged heart shadow was present. Echocardiography indicated the following: (1) prolapse, excrescence formation, and severe regurgitation of the aortic valve; (2) moderate mitral regurgitation; (3) mild to moderate regurgitation of the tricuspid valve, and mild regurgitation of the pulmonary valve; (4) mild pericardial effusion; and (5) an ejection fraction of 63% (**Figure 1**). Computed tomography indicated mild inflammation in both pulmonary lower lobes, bilateral pleural effusion, and enlargement of the spleen.

Blood was collected at 1, 6, and 12 h after admission for bacterial culture with Columbia blood agar base media, and *E. rhusiopathiae* was confirmed (**Figure 2**). According to a drug sensitivity test, intravenous penicillin (1000×10^4 U) was given twice daily. On the basis of manifestations, laboratory findings, imaging examinations, and blood culture, the patient was diagnosed with *E. rhusiopathiae*-induced acute infective endocarditis, prolapse, severe regurgitation of the aortic valve, and cardiac function of New York Heart Association (NYHA) class III. Considering that the patient had symptoms of heart failure and large excrescence in the aortic valve with a risk for shedding, emergency surgery was performed within 24 h after admission. Intraoperative findings indicated that the aortic valve was severely damaged and had severe regurgitation, and excrescence was extensively distributed in the aortic valve. An abscess of 8×8 mm in size was found in the perimembranous region of the ventricular septum under the aortic valve (**Figure 3**), and moderate to severe regurgitation of the mitral valve was observed. Aortic valve replacement and mitral valve plastic surgery were performed with a 23-mm mechanical aortic valve (Carbomedics Prosthetic Heart Valve, Sorin

Biomedica Cardio Inc., Italy) and a 32-mm mitral valve ring (Edwards Lifesciences Corporation, USA). The surgical intervention was successful and postoperative treatment with penicillin was performed (1000×10^4 U i.v.) twice daily for 4 weeks. Culture of the excrescence material also revealed the presence of *E. rhusiopathiae*. Pathological examination of the excrescence showed characteristics of infective endocarditis (**Figure 4**). The patient recovered and was discharged without complications. He was followed up for 2 years and six months and his general condition was favorable.

Discussion

Under the majority of conditions, infective endocarditis is caused by common pathogens, such as *Staphylococcus aureus* and *Streptococcus viridans*. *Erysipelothrix rhusiopathiae*-induced endocarditis is rarely reported. Infection with *E. rhusiopathiae* can spread in animals and humans and is associated with occupational exposure [1]. Endocarditis is the most severe form of *E. rhusiopathiae* infection in humans and has a high mortality [2]. To date, *E. rhusiopathiae*-induced endocarditis has rarely been reported in the literature, with fewer than 10 reports.

E. rhusiopathiae is a gram-positive, rod-shaped bacterium and the major pathogen of swine erysipelas [3]. *E. rhusiopathiae* is found in the soil and surface and gastrointestinal tract of some animals (such as fishes, swine, and birds). *E. rhusiopathiae* carriers engaging in the field of poultry, the fur and leather industry, and fisheries, as well as veterinarians and cooks are at risk for *E. rhusiopathiae* infection because of hand wounds, mosquito bites, or ingestion of insufficiently cooked pork [4]. Human *E. rhusiopathiae* infection is also known as erysipeloid and can be classified into three categories: focal and self-limited cellulitis with mild symptoms; diffuse cellulitis; and septicemia with or without damage to the skin, with endocarditis, arthritis, and meningitis [5-7]. Patients with malignancies, tuberculosis, and chronic liver disease, and those undergoing treatment with corticosteroids or cytotoxic drugs, are susceptible to severe *E. rhusiopathiae* infection [8].

