Unusual Presentation of Lumbar Surgical Site Infection: A Case Study of Early Onset *Pasteurella multocida* Infection after Arthrodesis

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**Patient:** Female, 70-year-old

**Final Diagnosis:** Acute *Pasteurella multocida* surgical site infection

**Symptoms:** Fever • pain • scar discharge

**Clinical Procedure:** —

**Specialty:** Infectious Diseases • Surgery

**Objective:** Rare coexistence of disease or pathology

**Background:** Infection is a serious surgical complication that significantly increases morbidity rates and health care expenses. Most human *Pasteurella multocida* infections are soft-tissue infections caused by dog or cat bites. *Pasteurella multocida* (P. multocida) is present in the oral, nasopharyngeal, and upper respiratory tract microbiota among cats, dogs, and other domestic or wild animals. Here, we report a case of lumbar surgical site infection caused by this bacterium.

**Case Report:** A 70-year-old diabetic and overweight woman had a *Pasteurella multocida* surgical site infection after lumbar arthrodesis carried out for lumbar stenosis associated with spondylolisthesis. The patient had been in contact with her cat and claimed to have simply slept with it in her bed. Multiple antibiotic therapies and 3 debridement-irrigations with change of spinal implants during the last revision were needed.

**Conclusions:** Infections caused by *P. multocida* are rare and most often occur as a result of animal scratches or bites, but can sometimes occur after simple contact with an animal. Surgical site infection of spinal arthrodesis due to *Pasteurella multocida* implies treatment difficulties. In case of *Pasteurella multocida* infection of lumbar spinal arthrodesis, even in the early period, implant removal seems to be useful to limit the appearance of biofilm more specific to this micro-organism.

**Keywords:** Case Reports • Neurosurgery • Orthopedic Procedures • *Pasteurella multocida*

**Abbreviations:** BMI – body mass index; MRI – magnetic resonance imaging; CT – computed tomography; L3 – third lumbar vertebrae; L4 – fourth lumbar vertebrae; L5 – fifth lumbar vertebrae; D – Day

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Background

Instrumented spinal fusion surgery is associated with a significant rate of surgical site infection (1-12%) [1,2]. The most frequently found pathogens are *Staphylococcus aureus*, coagulase-negative *Staphylococcus*, and other gram-positive bacteria [2]. *Pasteurella multocida* is a gram-negative coccobacillus saprophyte of the airway and digestive tracts of mammals and birds. Humans in contact with animals can be carriers in the oropharynx area [3]. In humans, *Pasteurella* infections are mostly described after inoculation of a wound by a bite or scratch, especially from a cat [4], and sometimes is involved in pneumonia with bronchiectasis and rarely in meningitis [5,6]. To the best of our knowledge, this is the first reported case of spinal surgical site infection caused by this pathogen and its management difficulties.

Case report

Our patient was a 70-year-old woman who was overweight (body mass index (BMI)=29 kg/m²) and was an active smoker (22 pack-years) and had diabetes mellitus, peripheral arterial disease, and high blood pressure was suffering from neurogenic claudication associated with fifth lumbar vertebrae (L5) radicular pain. Magnetic resonance imaging (MRI) and computed tomography (CT) scan show a 3-level lumbar stenosis associated with degenerative third lumbar vertebrae-fourth lumbar vertebrae (L3-L4) spondylolisthesis (*Figure 1*). After a well-conducted medical treatment, lumbar decompression and arthrodesis were performed.

Postoperative radiographs were satisfying (*Figure 2*). The postoperative course was simple, the patient remained apyretic, and her scar was clean. She was discharged from the hospital 6 days (D6) after surgery. Eight days later (D14), she came to the Emergency Department with scar exudate, without fever. Blood analysis showed biological inflammatory syndrome (*Figure 3*). We performed debridement and irrigation with antiseptic serum using a pulsed lavage system (*Figure 4*).

After taking intraoperative bacteriological samples, we initiated empirical antimicrobial therapy with daptomycin 10 mg/kg/d

*Figure 1*. Three-level lumbar stenosis associated with degenerative L3-L4 spondylolisthesis
Figure 2. Postoperative radiographs.

Figure 3. Illustration of the evolution of our patient’s C-reactive protein, leukocytes, hemoglobin, and temperature during hospitalization.
IV Daptomycin (10 mg/kg/d) and Piperacillin-tazabactam (4 g/6 h)

Early onset postoperative spinal implant infection
1st debridement

IV Amoxicillin-clavulanate (2 g/4 h)

D0

IV Daptomycin (10 mg/kg/d) and Piperacillin-tazabactam (4 g/6 h)

2nd debridement

IV Daptomycin (10 mg/kg/d) and Amoxicillin-clavulanate (2 g/4 h)

D14

IV Amoxicillin-clavulanate (2 g/4 h) and PO Levo/f_laxacin (750 mg/d)

D19

IV Meropenem (2 g/8 h) and Cefriaxone (1 g/12 h)

D21

Cefriaxone (1 g/12 h)

D25

PO Oxycycline (100 mg/12 h)

D28

3rd debridement
Removal and reinsertion of new implants

D29

Hospital discharge

D33

D39

D40

Figure 4. Treatment flow chart.

