8.6.19 Pasteurella 1088

8.6.19 Pasteurella 1088

section 8 Infectious diseases 1088 herds. This has been accomplished for a small number of herds in Norway, removing Yersinia, Salmonella, and Campylobacter carriage, but is not yet widespread. Sequencing of more strains of Y. enterocolit- ica (including Y. enterocolitica phylogroup PG1, biovar 1A strains) and Y. pseudotuberculosis will shed more light on pathogenic mechanisms and organism evolution. FURTHER READING Guern ASL, et al. (2016). Yersiniosis in France: overview and potential sources of infection. Int J Infect Dis, 46, 1–7. Hall M, et al. (2015). Use of whole-genus genome sequence data to develop a multilocus sequence typing tool that accurately identifies Yersinia isolates to the species and subspecies levels. J Clin Microbiol, 53, 35–42. Huovinen E, et al. (2010). Symptoms and sources of Yersinia enterocolitica-infection: a case–control study. BMC Infect Dis, 10, 122. Kolstoe EM, et al. (2015). Specific pathogen-free pig herds also free from Campylobacter. Zoonoses Public Health, 62, 125–30. Reuter S, et al. (2014). Parallel independent evolution of pathogen- icity within the genus Yersinia. Proc Natl Acad Sci U S A, 111, 6768–73. Rimhanen-Finne R, et al. (2009). Yersinia pseudotuberculosis causing a large outbreak associated with carrots in Finland, 2006. Epidemiology and Infection, 137 (Special Issue 03), 342–7. Vincent P, et al. (2007). Similarities of Kawasaki disease and Yersinia pseudotuberculosis infection epidemiology. Pediatr Infect Dis J, 26, 629–31. 8.6.19 Pasteurella Marina S. Morgan ESSENTIALS Pasteurella multocida is an important human Gram-negative pathogen residing primarily in the oropharynx of mammals and transmitted through bites and scratches. Presentation is typically within 12 h of the injury with rapidly spreading cellulitis or sepsis, leading to ser- ious morbidity and mortality (up to 40%) if untreated. Diagnosis is clinical: fresh bite wound cultures are unhelpful, but the organism is usually cultured in cases with established infection, especially if pre- senting within 24 hours of the injury. Treatment requires thorough wound debridement, with delayed closure if possible, along with antimicrobials to provide empirical cover against pasteurellae and all the other expected pathogens (e.g. amoxicillin-clavulanate plus ciprofloxacin, or meropenem plus clindamycin). Prevention is by avoidance of animal bites or scratches and prompt hygienic man- agement of wounds: antibiotic prophylaxis (amoxicillin-clavulanate or—for the penicillin allergic—doxycycline or azithromycin) should be reserved for high-risk bites (e.g. cat bites) or high-risk wounds that are difficult to debride adequately. Introduction Pasteurella multocida (literally ‘killer of many species’) is a major human pathogen and causes severe morbidity. Pasteurella septicaemia is associated with a mortality of 40% and a propen- sity for metastatic infection. Infection usually follows close animal contact or bites. The or- ganism is part of the colonizing oral flora in virtually every species from birds to elephants, water buffalo and Tasmanian devils, but found especially in cats. Historical perspective The genus Pasteurella was named in honour of Pasteur who, in 1880, discovered P. multocida to be the cause of fowl cholera. Pasteurella spp.

cause haemorrhagic septicaemia, ‘shipping fever’ in cattle, and respiratory infections in goats, sheep, and rabbits. Aetiology, genetics, pathogenesis, and pathology Nearly all infected patients have a history of animal exposure. Pasteurella spp. such as P. dagmatis, P. pneumotropica, P. bettyae, P. haemolytica, and P. caballi rarely cause human infection although P. bettyae has caused infection after hamster bites. Pasteurella spp. are small, Gram-negative coccobacilli, often with bipolar staining. Unusually for a Gram-negative rod, P. multocida is sensitive to penicillin and fails to grow on MacConkey’s agar. Potential virulence factors include capsule lipopolysaccharide, a cytotoxin, iron acquisition proteins, and other surface structures including homologues of the Bordatella pertussis filamentous haemagglutinin. An aggressive and opportunistic pathogen, P. multocida infection can colonize the oropharynx in those working with animals, causing invasive infection in those with underlying pathology such as liver cirrhosis or bronchiectasis. P. multocida is particularly associated with infection following animal bites, licks, or scratches. Metastatic infection of bones, joints, and brain following bacteraemia is not uncommon, whereas endocarditis and mycotic aneurysms are very rare. Cat-related trauma is particularly likely to result in pasteur- ella infection, especially septic arthritis and osteomyelitis following hand bites. Small, sharp cat teeth leave a septic focus in deeper tis- sues, under an apparently innocuous puncture wound. There are increasing numbers of reports of prosthetic joint infection following cat bites, with a propensity for knee replacements in females with rheumatoid arthritis. Necrotizing soft tissue infections such as tenosynovitis, septicaemia, and liver and brain abscesses are the more common manifestations, with very rare reports of epiglottitis, chorioamnionitis, and neonatal sepsis. Pasteruella tenosynovitis is especially severe, often resulting in amputation of digits. Epidemiology Infection can be occupationally related (e.g. in veterinary surgeons, farmers, and postmen), but more commonly follows bites from