E. rhusiopathiae-induced infective endocarditis is extremely rare. Since the first case of *E. rhu-*

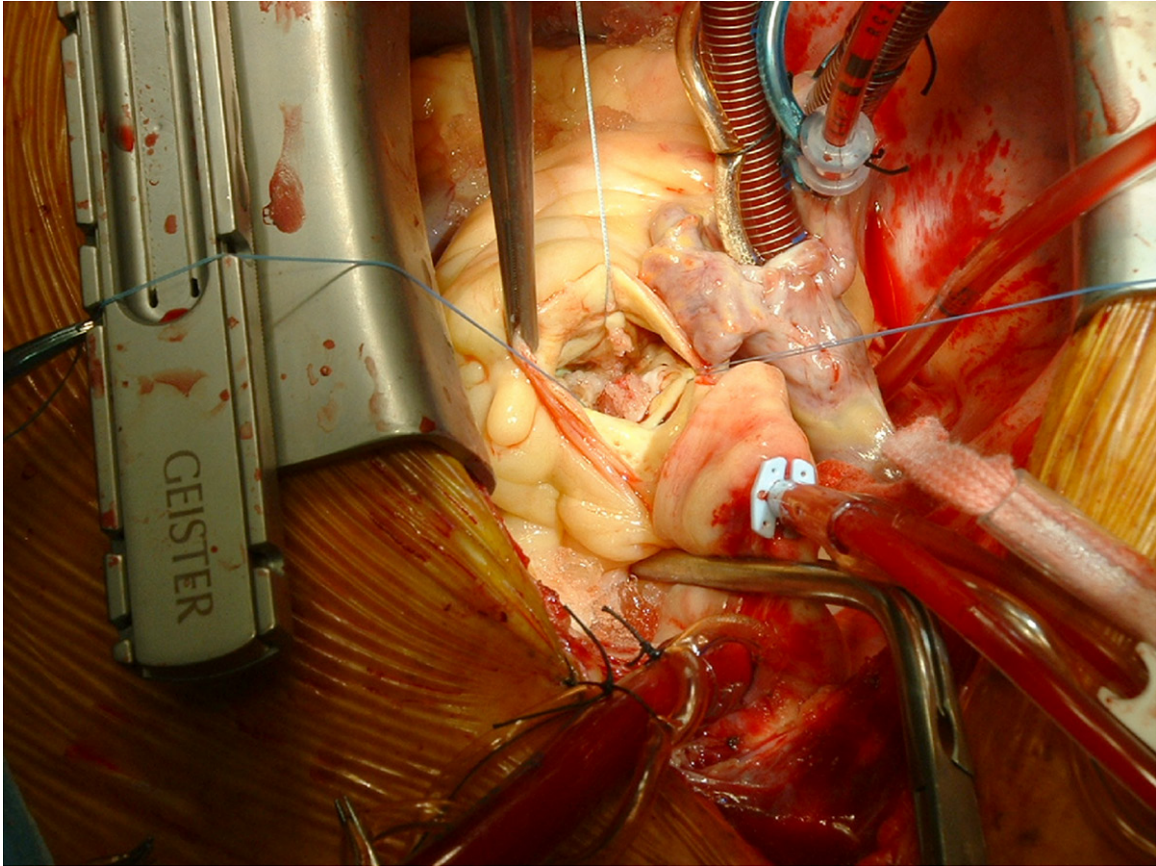


Figure 3. Excrescence observed during the surgery. During surgery, an excrescence 19 × 15 mm in size was found on the aortic valve and ventricular side of the left cusp. The left coronary cusp and non-coronary cusp were severely damaged and covered by some irregular excrescences.

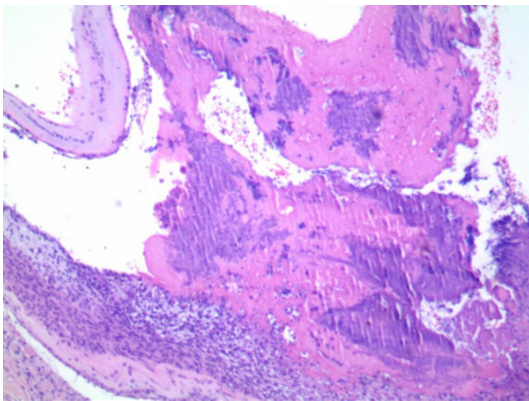


Figure 4. Pathological examination of excrescences. Chronic, purulent inflammation was noted in the valves. Excrescences were found on the valves, and numerous bacterial groups and thrombi were noted (H&E staining, ×40).

siopathiae-induced endocarditis was reported in 1912 by Gunther [9], no more than 60 cases of *E. rhusiopathiae*-induced endocarditis have

been reported. To date, only 10 cases of *E. rhusiopathiae* infection with involvement of the aortic valve (infective endocarditis of the aortic valve) have been reported in the literature, of which five were confirmed by surgery. In the present report, we describe the first case of *E. rhusiopathiae*-induced endocarditis in China.

E. rhusiopathiae infection is related to the weather and seasons, and is mainly found from July to October, and most patients are aged 40-60 years of age [10]. In addition, males are more susceptible to *E. rhusiopathiae* infection than females. Excessive drinking is a risk factor of *E. rhusiopathiae* infection and some patients with *E. rhusiopathiae* infection have a history of drinking [5, 11]. In a report by Tomaszuk-Kazberuk et al [8], a patient was re-admitted because of respiratory failure and heart failure after excessive drinking, and finally died owing to failure to respond to first aid. The clinical manifestations of *E. rhusiopathiae*-induced