Figure 5. Pasteurella multocida antibiogram of the first surgery.

Figure 6. Pasteurella multocida antibiogram of the second surgery.
and piperacillin-tazobactam 4 g/6 h in accordance with local protocol. We used postoperative external drainage for 3 days. Microbiological cultures only identified Pasteurella multocida (Figure 5). This rare discovery led us to requestion the patient about her contact with pets. She admitted sleeping with her cats, consistent with the zoonotic origin of Pasteurella multocida.

Five days after revision surgery (D19), we adapted antimicrobial therapy according to a multidisciplinary meeting, including infectious disease specialists. We started high-dose intravenous amoxicillin-clavulanate 2 g/4 h. We preferred amoxicillin-clavulanate to amoxicillin alone to cover other potential pathogens while waiting for the final microbiological results. Indeed, we wanted to maintain protection against gram-negative bacteria and anaerobic coverage while we tried to understand the mode of contamination.

Two days later (D21), a new purulent exudate occurred from the scar without fever nor pain but with a slight biological inflammatory syndrome (Figure 3). We performed a new debridement-irrigation associated with new intraoperative bacteriological sampling. We extended antibiotic therapy by discontinuing amoxicillin-clavulanate and replaced it with intravenous daptomycin and piperacillin-tazobactam at the same dosages as initially prescribed. Pasteurella multocida was found again on cultures in 3 out of 5 samples (Figure 6). Four days after the second debridement-irrigation (D25), we discontinued piperacillin-tazobactam, maintained daptomycin, and added intravenous amoxicillin-clavulanate at the same dosages as initially prescribed.

Seven days after the second debridement-irrigation (D28), the clinical and biological evolution was satisfying (Figure 3)
and allowed us to discontinue daptomycin and introduce per os levofloxacin 750 mg/d in combination with intravenous amoxicillin-clavulanate.

On the next day (D29), an abundant and purulent scar flow appeared again. Following the advice of infectious disease specialists, we stopped antibiotics to be able to obtain a microbiological sample without antimicrobial treatment exposure. We performed new sampling, debridement, and irrigation. A local instillation of vancomycin powder (2 g) was added. We also removed and refitted the arthodesis implants, and we introduced postoperative intravenous antimicrobial therapy with meropenem 2 g/8 h and daptomycin 10 mg/kg/d.

Four days after this third revision procedure (D33), in the absence of new microbiological identification, we switched antimicrobial treatment to daptomycin 10 mg/kg/d and ceftriaxone 1 g/12 h. The delayed cultures were negative but Pasteurella was detected at D39 in polymerase chain reaction (PCR) amplification of 16S rDNA genes. The clinical and biological evolution was then satisfying (Figure 3), allowing us to discontinue daptomycin and continue ceftriaxone alone. Eleven days after the third surgical revision (D40), the good outcomes allowed us to stop the ceftriaxone and to introduce per os doxycycline 100 mg twice a day, which has better tolerance and spectrum than levofloxacin. The multiple changes in antibiotic therapy were due to the fact that we suspected superinfection by another pathogen. We then proceeded to early rehabilitation as soon as the results of the first cultures did not reveal new microbiological documentation.

The treatment was conducted during 12 weeks from the last debridement-irrigation, with a good tolerance. The biological inflammatory syndrome had disappeared during that time, and the scar remained clean. The patient had a good clinical and radiological (Figure 7) outcome without lumbar neither radicular pain at the last follow-up (12 months).

Discussion

In our case, a complete change of equipment as soon as the pathogen was identified, combined with lavage and effective antibiotic therapy, would appear to be the only solution for definitively curing this infection. Animal bites, scratches, or licks from pets are possible in people who have undergone spinal surgery requiring equipment, and we believe that they should be informed about the risks and measures to take in case of a bite. Its implication in spinal surgical site infection appears exceptional. This case illustrates the difficulties of treatment, which required 3 debridement-irrigations. Superficial infections of the surgical site are very rare in the presence of lumbar scar discharge and should not be a diagnostic option delaying deep surgical debridement, which must include deep soft tissue and bone, as well as implants. The unusual failure of this recurring strategy made us suspect Pasteurella multocida as one of the possible causes.