8.6.19 Pasteurella 1089 companion animals. Animal bites account for roughly 2% of at- tendances at emergency departments in the United Kingdom, and nearly 60% of cat bites are infected with. P. multocida, usually with anaerobes. Prevention Avoidance of animal bites or scratches and prompt hygienic man- agement of wounds are key to preventing infection. Antibiotic prophylaxis should be reserved for high-risk bites (e.g. cat bites) or high-risk wounds that are difficult to debride ad- equately. Oral co-amoxiclav, 625 mg three times daily for 3 to 5 days will cover Pasteurella spp. as well as the hundreds of possible oral commensals present. Patients who have undergone mastectomy and those with dia- betes, immunosuppression, cirrhosis, steroid therapy, splenectomy, or prosthetic joints are ‘high-risk patients’ for whom prophylaxis should be seriously considered. ‘High-risk wounds’ include punc- ture wounds, particularly to the hand or wrist, and crush wounds with devitalized tissue. Erythromycin, clindamycin, and flucloxacillin are ineffective against Pasteurella spp. and should not be used for prophylaxis or treatment in the absence of sensitivity information. Numerous re- ports of breakthrough P. multocida septicaemia and meningitis have occurred during erythromycin or flucloxacillin therapy. Alternative prophylaxis for penicillin-allergic patients includes doxycyc- line, azithromycin, aztreonam, or linezolid. Metronidazole can be added for deep, penetrating wounds such as cat bites that cannot be debrided easily. Clinical features of Pasteurella infection The most common presentation of pasteurella infection is soft tissue infection but septic arthritis, osteomyelitis, osteomyelitis, septicaemia, and meningitis can occur, particularly in infants and immunocompromised individuals. Soft tissue infections are usu- ally cat or dog bites, or cat scratches, but might occur if an animal licks broken skin. Since Pasteurella spp. are extremely pyogenic, bite-related or scratch-related infections usually present 8–12 h after the incident and rapidly spreading cellulitis is typical (Fig.

8.6.19.1). Purulent discharge occurs in 40%, lymphangitis in 20%, and re- gional lymphadenopathy in 10%. P. multocida can cause bone and joint infections such as septic arthritis (usually monoarticular and involving the knee joint) or osteomyelitis. Most cases of septic arth- ritis occur after an animal bite distal to the joint. Osteomyelitis results either from extension of soft tissue infection or via direct in- oculation of bacteria into the periosteum by the animal bite; osteo- myelitis is more frequently associated with cat bites than dog bites, presumably because of cats' small, sharp teeth. Patients presenting with sepsis and positive blood cultures for pasteurella are less likely to have a history of a bite and are more likely to have comorbidities and need intensive care support. These patients, however, usually also have a history of contact with animals. Respiratory tract Pasteurella spp. can be commensals or cause infections such as glossitis, pharyngitis, sinusitis, otitis media, epiglottitis, bronchitis, pneumonia, and empyema. In one study of 108 patients with pleuropulmonary P. multocida infections, an underlying disease was found in 90% and mortality was 29%. P. multocida can also cause several other serious invasive in- fections such as meningitis, bacteraemia, endocarditis, and peritonitis. Intra-abdominal infections include peritonitis and appendicitis. Chorioamnionitis is associated with neonatal sepsis. Differential diagnosis Of the hundreds of bacterial species contaminating animal bites, other major pathogens to consider include streptococci, staphylo- cocci, and especially anaerobes; the latter more common in deep penetrating wounds. Clinical investigation A history of animal bite or scratch preceding any presentation of sepsis should alert the clinician to the possibility of pasteurella infec- tion. Established infections necessitate the taking of blood cultures and culture of any discharge. The microbiology laboratory should be alerted to the possibility of pasteurella so that specimens can be cultured appropriately. Unlike most Gram-negative rods it does not grow on MacConkey's agar and is susceptible to penicillin. Selective media containing vancomycin, clindamycin, and amikacin have been used to isolate pasteurella. Most strains are catalase, oxidase, indole, sucrose, and decarboxylate ornithine positive. Antibiotic susceptibility testing is warranted for isolates cultured from normally sterile sites and respiratory specimens, particularly in the immunocompromised. Pasteurella is usually susceptible to penicillin, amoxicillin-clavulanate, piperacillin-tazobactam, doxy- cycline, fluoroquinolones, extended spectrum cephalosporins (e.g. ceftriaxone, cefpodoxime, and cefixime), and carbapenems (imipenem, meropenem, and doripenem). Fig. 8.6.19.1 Pasteurella multocida hand infection, preoperative.

