Human bite leading to fatal Neisseria meningitidis septicaemia and pericarditis

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Introduction: Neisseria meningitidis is a human pathogen with five serogroups causing the majority of invasive disease worldwide. Pharyngeal carriage of N. meningitidis is known to occur, but it is not considered a significant pathogen in skin and soft tissue infections secondary to human bites. We present a rare case of meningococcal septicaemia and pericarditis resulting from a human bite to the breast.

Case presentation: A 43-year-old female with type 2 diabetes mellitus and hypertension presented with fever, tachycardia, hypotension and a history of a human bite to the left breast. On examination, there was an erythematous, infected wound on the left breast. Blood cultures obtained on admission were positive for N. meningitidis subtype W and the patient was treated for 7 days with intravenous ceftriaxone. However, the patient was readmitted 10 days later with a relapse of fever, dyspnoea and chest pain. A chest X-ray showed an enlarged cardiac silhouette, and echocardiography confirmed the presence of a large pericardial effusion. Intravenous ceftriaxone was recommenced and an urgent pericardiocentesis performed to relieve the cardiac tamponade. Blood cultures remained sterile and no organisms were detected from the pericardial fluid.

Conclusion: The patient unfortunately suffered a cardiopulmonary arrest and died while undergoing treatment. A post-mortem examination revealed myocardial necrosis and inflammatory debris within the pericardial sac. The most likely pathogenesis was considered to be inflammatory pericarditis secondary to meningococcal septicaemia with subsequent cardiac tamponade.

Keywords: Cellulitis; human bite; Neisseria meningitidis; pericarditis; septicaemia.

Introduction
Bite-related infections are commonly encountered in clinical practice, with human bites as the third leading cause after dog and cat bites (Conlon, 2007). Approximately 10–20% of human bites are ‘love bites’ to the breasts and genital areas (Al Fallouji, 1990). Factors involved in the development of infection at the bite site include the degree of tissue damage, depth of the wound, compartments affected and virulence of the inoculated bacteria. Studies of soft tissue infections caused by human bites have shown that the commonest organisms isolated are viridans streptococci, Streptococcus anginosus, Staphylococcus aureus, Eikenella corrodens, Haemophilus sp., Enterobacteriaceae (e.g. Klebsiella sp., Enterobacter sp.) and anaerobes (e.g. Fusobacterium sp., Prevotella sp., Peptostreptococcus sp.) (Goldstein et al., 1978; Talan et al., 2003).

Neisseria meningitidis is a Gram-negative diplococcus that produces a polysaccharide capsule, which forms the basis of the serogroup typing system. There are 12 known serogroups, of which five (A, B, C, W and Y) are responsible for the majority of invasive disease worldwide (Caugant & Maiden, 2009). On solid medium, N. meningitidis grows as transparent, non-pigmented, non-haemolytic colonies metabolizing glucose and maltose to acid without gas formation. It has a number of virulence factors, which include the polysaccharide capsule, type IV pili, cell wall lipo-oligosaccharide and other outer-membrane proteins (Coureuil et al., 2012; Hill et al., 2010).

N. meningitidis is exclusively a human pathogen, with pharyngeal carriage rates varying from 2 to 25% across age groups (Cartwright et al., 1987). Carriage rates have been demonstrated to be higher in groups with close contact such as university students and military recruits (Ala’Aldeen et al., 2011). Invasion from carriage is a complex process that is not yet fully understood, but certain...
risk factors such as passive smoking and influenza A infection have been linked in studies (Cartwright et al., 1991; Stanwell-Smith et al., 1994). Meningococcal disease is endemic in many countries with large outbreaks occurring, while in the UK, rates of invasive disease are highest during infancy and in teenagers (Ala’Aldeen et al., 2000).

This case report demonstrates an unusual aetiology for meningococcal septicaemia and an uncommon complication of pericarditis.

Case report

A 43-year-old woman presented with a 1-day history of fever and pain in the left breast, right wrist and right shoulder. She reported a human ‘love’ bite from her partner to the left breast 1 week prior to admission. Her past medical history included hypertension and diet-controlled type 2 diabetes mellitus but no other evidence of immunosuppression. Initial observations demonstrated she was hypotensive, tachycardic and tachypnoeic. Examination of the left breast revealed an erythematous, infected area of cellulitis approximately 5 cm in size. The physical examination was otherwise unremarkable. Specifically, there were no joint effusions, signs of meningism, skin rash or focal neurology.

Initial investigations showed a raised white cell count (14.3 × 10^9 l−1) with neutrophilia, elevated C-reactive protein, D-dimers and a stage 3 acute kidney injury. Arterial blood gas sampling and a chest radiograph revealed no abnormalities. A ventilation perfusion scan performed due to the tachypnoea and raised D-dimers was also normal. The initial working diagnosis was cellulitis with probable bacteraemia, and the patient was commenced on intravenous co-amoxiclav based on local guidelines for treatment of infection associated with a human bite.

Blood cultures were positive the following day and Gram staining revealed Gram-negative diplococci. Antibiotic treatment was therefore changed to high-dose intravenous ceftriaxone. Subcultures were performed on blood and chocolate agar. Oxidase-positive, grey colonies on chocolate agar were identified to be N. meningitidis using biochemical identification (API; bioMérieux). Latex agglutination confirmed N. meningitidis subtype W (Pastorex; Bio-Rad) and susceptibility testing established that the isolate was sensitive to ceftriaxone (Howe et al., 2012). Seven days of intravenous ceftriaxone was administered for meningococcal septicaemia based on national guidelines (NICE, 2010). Meningococcal disease is notifiable in England and the local public health unit was informed. Close contacts including the patient’s partner were offered ciprofloxacin prophylaxis and meningococcal quadrivalent vaccine (against serotypes A, C, W and Y) (Health Protection Agency, 2012). Repeat blood cultures while on treatment remained negative and clinically she made a full recovery with normalization of inflammatory markers. The patient was subsequently discharged home.

