Prosthetic Valve Endocarditis Caused by a *Pasteurella dagmatis*-like Isolate Originating from the Patient’s Cat

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Abstract

*Pasteurella* species are part of the oral flora of cats and dogs. In humans, they are frequently found in infected animal bite wounds, but invasive infections are rare. This is the first report of a prosthetic-valve endocarditis with a *Pasteurella dagmatis*-like species, which originated from the patient's cat.
Case Report

A 77-year-old man with an aortic bioprosthesis (Shelhigh 25 mm, Shelhigh, Inc., Millburn, NJ, USA) implanted 5 years ago was admitted to the hospital with sudden onset of fever and chills. Five months prior to admission, a first episode of prosthetic valve endocarditis due to Enterococcus faecalis has been successfully treated with intravenous antibiotics for six weeks without valve replacement (amoxicillin 2g every six hours plus gentamicin 120 mg twice a day for two weeks followed by daptomycin 8.5 mg/kg once daily for the remaining 4 weeks). Two weeks after the end of treatment, control blood cultures were negative and the patient had fully recovered. However, a transesophageal echocardiogram (TEE) demonstrated an aortic paravalvular leak. The patient was immunocompetent and had an unremarkable medical history, except for chronic atrial fibrillation. On admission he was febrile (38.6°C), tachycardic (105/min) and hypotensive (94/47 mmHg). Physical examination revealed congestive heart failure and a systolic and diastolic murmur. Laboratory studies showed leukocytosis (16.4 x 10^9/l), thrombocytopenia (84 x10^9/l), elevated creatinin levels (224 micromol/l) and a C-reactive protein of 242 mg/l. TEE demonstrated a severe aortic insufficiency, a large aortic vegetation, and an extensive paravalvular leak due to dehiscence of the bioprosthesis valve ring involving half the circumference. Blood cultures yielded small Gram-negative coccobacilli, identified as Pasteurella pneumotropica by the commercial phenotyping methods Vitek 2 (bioMérieux (Suisse) SA, Genève) and API 20NE system (bioMérieux (Suisse) SA, Genève). To confirm identification, 16S rRNA gene sequencing of the patient’s isolate 400127/2011 was performed and the sequence deposited under GenBank acc.no. JF706218. A Basic Local Alignment Search Tool (BLAST) search revealed > 99.9% similarity to a Pasteurella dagmatis-like species (GU177868, GU177869) as well as to GenBank entry AF224296 assigned to Pasteurella pneumotropica strain NCTC10827. Treatment with ceftriaxone was initiated, and later switched to penicillin 5 million units every six hours after obtaining the results of susceptibility testing. Four weeks after start of treatment, aortic valve and aorta ascendens replacement by a homograft was necessary.
due to progressive valve destruction. Since cultures of the resected bioprosthetic valve were negative, antibiotic treatment was stopped two weeks after valve replacement. The patient’s condition gradually improved. Two months after surgery, control blood cultures were negative; a follow-up TEE showed normal valve function, and the patient was in good clinical condition. Eight months after surgery, the patient had fully recovered, and computed tomography of the aortic arch as well as TEE revealed no pathological findings.

The patient owned an 18-year-old cat but had not experienced a bite or scratch recently. However, the cat often licked the patient’s hands, which were affected by a pruritic skin eruption one week prior to the onset of the illness. A swab from the cat’s oral cavity was performed. From the oral mixed flora, two Pasteurella morphotypes could be isolated and were further characterized. 16S rRNA gene sequencing revealed identical sequence of the two Pasteurella strains from the cat’s mouth and the patient’s blood culture isolate, with >99.9% similarity to a Pasteurella dagmatis-like species (GU177868, GU177869). Pulsed-field gel electrophoresis (PFGE) after DNA digestion with Xba I (4) demonstrated the clonal identity of the feline and human isolates (Fig.1). As controls, we used the independent P. dagmatis-like strain JF5098 and the Pasteurella pneumotropica Type strain DSM 21403T.

Human infections with Pasteurella species are most often caused by dog and cat bites resulting in locoregional infections. Pasteurella multocida is the most frequently isolated species; P. dagmatis can be isolated in only 4-7% (1, 15). Systemic disease is uncommon and mostly occurs in patients with underlying comorbidities (17). Association of P. dagmatis with invasive human infection is exceedingly rare. We found ten published cases to date including two cases of native valve and one case of prosthetic valve endocarditis (2, 3, 5-8, 10, 12, 14, 16). In eight out of ten cases, direct contact with cats or dogs was confirmed. Ways of contact were bites, scratches, licking or simply close animal contact. In all three cases of endocarditis, P. dagmatis
was identified by conventional biochemical methods that do not differentiate between other, closely related Pasteurella species. The common risk factors for invasive infections or endocarditis were either a predisposing heart disease or an immunocompromised host. It can be concluded that detailed patient interviewing with regard to animal contacts and knowledge of the association of Pasteurella species and endocarditis are the clues to diagnosis.

Pasteurella species of animal origin are often misidentified using commercial phenotypic identification systems since they focus on clinically relevant species. For exact identification additional molecular diagnostic tests may be necessary (9). Nevertheless, as seen in our case, even 16S rRNA gene based identification can be misleading if GenBank entries are associated with wrong species designations. Besides high similarity of our clinical isolate with P. dagmatis-like species, a 100% match was seen with the 16S rRNA GenBank entry AF224296 of P. pneumotropica NCTC 10827. However, this strain is wrongly assigned with the species P. pneumotropica since its 16S rRNA gene only shows 93.6% similarity to the one of the P. pneumotropica Type strain (GenBank acc. No. AY362924). In fact Sellyei et al. (13) showed that P. pneumotropica NCTC 10827 is part of the same taxonomic group as the P. dagmatis-like isolates they described. P. dagmatis-like strains, including our human isolate, form a monophyletic group closely related to - but still distinct from - P. dagmatis and might define a new Pasteurella species (13). Similar observations were made by Krol et al. (11) who postulate that P. dagmatis is a genetically heterogeneous species with at least two host-specific lineages. Our case further supports the existence of a P. dagmatis-like species associated with cats.

In conclusion, this is the first report of a Pasteurella dagmatis-like species isolated from a human. This putative new species is part of the oral flora of cats and infections may develop in patients with close contact to pet animals, even without a history of bites or scratches. In our patient, it caused severe invasive disease with prosthetic-valve endocarditis leading to aortic valve and aorta ascendens replacement. The species was misidentified by commercial
phenotypic systems. The case also highlights that genetic identification based on 16S rRNA
gene sequences has to be assessed carefully due to possible wrong species designations
associated with GenBank entries.

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References


Legend to Figure 1

Pulsed field gel electrophoresis after DNA digestion with Xba I, demonstrating identity of the Pasteurella dagmatis-like isolates from the human patient and the cat’s oral cavity (two morphotypes).

The independent P. dagmatis-like strain JF5098 and the Pasteurella pneumotropica Type strain DSM 21403^T were used as controls.
P. dagmatis-like, cat, morphotype 1C
P. dagmatis-like, human, patient isolate
P. dagmatis-like, JF5098, unrelated
P. pneumotropica, Type strain DSM 21043T
P. dagmatis-like, cat, morphotype 2C