Iatrogenic bacterial meningitis: an unmasked threat

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ABSTRACT

Iatrogenic bacterial meningitis (IBM) is a rare but serious complication of neuraxial procedures, such as spinal and epidural anesthesia or lumbar puncture. We report a case of a 46-year-old female who presented to the emergency department with bacterial meningitis after spinal anesthesia. We review the existing literature outlining the pathogenesis, vector hypothesis, diagnosis, treatment, and prevention as they relate to IBM. We highlight the role of the emergency physician in the rapid diagnosis of this disease, and underscore the need for sterile technique when performing lumbar punctures.

RÉSUMÉ

La méningite bactérienne iatrogénique (MBI) est une complication rare mais grave d'interventions centrales comme la rachianesthésie, l'anesthésie péridurale, et la ponction lombaire. Il sera ici question du cas d'une femme de 46 ans, qui s'est présentée au service d'urgence pour une méningite bactérienne après une rachianesthésie. Nous passerons en revue la documentation actuelle et exposerons brièvement la pathogenèse de la MBI, les vecteurs possibles, le diagnostic, le traitement, et la prévention de la maladie. Nous ferons ensuite ressortir le rôle de l'urgentologue dans la pose rapide du diagnostic et insisterons sur la nécessité de la stérilité des techniques dans les ponctions lombaires.

Keywords: anesthesia, bacterial meningitis, epidural, iatrogenic, lumbar puncture, spinal

Neuraxial procedures such as spinal and epidural anesthesia or lumbar puncture (LP) can lead to catastrophic infections, such as bacterial meningitis or epidural abscess.[1–3] Bacterial infections after spinal and epidural anesthesia are uncommon events, with a reported incidence of less than 1 for every 53,000 procedures.[4,5] As of 2006, 179 cases of iatrogenic bacterial meningitis (IBM) occurring as a result of neuraxial procedures have been reported in the literature.[6] The Centers for Disease Control and Prevention (CDC) mandates reporting only of *Neisseria meningitidis*,[7] and these few published case reports may not reflect the true incidence of IBM, which could be expected to rise with the increasing popularity and routine use of obstetric epidurals. Furthermore, due to the rapidity of clinically apparent infections, typically 3 to 36 hours after dural puncture, IBM seldom meets inclusion criteria for nosocomial infection reporting, which is defined by the CDC as one or more positive blood cultures drawn at least 72 hours after hospital admission.[6,8] LP is a common procedure in the emergency department (ED), and prevention with the use of sterile techniques and early recognition of IBM in these postprocedural patients is exceedingly important.

CASE REPORT

A 46-year-old diabetic female was brought to the ED with gradual onset of nonbloody, nonbilious vomiting and generalized abdominal pain. Two days previously, the patient had undergone an uncomplicated elective cystoscopy to remove a retained suture left after a remote bladder sling surgery. The cystoscopy was performed under spinal anesthesia, and recovery had been uneventful until approximately 8 hours prior to presentation, when her symptoms began. She had vomited eight times prior to arrival and had noted increasing blood glucose levels at home. The patient denied fever, chills, headache, neck stiffness, photophobia, or rash. The patient's past medical history was notable for insulin-dependent diabetes mellitus, hypertension, hyperlipidemia, bipolar disorder, and migraines. She had multiple drug allergies, including a previous anaphylactic reaction to penicillin.

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On presentation, the patient was found to have a rectal temperature of 38.6°C (101.5°F), blood pressure of 165/82 mm Hg, heart rate of 129 beats/min, respiratory rate of 35 breaths/min, oxygen saturation of 97%, and a finger-stick blood glucose of 16 mmol/L. Physical examination showed an ill-appearing female who was slow to respond to questions. Her abdomen was soft and nondistended, with focal suprapubic tenderness and no signs of peritonitis. She had diffuse muscle tenderness to palpation and movement without clear meningismus or petechiae. Cranial nerves II to XII, motor and sensory examinations, deep tendon reflexes, and cerebellar testing were normal.

Laboratory investigation showed a white blood cell count of 27.1×10^3 cells/μL with 94% neutrophils. Electrolytes were significant for bicarbonate of 17 mmol/L, which was felt to be due to vomiting as her pH by venous blood gas was 7.43 and serum lactate was 3 mmol/L. Her urinalysis was negative for both nitrites and leukocyte esterase with less than 1 white blood cell, 15 red blood cells/high-power field, and gucose > 55 mmol/L. Blood cultures were obtained and would remain negative. A computed tomographic scan of the abdomen and a portable chest radiograph were unremarkable.

Considering the patient's recent spinal anesthesia and lack of source for infection, an LP was performed, which revealed grossly purulent fluid significant for a white blood cell count of 11,556/μL and a red blood cell count of 667/μL. The glucose and protein were 3 mmol/L and 8.57 g/L, respectively. The Gram stain revealed gram-positive cocci in pairs, with a preliminary identification as *Streptococcus viridans*.

Intravenous levofloxacin 750 mg was administered empirically prior to the initial laboratory results for presumptive genitourinary tract infection and developed pruritis. After the LP results were obtained, she was given dexamethasone 10 mg IV, vancomycin 1 g IV, aztreonam 1 g IV, and metronidazole 500 mg IV in consultation with the infectious disease specialist.

The patient subsequently completed a 10-day course of vancomycin, gentamicin, and ceftazidime, with final cerebrospinal fluid (CSF) cultures growing *Streptococcus vestibularis*. The patient was discharged on hospital day 10 without complications.