Ten days following discharge, the patient re-presented with dyspnoea and a low-grade fever. On examination, she was hypotensive, tachycardic and tachypnoeic. Examination of the cardiovascular system elicited a raised jugular venous pulse, pulsus paradoxus and muffled heart sounds. Examination of the left breast showed resolving cellulitis. A chest radiograph showed an enlarged cardiac silhouette, and an electrocardiogram revealed a sinus tachycardia with small voltage complexes (Fig. 1). A transthoracic echocardiogram confirmed the presence of a large pericardial effusion causing cardiac tamponade.

Urgent pericardiocentesis was performed and 450 ml was aspirated with a further 360 ml collected through a pericardial drain. Intravenous ceftriaxone was commenced for a possible infected pericardial effusion as well as non-steroidal anti-inflammatory drugs for a reactive effusion. Culture of the pericardial fluid detected no organisms on both routine culture and 16S bacterial RNA gene detection. Blood cultures and swabs of the left breast obtained on readmission yielded no organisms.

Unfortunately, the patient experienced a cardiopulmonary arrest while undergoing treatment 6 days following readmission. A post-mortem examination demonstrated myocardial necrosis and fibrin deposits within the pericardial sac secondary to inflammatory pericarditis. However, histological examination of the myocardium and pericardial tissues did not detect any organisms.

Discussion

Cellulitis caused by N. meningitidis is a well-recognized clinical presentation (Cartolano et al., 2003; Chand et al., 2005), but a literature search did not reveal any cases secondary to a human bite. Intravenous co-amoxiclav is a recommended treatment for cellulitis secondary to human
bites (Clark, 2003; Stevens et al., 2005) to cover a broad range of potential pathogens. The yield from blood cultures in patients with cellulitis is usually low (Perl et al., 1999); however, this increases significantly in patients exhibiting signs of septicemia such as those present in this case (Jones & Lowes 1996). The importance of obtaining of blood cultures is highlighted by this case because it led to the identification of the pathogenic organism and changes in antibiotic treatment. However, one of the limitations of this report is that we did not isolate the organism from the area of cellulitis. This was due to the lack of any significant pus or exudate to culture, as well as the use of empirical therapy prior to swabs being obtained. It is therefore possible that the bite wound and meningococcal septicemia were unrelated events.

In the UK, the routine vaccination programme includes N. meningitidis serogroup C (Public Health England, 2014). Consequently, the majority of invasive cases of N. meningitidis are due to serogroup B with sporadic cases of C, Y and W (Health Protection Agency, 2012). In the initial presentation, there were no complicating features and 7 days of intravenous ceftriaxone is the recommended treatment for meningococcal septicemia (NICE, 2010).

Unfortunately, the patient was readmitted with signs of pericarditis 10 days later, which may be explained by a number of reasons. The initial presentation by the patient was delayed by 1 week, which may have allowed sufficient time for the organism to enter the pericardial space. She also had underlying diabetes, which is known to be associated with increased severity of soft tissue infections and a reduced immune response (Stevens et al., 2005).

N. meningitidis is the fourth commonest cause of purulent pericarditis after staphylococci, pneumococci and streptococci, accounting for 6–16% of cases (Blaser et al., 1984; Ejlertsen et al., 1988). Meningococcal pericarditis has been classified into three main categories: isolated, disseminated and reactive (immunological) pericarditis (Finkelstein et al., 1997). Isolated and disseminated pericarditis are due to direct invasion of N. meningitidis into the pericardial space and myocardium causing damage to tissues and exudative effusions. Reactive pericarditis involves progressive accumulation of serous and sterile fluid later in the course of disease, after the infectious process has abated and despite adequate antibiotic treatment (Finkelstein et al., 1997).

N. meningitides-specific PCR might have been more sensitive at detecting the organism from pericardial fluid, but the locally available PCR (Public Health England, Manchester, UK) is not validated for this sample type. Furthermore, the initial treatment administered was focused on N. meningitidis and potentially other pathogens originating from the bite may have been missed, allowing seeding into the pericardial space. Hence, 16S rRNA gene detection was performed to cover a broad range of pathogens.

We hypothesize that reactive pericarditis was the most likely pathology in this patient because N. meningitidis was not detected from pericardial fluid by routine culture methods or bacterial 16S rRNA gene detection. The patient also re-presented following recovery from the original meningococcal septicemia and having completed a full course of treatment. Reactive meningococcal pericarditis is usually more severe than the other two forms and is often complicated by tamponade (Finkelstein et al., 1997), as demonstrated in this case. However, myocardial necrosis and fibrin deposits were noted during the post-mortem examination, and it is possible that the myocardium and pericardial effusion had been infected and were subsequently rendered sterile by antibiotic treatment.

In summary, to the best of our knowledge, this is the first reported case of cellulitis due to N. meningitidis from a human bite and subsequent septicemia. It also highlights the importance of obtaining blood cultures in septicemic patients, and demonstrates pericarditis as a rare but significant complication of meningococcal septicemia.

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References


