In Brief

Pasteurella multocida Infections

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Pasteurella sp are small, gram-negative coccobacilli that are pathogens primarily in animals but can cause a variety of infections in humans, usually as a result of a cat or dog bite. Of the *Pasteurella* sp known to infect humans, *P multocida* is the most important. *Pasteurella* sp are distributed worldwide as commensals or parasitic organisms in the upper respiratory and gastrointestinal tracts of domestic and wild animals and birds. *P multocida* is found in the oropharynx of 70% to 90% of domestic cats, 25% to 50% of dogs, and many other animals. Transmission to humans usually occurs by contact with saliva of colonized animals, the most common sources of infection being bites, scratches, and licks by cats or dogs. Respiratory infection with this organism has been described in veterinarians, farmers, milkmen, and persons employed in areas where animal tissues are processed. The possibilities of a reservoir of infection in humans and interhuman spread have been considered. *P multocida* has been recovered from nasopharyngeal excretions, urine, and feces of asymptomatic humans, and the colonized female genital tract is regarded as a potential source for cases of septicemia and meningitis in the newborn.

In animals that are stressed, *P multocida* can overwhelm the host, and a picture of hemorrhagic septicemia develops. Three major types of infection occur in humans: wound infection, infection of the respiratory tract, and serious invasive infection. The most common type is local wound infection after a cat or dog bite or scratch. Septic arthritis and osteomyelitis are common, resulting either from local extension of soft-tissue infection or from direct inoculation of the organism into the joint capsule or periosteum. Infection of the respiratory tract and invasive infections are less common. Pneumonia with or without empyema occurs chiefly in adults who have underlying bronchopulmonary disease. Invasive infections with bacteremia can lead to septicemia, meningitis, acute appendicitis, hepatic abscess, peritonitis, endocarditis, or ocular infections in the young infant and immunocompomised host.

The most common manifestation in children is cellulitis associated with an animal bite. The usual clinical pattern of the wound infection is very rapid progression of swelling, erythema, and tenderness within the first 12 to 24 hours of injury. There may be a serosanguineous-to-purulent discharge at the site. Signs of systemic toxic effects such as chills and fever may be present; regional lymphadenopathy often is evident. Less commonly, the infection may be low-grade and smoldering. Local complications such as septic arthritis, osteomyelitis, and tenosynovitis are common and occur most often after a cat bite, due to the sharpness of the teeth and depth of penetration. Cat bites of the hand, if untreated, can result in the combination of osteomyelitis of the phalanx and interphalangeal arthritis. Most patients who have this infection require surgical drainage and repair, without which there is the risk of a poor functional outcome.

Infection with *Pasteurella* is diagnosed definitively by isolating the organism in a culture. *Pasteurella* grows readily on blood agar and generally appears as a single gram-negative coccus. However, the organism may grow in clusters or pairs or resemble a short rod and, therefore, has been mistaken for *Neisseria meningitidis* or *Haemophilus influenzae*, especially on Gram stains of sputum or cerebrospinal fluid.

Treatment of *Pasteurella* soft-tissue infection associated with an animal bite should begin with appropriate management of the bite wound, including evaluation of nerve function, tendon integrity, and vascular supply. Surgical drainage or debridement may be necessary, and consultation with an appropriate surgical specialist is recommended. All infected wounds caused by human or

animal exposure should be cultured and susceptibility testing performed. Usually, *Pasteurella* sp are exquisitely sensitive to penicillin, but some beta-lactamase-producing strains have been recovered. The organism also is sensitive to ampicillin, ticarcillin, amoxicillin-clavulanic acid, tetracyclines, second- and third-generation cephalosporins, fluoroquinolones, and trimethoprim-sulfamethoxazole (TMP/SMX). Semisynthetic penicillins (eg, nafcillin, methicillin, dicloxacillin), erythromycin, first-generation cephalosporins, clindamycin, and aminoglycosides have relatively low activity against *P multocida* and should not be used to treat these infections.

Amoxicillin-clavulanate (25 to 45 mg/kg per day of amoxicillin divided bid) is the treatment of choice for patients who have an infected cat or dog bite without a known bacterial cause. The agent is active not only against *P multocida* but also against oral anaerobes and most strains of *Staphylococcus aureus,* which may be copathogens. For those allergic to penicillin, TMP/SMX (8 to 10 mg/kg per day of TMP divided bid) in conjunction with clindamycin (10 to 30 mg/kg per day divided tid) are the drugs of choice for empiric treatment of the infected bite wound. Doxycycline and fluoroquinolones are effective, but should not be given to children younger than 8 and 18 years of age, respectively. The duration of therapy is 7 to 10 days for local infections.

Septic arthritis, tenosynovitis, and osteomyelitis should be treated surgically and with intravenous antibiotics. Other indications for intravenous antibiotics are signs of toxicity, developing lymphangitis, and poor response to oral antibiotics. Ticarcillin-clavulanate (200 to 300 mg/kg per day of the ticarcillin component divided every 4 to 6 hours) or ampicillin-sulbactam (200 to 300 mg/kg per day of the ampicillin component divided every 6 hours) are the drugs of choice for intravenous treatment and should cover the most common organisms associated with polymicrobial infection, including *P multocida.* With appropriate treatment, total resolution is the typical outcome, but the healing process may be slow, particularly in local infections that extend to the bone or tendons.

No *Pasteurella* vaccine for human use is available. Controlled contact with wild and domestic animals is probably the best approach to preventing human infection. Children should be taught at an early age about pet safety and proper hygiene when handling animals. Parents should be discouraged from allowing pets to lick infants and children on the face or on wounds. At home, animal bites and scratches should be washed immediately with water and soap. In the medical office or the emergency department, animal bites and scratches should be irrigated vigorously and devitalized tissue debrided cautiously. Suturing of bite wounds and use of antibiotic prophylaxis remain controversial. When the wound can be cleaned thoroughly, primary closure is acceptable, particularly with facial lacerations, for which good cosmetic outcome is a priority. Puncture wounds are prone to infection, so suturing is contraindicated. Prophylactic antibiotic treatment for 3 to 5 days should be considered for puncture wounds, wounds on hands and feet, all cat bite wounds, and any bite wound laceration that is sutured. The choice of antibiotic for prophylaxis is the same as for empiric treatment of infection.

Comment: Every year, Americans bitten by animals, primarily dogs and cats, number in the millions, and children are the most common victims. Up to 25% of dog bites and probably more than 50% of cat bites for which medical attention is sought become infected, with *Pasteurella* playing a starring role. Typically, *Pasteurella* wound infections are fulminant in their onset, with swelling, redness, and intense pain frequently developing within hours of the bite. Although penicillin is the drug of choice for *P multocida*, bite wound infections are likely to be polymicrobial, reflecting how well the mammalian mouth (including, of course, our own) functions as an incubator. At least initially, until the results of culture are available to guide therapy, antimicrobial coverage needs to be relatively broad in its spectrum, whether as prophylaxis or as treatment for evident infection.

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