Septic complications are a significant concern among the potential risks associated with spine surgery. The occurrence of acute surgical site infections in this domain surpasses that observed in other orthopaedic surgeries and these infections may result in more severe local and general complications. As such, special attention must be given to the prevention and management of septic complications in patients undergoing spine surgery.

The rate of this adverse event reported in the literature is between 0.5% and 20% [7]. The observed variability can be attributed to the extensive diversity of surgical interventions and the patient population undergoing surgery [8].

Postoperative infections are predominantly linked to gram-positive cocci, with Staphylococcus aureus being the most frequently identified pathogen, accounting for over 50% of infections in certain studies. Other commonly encountered pathogens include Staphylococcus epidermidis and beta-hemolytic Streptococcus. Gram-negative bacteria such as Escherichia coli, Pseudomonas, Klebsiella, and Enterobacter cloacae are also observed.

The identification of pathogens can be affected by the specific anatomical location of the surgical procedure. It has been noted that digestive contaminations are commonly observed in the lumbar spine and lumbosacral region [9-13]. P. multocida infection is usually caused by direct tissue inoculation. A multidisciplinary coordination meeting should be organized to encourage collaboration and deliberate on the most effective therapeutic approach. For early-onset spinal implant infection, debridement surgery with implant retention followed by combination antibiotic therapy for 3 months classically appeared safe and effective [14-16].

Indeed, according to international recommendations, there is little information available on management of spinal implant infection. Indications and modalities of surgical treatment are relatively well defined: implants should be removed whenever spinal fusion is achieved [7,17,18]. If the removal of an implant is hazardous, as in early-onset spinal implant infections, debridement surgery with implant retention should be performed [19].

When the implant cannot be removed, the modalities of antibiotic treatment are crucial to prevent a relapse of the infection. P. multocida is usually susceptible to several antibiotics,
including penicillin, amoxicillin-clavulanate, piperacillin-tazobactam, doxycycline, fluoroquinolones (eg, levofloxacin, ciprofloxacin), third- or later-generation cephalosporins (eg, cefpodoxime, cefixime, ceftriaxone, ceftaroline), carbapenems (eg, imipenem, meropenem), and cefotaxime. To the best of our knowledge, there have been no published clinical studies investigating the performance of several antibiotic classes against Pasteurella spp. infections. Recommendations regarding the treatment of choice are evidence-based and founded on the expected antimicrobial susceptibility of the bacterium in in-vitro assays [20]. Human infections caused by P. multocida resistant to amoxicillin/clavulanic acid are extremely rare. Only 1 case was described, in 2021, and concerned a skin and soft-tissue infection of the wrist following a cat bite [21]. The choice of conservative treatment with implant retention must always be considered in cases of acute infections (onset of symptoms less than 3 weeks), including radical surgical debridement with replacement of the mobile components and targeted antibiotic therapy for 12 weeks, according to current recommendations [22,23].

At our institution, all patients with postoperative spinal implant infections are treated by an interdisciplinary team including surgeons, infectious disease specialists, and microbiologists.

In this case, antibiotic therapy with daptomycin and piperacillin-tazobactam was initiated in light of the local bacterial ecology and resistance data, based on the latest peer-reviewed literature recommendations [24-26]. It was later replaced by high-dose intravenous amoxicillin-clavulanate. These molecules were effective against the pathogen identified, but 2 treatment failures occurred, requiring 3 revision surgeries.

Humans acquire Pasteurella infection primarily through contact with animals [5]. Pasteurella multocida is the predominant human pathogen encountered. Some genes encoding putative virulence factors are universally present in all 6 Pasteurella multocida genomes. Among them, genes encoding the outer membrane protein and the adhesion/Flp pilus assembly cluster play key roles in biofilm formation, colonization, and pathogenesis [6]. Those particularities led us to consider replacement of implants after 2 debridement-irrigations.

This therapeutic management resulted in resolution of the infection. The rarity and severity of this type of infection does not allow us to define recommendations or to hypothesize about specific early production of a biofilm. However, it seems necessary to consider all available means to reduce the bacterial inoculum and promote the effectiveness of antibiotics.

Conclusions

An exceptional early-onset spinal surgical site infection by Pasteurella multocida illustrates rare treatment difficulties. The high prevalence of pets in the home increases the risk of exposure to P. multocida and thus the number of possible infections. Patients undergoing spinal surgery should be advised of the risk of close contact with pets. To our review of the literature, we report the first case of spinal surgical site infection caused by this pathogen, which was successfully treated with a multidisciplinary approach including implant replacement with multiple irrigations and targeted antimicrobial therapy.

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Ethics Approval

This report was approved by the institutional Ethics Committee (Charles Nicolle Research Ethics Review Committee).

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