**Pasteurella multocida** bacteremia in asymptomatic plateletpheresis donors: a tale of two cats

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**BACKGROUND:** Bacterial contamination of platelet (PLT) concentrates occurs in 1 in 1000 to 1 in 3000 components and has been a leading cause of transfusion-associated morbidity and mortality. Two cases of **Pasteurella multocida** bacteremia in asymptomatic plateletpheresis donors are reported. Clinical outcomes were profoundly different, emphasizing the importance of robust methods to detect bacterial contamination.

**CASE REPORTS:** The first case occurred before the implementation of bacterial testing of PLTs. A plateletpheresis component was collected from a 70-year-old man and transfused to an 88-year-old man, who developed rigors, tachycardia, and hypotension within 15 minutes of the start of the transfusion. Cardiopulmonary arrest ensued and he expired 6 hours after transfusion. Blood cultures collected after transfusion and cultures of the PLT component were positive for the presence of *P. multocida*. Investigation revealed that a feral cat had bitten the donor 100 minutes before his donation. He had not reported the event to the donor room staff. The second case involved a 74-year-old woman who developed a flulike syndrome 2 days after plateletpheresis donation. *P. multocida* was isolated in routine bacterial culture of her PLT component. The donor had several feral cats, and although there was no history of bite or scratch, one cat liked to lick her hands, which were chapped from gardening.

**CONCLUSION:** Occult bacteremia with *P. multocida* transmitted by feral cats was the source of PLT contamination in two cases over 3 years. Bacterial testing of PLTs is critical in the prevention of transfusion-acquired sepsis and allows the identification and treatment of asymptomatic bacteremic donors.

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Transfusion-associated sepsis due to bacterial contamination of platelet (PLT) concentrates was, until recently, a leading cause of transfusion-associated morbidity and mortality in the United States. PLT concentrates are particularly susceptible to bacterial contamination, because they are stored in plasma at room temperature (20-24°C) to maintain optimal PLT viability and performance. These conditions provide a rich growth environment for bacteria.

Donor questioning about risks and symptoms of blood-borne infections and a limited physical examination, including general appearance and vital signs, are currently the two screening methods in use to prevent the occurrence of a septic transfusion reaction. Donors with abnormal vital signs, symptoms or risks for infection, or recent antibiotic use are temporarily deferred from donation. Methodic cleansing of the phlebotomy site before collection of the component and the use of diversion techniques to discard the first aliquot of blood and prevent contamination of the unit with a skin core constitute the physical steps taken to prevent component contamination. Subsequent component preparation is performed in a sterile fashion, and the final products are stored, shipped, and transfused with strict adherence to time and temperature conditions. Despite these precautions, bacterial contamination of PLTs remained a leading cause of transfusion-transmitted disease. It was not until routine
bacterial testing of PLTs was implemented that a decrease in the incidence of transfusion-associated bacterial sepsis was noted.

A total of 9.88 million PLT dose equivalent units were transfused in the United States in 2004, as reported in the most recent Nationwide Blood Collection and Utilization Survey. Sixteen percent of these units (1.54 million) were derived from whole blood, and the remaining 84 percent (8.34 million) were collected by apheresis (1.39 million apheresis packs). Because the most common dose of PLTs given per transfusion was 6 units, an estimated 1.65 million PLT transfusion events occurred per year.

Multiple studies before 2002 demonstrated that bacterial contamination of PLTs occurred in 1 in 1000 to 1 in 3000 components, thereby resulting in the potential transfusion of 2000 to 4000 bacterially contaminated units per year. Prospective clinical studies suggest that overt clinical sepsis occurs in 10 to 40 percent of transfused bacterially contaminated units. Data from prospective hemovigilance and surveillance studies in England, France, and the United States indicate that fatalities happen in one-fifth to one-third of these transfusions, translating to a risk of death from the transfusion of a bacterially contaminated PLT unit of 1 in 7500 to 1 in 30,000. More recent reports after the implementation of routine prospective microbial culture of plateletheresis concentrates revealed that 0.017 to 0.019 percent, or approximately 1 in 5000 apheresis concentrates, were truly contaminated with bacteria.