section 8 Infectious diseases 1090 Typing of P. multocida has traditionally been done serologically. There are 5 capsular serogroups and 16 somatic serotypes; most human infections are caused by serotypes A, D, and F. New typing methods rely on molecular methods. Subspecies of P. multocida can be identified by polymerase chain reaction fingerprinting. Human infections have been reported with P. multocida subsp. multocida, P. multocida subsp. septica, P. multocida subsp. gallicida, P. canis, P. dagmatis, and P. stomatis. Treatment Indications for hospital admission after animal bites include sys- temic sepsis, involvement of joint or tendon, immunocompromise, bites requiring reconstructive surgery, severe cellulitis, and infection refractory to oral therapy. Hands are especially prone to infection because of the numerous small compartments and lack of soft tis- sues separating the skin from bone and joint. Inadequate debridement and incorrect antibiotic prophylaxis are major contributors to the excessive morbidity of P. multocida infection. Where adequate debridement of deep wounds, especially cat bites, is not possible, irrigation with 250 ml saline, using a 19- or 20-gauge needle or plastic intravenous catheter on a 30-ml syringe, followed by prophylactic antibiotics might be effective (Fig. 8.6.19.2). Thorough irrigation and debridement of the wound, and, where possible, delayed closure of limb bites maximizes salvage. Limbs should be elevated and immobilized. Tenosynovitis can be so ad- vanced on presentation that amputation

is the only option. Pus must be drained and affected joints washed out, and the wound left open where possible. Facial bites can be closed primarily since bleeding is profuse and wounds are easily cleaned. While most pasteurellae are susceptible to penicillin, β- lactamase producing strains are increasingly reported, so penicillin monotherapy is not advised until susceptibility is confirmed. Broad- spectrum empiric antimicrobial therapy should be directed at polymicrobial infection that occurs after bite infections and a com- bination of a penicillin and a β-lactamase inhibitor (e.g. amoxicillin- clavulanate) recommended in patients without penicillin allergy. Definitive treatment is based on the result of wound cultures and should be continued for 7–10 days. Alternative treatments for established pasteurella infections for patients allergic to penicillins, or infected with β-lactamase produ- cing strains, include oral doxycycline or intravenous aztreonam, or ciprofloxacin. Patients without a history of anaphylaxis to penicillins can be treated with ceftriaxone. For established soft tissue infection, 10–14 days of therapy is usual, compared with 3 weeks for tenosynovitis, 4 weeks for septic arthritis, and 6 weeks for osteomyelitis. In practice, intravenous therapy until the C-reactive protein falls to less than 50 mg/litre is a useful ob- jective guideline for switching to oral therapy. Prognosis The prognosis of P. multocida infections depends on the site of infec- tion and comorbidities. Soft tissue infections usually resolve with ad- equate debridement, drainage, and antibiotics. Established bite-related hand infection unfortunately often results in permanent impairment of function. Factors particularly associated with poor outcome in- clude inadequate initial antimicrobials and inadequate debridement. Pasteurella septicaemia, metastatic infection, and death been reported following inappropriate therapy with erythromycin or flucloxacillin. P. multocida prosthetic joint infection, usually associated with rheuma- toid arthritis and female gender, results in loss of the prosthesis in 70% of patients, even with early appropriate antibiotic therapy. Areas of controversy The role of antimicrobial prophylaxis following animal bites, in the absence of any other risk factor for infection, is debatable. One meta-analysis of eight randomized trials concluded that the rela- tive risk for infection in patients given antibiotics compared with controls was 0.56 (95% confidence interval, 0.38–0.82), whereas an- other meta-analysis included trials with few cat bites, resulting in no evidence for the benefit of prophylaxis. While there may be cause for careful consideration of prophylaxis for other animal bites, anti- microbial prophylaxis for cat bites is usually indicated. FURTHER READING Adlam C, Rutter JM (1989). Pasteurella and pasteurellosis. Academic Press, London. Cummings P (1993). Antibiotics to prevent infection in patients with dog-bite wounds: a meta-analysis of randomised trials. Ann Emerg Med, 23, 535–40. Giardano A, et al. (2015). Clinical features and outcomes of Pasteurella multocida infection. Medicine (Baltimore), 94, e1285. Heydemann J, Heydemann J, Antony S (2010). Acute infection of a total knee arthroplasty caused by Pasteurella multocida: a comprehensive
Fig. 8.6.19.2 The same patient: infected area being incised and drained.

Revision #1
Created 2026-01-22 16:45:36 UTC by Omar Ayman
Updated 2026-01-22 16:45:36 UTC by Omar Ayman