First Case of Postaneurysmal Prosthetic Vascular Infection Due to a Nonsuperantigenic *Yersinia pseudotuberculosis* Strain[▽]

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Among *Yersinia* spp., *Y. enterocolitica* is the species most frequently isolated from infected aneurysms. This report describes the first case of postaneurysmal prosthetic vascular infection due to a superantigen-negative *Yersinia pseudotuberculosis* strain, showing a potential affinity of this species for endovascular tissue.

CASE REPORT

A 58-year-old man was admitted to the cardiovascular unit for abdominal pain with fever (38°C). One month before, this patient was treated by endovascular *in situ* graft for an aortoiliac aneurysm rupture. On admission, the patient, known to have been treated for a history of hypertension and presenting cirrhosis, showed an exacerbation of the spontaneous pain after abdominal palpation. The abdominal angioscanography revealed a retroperitoneal abscess in contact with the vascular prosthesis due to a potential infection of the material. Blood tests showed a white blood cell count of $16.5 \times 10^3/\mu\text{l}$ (85% polymorphonuclear leukocytes), and the C-reactive protein concentration was 140 mg/liter (the normal range is <6 mg/liter). The biochemical results were unremarkable except for gamma-glutamyl transferase at 220 UI/liter. The patient did not present signs of severe sepsis. The retroperitoneal abscess was rapidly evacuated by surgery without vascular prosthesis replacement, combined with a first antimicrobial treatment with piperacillin-tazobactam, ciprofloxacin, and vancomycin.

Three blood culture sets (aerobic and anaerobic bottles) drawn on admission and a sample of the retroperitoneal abscess were sent to the microbiological laboratory. A bipolar Gram-negative rod was isolated from the three blood culture sets using a BacT/Alert (bioMérieux, Marcy l'Etoile, France). The direct smear examination of the retroperitoneal abscess, showing leukocytes without bacteria, also yielded a bipolar Gram-negative rod in pure culture. This Gram-negative bacillus had the same aspect in the two pathological products. This nonmotile, non-spore forming, aerobic-facultative bacterium was able to grow on bromo-cresol purple agar, blood agar, and chocolate agar plates within 18 h. This rod was oxidase negative and did not produce indole. It was able to reduce nitrate to nitrite and to hydrolyze urea. Phenotypical identification performed with an API 32 GN and a Vitek 2 GN system (bioMérieux, Marcy l'Etoile, France) gave *Yersinia pseudotu-*

berculosis (the identification was excellent, with a probability of 97%). To confirm this identification, a thin smear of this strain was deposited on a matrix-assisted laser desorption ionization (MALDI) mass spectrometry (MS) plate. Measurements were performed with a Microflex mass spectrometer (Bruker Daltonik, Wissembourg, France) using FlexControl software (version 3.0). The spectrum was imported into BioTyper software (version 2.0; Bruker, Germany). The Biotyper database contains the spectra of approximately 3,847 species and is regularly updated by the Bruker Company. The result of the pattern-matching process was expressed with a score of 2.27, giving *Y. pseudotuberculosis* 29490 RKB as the first choice (a score of >2.0 is considered identification to species level). The routine biochemical phenotype identification and MALDI-time-of-flight (TOF) MS spectrum had exactly the same identification to the species level, so the identification was considered final. This isolate belonged to *Y. pseudotuberculosis* serotype O:1. To evaluate the pathogenicity of this isolate, variants of *ypm* superantigens were searched directly in the strain using a PCR technique with the following primers: *ypmA1*:C1/*ypmA2*:C2, ACA-CTT-TCC-TCT-GGA-GTA-(GCG/ACA)-GGA-CAT-TTC-GTC-A, and *ypmB1*/*ypmB2*, CTA-ATC-CCC-CGA-GGA-TAA-(GTT/GGC)-GAT-TCC-GAC-GAC-ATA-TAA-C (2). The strain did not harbor this superantigen gene (Fig. 1). Finally, the *in vitro* antimicrobial susceptibility of this strain was determined by the disk diffusion method on a Mueller-Hinton agar plate as recommended by the Comité de l'Antibiogramme de la Société Française de Microbiologie (CA-SFM) criteria (<http://www.sfm.asso.fr/>) (4). The strain was susceptible to ampicillin, piperacillin, cefotaxime, imipenem, aminoglycosides, trimethoprim-sulfamethoxazole, and fluoroquinolones and resistant to colistin.