We report two cases of asymptomatic bacteremia in plateletheresis donors caused by an unusual organism, Pasteurella multocida. The first case occurred before the implementation of bacterial testing of apheresis PLTs. Clinical outcomes in these cases were profoundly different, emphasizing the importance of sensitive bacterial detection methods. Both cases also illustrate the responsibility and crucial role of the blood center in donor notification and assuring prompt referral to an urgent care facility for donors with potentially life-threatening medical conditions.

**CASE REPORTS**

**Case 1**

The recipient was an 88-year-old man with myelodysplastic syndrome who received outpatient red cell (RBC) and PLT transfusions as needed. After a morning arrival, he received two RBC units uneventfully and was on schedule to receive a PLT transfusion in the afternoon. Before the PLT transfusion, the patient had an oral temperature of 37.6°C, a pulse of 72 bpm, and blood pressure of 160/70 mmHg. Fifteen minutes after the transfusion began, with approximately 150 mL of the 556-mL apheresis PLT concentrate transfused, the patient suffered rigors and shortness of breath. His pulse and temperature rose to 128 bpm and 39.2°C, respectively, and his blood pressure fell to 104/50 mmHg. The transfusion was halted and the patient was admitted to the intensive care unit. Antibiotics were started (ceftazidime and gentamycin) 3 hours 55 minutes after the transfusion reaction. Blood pressure continued to fall to 75/35 mmHg and urine output ceased. Six hours after transfusion, the patient experienced a cardiorespiratory arrest and expired. Blood cultures performed on patient samples drawn before the transfusions were negative. Blood cultures drawn after the PLT transfusion event but before the administration of antibiotics grew P. multocida.

The implicated plateletheresis product was collected from a 70-year-old male donor who had a history of 51 prior plateletheresis donations. The donor was found to meet all donation eligibility criteria as elicited by routine predonation questioning and had normal vital signs, including a predonation oral temperature of 36.3°C. A standard plateletheresis component was collected with a dual-access continuous-flow apheresis instrument (Amicus, Baxter Healthcare, Deerfield, IL) with a total collection time of 1 hour 17 minutes. The right antecubital vein was used as the draw line, and the collection kit was not equipped with a diversion pouch. The collection was uneventful as was the subsequent PLT storage and release by the blood collection center.

The product was 4 days old at the time of shipment to the receiving hospital and transfusion to the patient. A transfusion reaction investigation ruled out possible ABO-Rh mismatch, and the returned PLT component bag appeared unremarkable. Gram stain of a posttransfusion patient blood sample and the residual contents in the PLT bag revealed Gram-negative rods. Aerobic cultures from both sources showed an oxidase-negative, indole-positive organism, definitively identified as P. multocida by routine microbiologic methods and subcultures. Cultures of the two RBC units given to the patient on the same day were negative. Pretransfusion patient blood cultures also showed no growth.

A sample from the residual PLT component was sent to the Centers for Disease Control for evaluation. Serial 10-fold dilutions of this material were plated in duplicate onto blood agar plates and colonies were counted after 24 hours of incubation at 35°C. Final colony counts were calculated by multiplying the mean colony-forming unit (CFU) by the dilution factor. The cultures were positive for the presence of P. multocida at a level of 2.5 × 10^7 CFUs per mL with an endotoxin level of 238 endotoxin units (EUs). The EU dose the patient received was approximately 13.6 EUs per kg per hour. The threshold pyrogenic dose is 5 EUs per kg of body weight per hour.

The blood center was alerted by the hospital facility when organisms were identified on the Gram stains. The blood center arranged for the culture of a refrigerated 7.0 mL ethylenediaminetetraacetate retention tube
derived from the donor’s left arm at the start of the collection. This specimen was used to determine the donor’s PLT count and stored at 4°C after testing. Culture results of this source proved to be negative.