endocarditis are non-specific and difficult to differentiate from those of bacterial endocarditis [10]. The manifestations of *E. rhusiopathiae*-induced endocarditis include fever, dyspnea, fatigue, anemia, joint pain, enlargement of the liver and spleen [12], itching of the limbs and skin, edema of both lower limbs, body weight loss, and poor appetite. Needle-like skin lesions can be found in the limbs and usually disappear within several weeks [13]. Among some patients with *E. rhusiopathiae*-induced endocarditis, lower back pain [14] and abdominal pain [15] are the main manifestations, which may be related to thrombosis in the kidney, spleen, and mesenteric artery. Compared with bacterial endocarditis, *E. rhusiopathiae*-induced endocarditis has a higher mortality rate (40%) because of severe complications, including septic shock, heart failure, renal failure, meningitis, mycotic aneurysm, valvular perforation, and myocardial abscess [9, 13, 16]. In the present report, our patient had a normal body temperature and the blood cell count was mostly unchanged (white blood cells: $10.04 \times 10^9/L$; proportion of neutrophils: 79.6%). These findings are not in accordance with the clinical characteristics of infective endocarditis. On inquiry, this patient was a gatekeeper and had no exposure to animals, including swine. He complained that he was bitten by a mosquito 3 months ago and rashes were present. Therefore, we speculate that a mosquito, which bit an *E. rhusiopathiae*-carrying swine, then bit this patient, resulting in transmission of *E. rhusiopathiae* infection. In this case, the swine was the host and the mosquito was the transmitter. This manner of *E. rhusiopathiae* infection has rarely been reported.

E. rhusiopathiae-induced endocarditis mainly involves normal valves, including the aortic [13], mitral, or tricuspid valve [6, 11, 17]. Tomaszuk-Kazberuk [8] reported an extremely rare case with involvement of three valves. Echocardiography, which can be used to determine the extent of valve damage, usually reveals thickness, perforation of valves, excrescences on the valves, and paravalvular abscess [18]. Histological examination of *E. rhusiopathiae*-induced endocarditis shows similar findings as infective endocarditis, which is characterized by valve degeneration, calcification or

necrosis, and concomitant infiltration of numerous inflammatory cells. In the present case, microscopy showed infiltration of numerous inflammatory cells in the excrescences, and interstitial hyalinization, mucinous degeneration, hyperplasia of granulation tissues, and tissue necrosis. Bacterial masses on the excrescences were also noted, which are consistent with previous findings [6, 11].

Blood culture is the most important method for the diagnosis of sepsis and infective endocarditis, but *E. rhusiopathiae* infection is usually misdiagnosed as *Lactobacillus*, *Enterococcus*, or *Streptococcus viridans* [13, 19] or as specimen contamination. Obtaining positive bacterial cultures of *E. rhusiopathiae* from skin lesions is difficult and the rate is also low in bacterial culture of excrescences. In the present case, multiple preoperative blood cultures and postoperative bacterial cultures of excrescences had identical results, showing *E. rhusiopathiae* infection.

Anti-infection is a major strategy in the treatment of *E. rhusiopathiae* infection and antibiotics should be selected according to drug sensitivity test results. *E. rhusiopathiae* is usually sensitive to penicillin, cephalosporins, imipenem, clindamycin, and fluoroquinolones. However, *E. rhusiopathiae* is insensitive to macrolides and chloramphenicol, and resistant to sulfonamides, vancomycin, and aminoglycosides [13]. An appropriate anti-infective agent may achieve significant improvement in symptoms and inflammatory parameters, but have no effect on excrescences, hemodynamics, and cardiac function. When patients develop thrombosis or even heart failure, inflammatory parameters are abnormal after active anti-infective treatment, and the excrescences are large [3]. In this situation, surgical intervention is preferred [19]. After surgery, treatment with antibiotics is also required. In our case, the patient had unstable hemodynamics due to acute heart failure, and then emergent aortic valve replacement and mitral valve plastic surgery were performed. High-dose penicillin was administered after surgery, yielding a favorable outcome.

Conclusion

In summary, *E. rhusiopathiae* infection is an occupation-related disease. Health education

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on *E. rhusiopathiae* infection should be carried out in appropriate workers. They should be educated to prevent *E. rhusiopathiae* infection, perform regular sterilization of sources of *E. rhusiopathiae* infection, and carry out timely management of wounds. The early diagnosis and treatment of *E. rhusiopathiae*-induced endocarditis are important for prognosis. Underlying heart disease, excessive drinking, malnutrition, and diabetes are risk factors of *E. rhusiopathiae* infection. In addition, medical history and occupation should be carefully reviewed, and lesions in the skin should be differentiated from those of other diseases. Appropriate antibiotics with sufficient strength can be administered for multiple courses. If necessary, surgical intervention can be performed, which is beneficial for prognosis.

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Disclosure of conflict of interest

None.

Address correspondence to: Dr. Ping Hua, Department of Cardiovascular Surgery, Sun Yat-Sen Memorial Hospital, Sun Yat-Sen University, Guangzhou 510120, China. Tel: +86(20)81332295; E-mail: huaping88@sina.com; Dr. Songran Yang, Department of Experimental Psychology, University of Oxford, 9 South Parks Road, Oxford OX1 3UD, United Kingdom. Tel: +44(0)1865618631; Fax: +44(0)1865310447; E-mail: yangsongran79@gmail.com

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