DISCUSSION

Many different bacteria have been implicated as the causative organisms of IBM. With varying incidence, these include *Strepococcus*, *Staphylococcus*, *Enterococcus*, and *Acinetobacter*.[1,6] Among these, viridans group streptococci have been found to be by far the most prevalent group of organisms isolated.[2] Reports indicate that within the viridans group, *Streptococcus salivarius* may be the organism most commonly associated with IBM.[6] In a recent case series published by Pandian and colleagues, viridans group streptococci comprised 31 of 52 cases (60%) of those isolates identified, 11 of 33 (33%) of which were caused by *S. salivarius*.[1] Other less commonly isolated viridians group streptococci included *Streptococcus mitis* and *Streptococcus sanguinis*. *Staphylococcus aureus* was found in only 6%. *S. salivarius* and *S. vestibularis* are grouped together under the salivarius group of viridans streptococci. As previously stated, *S. salivarius* is the most frequently isolated organism in IBM, but in this case, *S. vestibularis* was isolated, making this the first reported case of *S. vestibularis* bacterial meningitis.[9]

Viridans group streptococci are ubiquitous facultative anaerobes and commensals of the oral cavity and upper respiratory tract. They are also indigenous to the gastrointestinal tract, female genital tract, and skin.[2,10] As they are typically of low virulence, these organisms tend to be significantly susceptible to native serum and lysosomal enzymes. When isolated in culture, they are often dismissed as contaminants, but once in spinal fluid, they multiply rapidly, causing full-blown purulent meningitis within 7 to 24 hours.[6] Viridans group streptococci appear to have a low affinity for the leptomeninges, accounting for only 0.3 to 2.4% of all cases of bacterial meningitis.[2] Bypassing the usual host defenses with an invasive procedure such as LP may explain why this docile organism continues to account for the highest percentage of iatrogenically acquired meningitis.

Evidence strongly points to droplets from the mouth or upper airway of medical personnel as the source of infection in cases of IBM. In a series of separately published case reports, deoxyribonucleic acid (DNA) fingerprinting, polymerase chain reaction (PCR), and other biochemical assays have linked isolates from the throat swab of the health care provider to those in the CSF of patients diagnosed with IBM. Interestingly, skin swabs from the patient and the oropharynx of other medical personnel present at the time of the procedure did not match the CSF isolate. Furthermore, none of these patients were reported to have been febrile, and their CSF was presumably sterile prior to LP.[6,11] Therefore, it is reasonable to conclude that the source of infection was not from the patient's skin, existing infection, or medical personnel other than the proceduralist. The US Department of Health and Human Services described a cluster of *S. salivarius* IBM cases in Ohio and New York after spinal anesthesia. An anesthesiologist practicing in New York, who reportedly wore a mask, transferred *S. salivarius* to three serial patients presumably due to a break in sterile technique. An Ohio anesthesiologist, who did not wear a mask, was also implicated when his nasopharyngeal swab tested positive for *S. salivarius* by PCR. This case resulted in the patient dying of IBM.[12]

The diagnosis of IBM is straightforward and usually based on typical clinical manifestations of bacterial meningitis in the setting of a recent neuraxial procedure; however, in our case, the patient presented with the chief complaint of abdominal pain after bladder surgery. Furthermore, this case lacked the classic features seen in bacterial meningitis, such as headache, photophobia, and meningismus. Only after exclusion of other probable sources for infection and the further elicited history that the urologic procedure was performed under spinal anesthesia was the LP pursued. As a rule in bacterial meningitis, CSF protein and cell counts are high, but glucose concentrations may be normal in cases of *S. viridans* meningitis.[2] No treatment recommendations exist specific to meningitis related to LP. Because the majority of strains are viridans streptococci, it is reasonable to empirically treat patients similarly to the most recent guidelines of the Infectious Diseases Society of America (IDSA) for bacterial meningitis specific for *Streptococcus pneumoniae* with adjuvant steroids and antimicrobials.[6,13]

Preventing postprocedural bacterial meningitis is paramount. Although no studies have proven their efficacy and cost-effectiveness, a good surgical mask has been shown to prevent the growth of oral flora on agar plates at a distance of 30 cm, whereas the same subjects talking without masks resulted in organism growth on more than 50% of the plates.[14] Still, no specific infection control guidelines exist for simple diagnostic LP. In 2005, the Healthcare Infectious Control Practices Advisory Committee stated that "... there is sufficient experience to warrant the additional protection of a face mask for the individual placing a catheter or injecting material into the spinal or epidural space."[15] Some authors have concluded that full aseptic precautions should be recommended for the prevention of LP-associated meningitis and advocate specifically for the routine wearing of masks when performing LP and other invasive spinal procedures, as well as the changing of masks between patients.[16,17] Although the incidence of IBM appears rare, the cost of a surgical mask is miniscule compared to the cost of a prolonged in-patient hospital stay and the potential morbidity and mortality associated with IBM. The authors recommend at least the use of surgical face masks for everyone who may come within close proximity of the procedure tray and sterilized area of the patient during LP. Other suggested preventive measures include covering the spinal needle stylet when separated from the spinal needle[6] and using bactericidal alcohol-based cleansing solutions over traditional povidine-iodine.[3]

CONCLUSION

IBM is a rare but serious complication of neuraxial procedures. A recent history of such a procedure in an ill-appearing patient should alert the emergency physician to consider IBM. In the ED, the use of proper sterile technique, including the appropriate use of masks and sterile gloves and the thorough aseptic cleansing of the skin prior to puncture by individuals performing and assisting with the procedure, may reduce the incidence of this infection.

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