Upon identification of a Gram-negative rod in the PLT bag, the donor was contacted and questioned about his general health. He was a retired aerospace engineer living in a rural area on a farm. He had a history of hypertension, well controlled on medications. Although he denied being physically ill before donation, he reported the occurrence of a cat bite approximately 100 minutes before the start of his plateletpheresis donation. When questioned further, the donor stated that he had recently adopted a feral cat with her newborn kittens. On the morning of donation, the cat had scratched and bitten him when he attempted to pick her up. The bite occurred on his right index finger and was described as a deep puncture wound with a great deal of bleeding. He cleansed the area with peroxide and bandaged it before appearing for his scheduled plateletpheresis donation. He did not communicate the injury to the apheresis collection staff. The evening after donation, the donor noted that his finger had swollen. He treated the finger with warm Epsom salt soaks, and the wound appeared improved on the following day. He did not contact the blood collection center, and he did not seek further medical care for the cat bite, although he was advised to do so when contacted by the blood center 4 days after donation. He reported that his tetanus vaccination was current and he did not believe that he required rabies vaccine. The cat continued to appear healthy and exhibited no signs of rabies.

The donor returned to the blood center for a physical examination by a blood center physician 10 days after donation. The cat bite wound was well healed, without evidence of infection. His right antecubital area was scarred but also well healed from multiple PLT donation venipunctures. Blood cultures drawn that day were negative.

**Case 2**

The donor was a 74-year-old woman with 163 prior plateletpheresis donations in the past 20 years. She felt well on the day of donation, met all health history criteria for allogeneic donation, and had normal vital signs (pulse, 80 bpm; blood pressure, 105/70 mmHg; and temperature, 36.7°C). The PLTs were collected with a single-vein access discontinuous-flow cell separator and a collection kit equipped with a diversion pouch (MSC+, Haemonetics Corp., Braintree, MA). Three liters were processed during six apheresis cycles in an uneventful donation. Per standard operating procedures, a 5-mL sample was obtained for culture by aseptic technique with a sterile connecting device (TSCD, Terumo Medical Corp., Somerset, NJ) and plasma transfer set (Charter Medical Ltd, Winston-Salem, NC) and inoculated into a single aerobic culture bottle (BacT/ALERT, bioMérieux, Durham, NC). Nine hours after inoculation, the bottle indicator became positive for the presence of bacterial growth. Gram stain from the culture bottle revealed small Gram-negative rods with a coccobacillary appearance. Upon notification from the microbiology department of the positive blood culture bottle and Gram stain results, the entire plateletpheresis component was placed into quarantine. Two additional samples for aerobic culture obtained 48 hours after collection were also positive for the presence of Gram-negative rods. Subculture on selective growth media and chemical characterization identified the organism as *P. multocida* (Fig. 1). The infected plateletpheresis unit remained in quarantine until it was discarded after the completion of bacterial identification. Review of testing results on the preapheresis blood sample revealed a hemoglobin level of 13.2 g per dL, white blood cell count of $6.4 \times 10^9$ per L, and an absolute neutrophil count of $4.6 \times 10^9$ per L.

Two days after donation, the donor developed fevers to 38.9°C with diffuse myalgias, arthralgias, and intermittent rigors. She also complained of a “sore spot” on her neck that was raised, erythematous, and painful. On Day 5 after donation, she called her personal physician, who diagnosed a flulike syndrome and prescribed oseltamivir. The donor then called the donor center to report her illness. Within 30 minutes of this call from the donor, the blood bank medical staff received notification of the final culture results from the microbiology department. The donor and her personal physician were immediately
contacted, on Day 5 after donation, and arrangements were made for hospital admission and infectious disease consultation.