The first therapy was modified to administration of cefotaxime plus levofloxacin after the results of the susceptibility tests. After 6 weeks, the treatment was continued with levofloxacin alone for 6 months.

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Discussion. *Yersinia pseudotuberculosis* is an enteric pathogen. In humans, this Gram-negative bacterium causes digestive illness (diarrhea and abdominal pain) and, also, systemic symptoms, such as fever, scarlatiniform rash, erythema nodosum,

FIG. 1. PCR detection of the *ypm* superantigen genes in *Y. pseudotuberculosis* strains. Lanes 1, strain AH (*ypmA*⁺); lanes 2, strain 487/90 (*ypmB*⁺); lanes 3, strain 2777 (nonsuperantigenic); lanes 4, strain isolated in this study. *Yptb3405* is an open reading frame conserved in the *Y. pseudotuberculosis* species. PCR conditions have been described previously (3).

and lymphadenopathy. *Y. pseudotuberculosis* is the only Gram-negative bacterium producing a superantigen. The 14.5-kDa exotoxin (designated YPM, for *Yersinia pseudotuberculosis*-derived mitogen) might be involved in inflammatory postinfection complications (reactive arthritis and erythema nodosum) and in Kawasaki syndrome (11).

Hypertension is considered a common underlying etiologic factor for atherosclerosis and is associated with increased risk for aortic aneurysm. Using conventional bacteriological techniques, the most commonly identified responsible organisms in primary infected aneurysm are *Salmonella* spp. (50%) and *Staphylococcus aureus* (30%), followed by other *Enterobacteriaceae*, such as *Escherichia coli*, *Streptococcaceae*, and some Gram-negative bacilli. In prosthetic vascular graft infections, the bacteria most frequently involved are *Staphylococcus aureus* in the early infections and coagulase-negative staphylococci in the late infections (9, 10). A search in MEDLINE from 1975 up to now using the key words aneurysm and *Yersinia* reported a total of 16 cases. Among *Yersinia* spp., the species most frequently found in mycotic aneurysm is *Y. enterocolitica* (5, 8, 12–18). *Y. pseudotuberculosis* was reported once in 2006 in an elderly patient with atherosclerotic cardiovascular disease by Hadou et al. (7). Among the prosthetic vascular graft infections, only 2 cases due to *Y. enterocolitica* were reported (1, 19). Our case is the first describing a prosthetic vascular infection due to *Y. pseudotuberculosis*. In our case, predisposing factors, such as cirrhosis, may explain the susceptibility of the patient to *Yersinia* although no gastrointestinal disorder was found; the stool culture remained negative for *Y. pseudotuberculosis*. The tropism of *Y. pseudotuberculosis* to the vascular system may be explained by the possibility of the bacteria harboring the *ypm* gene, which can be involved in microvascular disease, as in Kawasaki syndrome (11). Consequently, it would be of interest to find this superantigen marker in this case. Unfortunately, the test was negative for our strain—serotype O:I is rarely positive for the *ypm* marker (6). The analysis of the *Y. pseudotuberculosis* genomes (4 completed and 3 in progress) did not reveal the presence of a gene encoding a superantigen-related toxin other than *ypmA*. Thus, it is highly unlikely that the strain

isolated in this study carries another version of the *Y. pseudotuberculosis* superantigenic toxin. Physicians and microbiologists should pay particular attention to *Y. pseudotuberculosis* having a predilection for vascular tissue. As resection of the vascular material was not considered likely to be successful and so was not performed, a long antimicrobial treatment with fluoroquinolone followed and seemed to be effective, since a good permeability of the prosthesis has been noted without inflammatory signs for 8 months.

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