Further history revealed that the donor had four feral cats but denied being bitten or scratched by them. She indicated that her hands were chapped from gardening without gloves and that one of the cats frequently licked her hands. Her personal physician prescribed oral ampicillin-clavulanate and ciprofloxacin during the 24 hours before admission, and she became afebrile. Her hospital admission physical exam was remarkable only for an enlarged tender left supravacular lymph node that corresponded to the “sore spot” on the donor’s neck. Blood cultures during hospitalization were negative, and two-dimensional echocardiography confirmed known aortic stenosis and mitral regurgitation but did not reveal evidence of valvular vegetations. Because the donor had a history of right total hip arthroplasty 7 years earlier, radiographic imaging of her right hip was performed and found to be normal. She received 10 days of intravenous (IV) ampicillin-sulbactam as an inpatient and was discharged to continue an additional 6 weeks of IV antibiotics (ampicillin-sulbactam every 6 hr via a peripherally inserted central catheter) followed by 2 weeks of oral ciprofloxacin at home. Outpatient transesophageal echocardiogram performed 2 weeks after hospital discharge revealed two small vegetations, one each on the aortic and mitral valves. The patient was cautioned to wear protective gloves while gardening and to guard herself from cat bites, scratches, and licks. She was deferred from donating for 1 month after the completion of all antibiotics and after obtaining clearance from her personal physician.

**DISCUSSION**

The two cases described in this study represent the first reported incidents of *P. multocida* bacteremia in asymptomatic plateletpheresis donors. They furthermore illustrate the profound difference in transfusion outcomes that can follow the implementation of routine prospective microbial monitoring of plateletpheresis concentrates. In the first case, transfusion of a concentrate containing a large inoculum of *P. multocida* and a high endotoxin level resulted in septic shock and death in the recipient. The donor of the unit had experienced only a transient local infection at the site of a cat bite. Predonation screening does not require questioning about animal bites. The donor failed to attribute significance to the cat bite and therefore did not mention it to the donor room staff. This case occurred before the implementation of routine bacterial monitoring. It is not possible to speculate as to whether a surveillance culture drawn from the component 24 hours after storage at 37°C would have turned positive before the unit was transfused. The first 2 years of experience with routine bacterial monitoring with automated microbial culture systems in the United States, however, suggests that the overwhelming majority of bacterial contamination cases, and particularly those involving Gram-negative organisms, are detected before transfusion of the component.7,8

The second case is an example of *P. multocida* bacteremia due to contact with cat saliva, but not resulting from an animal bite. The donor denied having been bitten by her pet cats, but one cat often licked her hands, which were chapped from gardening. This donor became symptomatic 2.5 days after her donation, with symptoms that she and her personal physician believed were consistent with a flu-like illness. Routine monitoring of plateletpheresis concentrates by bacterial culture had become the standard of care at the time of the second case, and the transfusion of a contaminated product was prevented.

Both cases illustrate the role of the blood center in identification, urgent notification, and facilitation of medical treatment for bacteremic donors. The donor in the first case had recovered from transient bacteremia by the time the infectious organism was identified. Although he refused to seek further medical care from a community physician, follow-up examination by the blood center physician and repeat blood cultures revealed no evidence of persistent infection. In the second case, however, the donor became symptomatic within 72 hours of her PLT donation. In her case, *P. multocida* bacteremia was complicated by existing valvular heart disease and a prosthetic hip, which made the infectious event potentially life-threatening. The blood center physician had to be persuasive and consistent with both the donor and her personal physician to ensure prompt, comprehensive inpatient treatment.

*P. multocida* is a small, aerobic and facultative anaerobic, Gram-negative coccobacillus that produces a lipopolysaccharide endotoxin. It was first isolated in 1878 from wild hogs and birds and is responsible for many diseases in mammals including shipping fever and hemorrhagic septicemia in cattle, fowl cholera in chickens and turkeys, rabbit snuffles, and atrophic rhinitis in pigs.9,10 *P. multocida* has a worldwide distribution and is frequently found as a commensal organism among the normal flora of the digestive and respiratory systems of many wild and domesticated animals. Carriage rates are reported to be 50 to 70 percent in cats and 12 to 66 percent in dogs.11

*P. multocida* is a zoonotic agent of human disease that is potentially life-threatening but easily treatable. Infections in humans range from localized soft tissue injuries and cellulitis to systemic manifestations affecting every organ system, including septicemia, endocarditis, pericarditis, pneumonia, empyema, lung abscess, peritonitis, osteomyelitis, osteoarticular infection, epiglottitis, meningitis, and brain abscess.9,12-22 Soft tissue infections
are the most common presentation, appearing as purulent wounds (48% of cases), cellulitis (36%), or abscesses (16%).23 Systemic consequences of _P. multocida_ infections have generally been reported in chronically ill or immunosuppressed hosts; however, in one study, 24 percent of patients with sepsis had no known underlying medical conditions.24,25 The overall mortality rate in _P. multocida_ sepsis is 31 percent.23

Human infections with _P. multocida_ most commonly occur as a result of an animal bite. Cat bites are implicated in the greatest number of cases due to the sharp, slender teeth and very high carriage rates in cats.11 A case of _P. multocida_ sepsicaemia has even been attributed to a sleeping patient’s cat chewing on his Hickman catheter.26 Other human infections result from nonbite exposure to contaminated animal secretions such as cat or dog saliva. Reported examples include infections associated with domestic dogs or cats licking leg ulcers, herpetic lesions, and home nebulizers.11,14,16,27 Finally, there are cases with unknown animal exposure.18,24,25

Approximately 9.9 million PLT dose equivalent units are transfused each year in the United States.7 Although sepsis has been reported with RBC transfusions, PLT products have accounted for almost 75 percent of fatalities that occur from bacterially contaminated transfused blood products.4,5 Before the implementation of routine bacterial testing, the risk of bacterial contamination of PLTs was 50 to 250 times greater than the combined risk of human immunodeficiency virus, hepatitis B virus, hepatitis C virus, or human T-lymphotropic virus-I and -II transfusion-transmitted infection and increased with the age of the PLT product.28 The organisms responsible for septic transfusion reactions arise from three sources: 1) from the skin, involving commensals such as _Staphylococcus aureus_ or _Staphylococcus epidermidis_; 2) from occult donor bacteremia associated with organisms such as _Streptococcus viridans_ or _Vesirnea enterocolitica_; and 3) from contamination during blood processing with organisms such as _Bacillus, Pseudomonas_, and _Enterobacteriaceae_ spp.29 To reduce the morbidity and mortality of PLT transfusion–associated sepsis, the AABB mandated bacterial testing for all PLT products beginning March 1, 2004.30 Routine bacterial testing of PLT units has led to the identification of unrecognized life-threatening disease or infection in at least one prior donor. _Streptococcus bovis_ was detected by routine bacterial testing of a PLT component collected from an asymptomatic donor who, after referral by the blood center to her personal physician, was found to have a 3-cm, moderately differentiated adenocarcinoma of the colon.31

Occult bacteremia with _P. multocida_ transmitted by feral cats was the unusual source of PLT contamination in two cases over a 3-year period in a single geographic area. This highlights the importance of this organism as a potential cause of bacterial contamination in units collected from apparently healthy, asymptomatic donors. It is perhaps surprising, given the high carriage rates for this organism in cats and dogs, and the frequency with which healthy volunteers are exposed to the salivary secretions of household pets, that _P. multocida_ contamination of PLT components has not previously been reported. Because the residual risk of septic reactions from bacterially screened plateleapheresis components is extremely small, we do not recommend that donor screening be modified to include questions related to animal bites or licks. Bacterial testing of PLTs is paramount in the prevention of transfusion-acquired sepsis and also allows for the identification and urgent treatment of bacteremic donors.

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