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QUESTION 7: Should antibiotics be held prior to image-guided biopsy/aspiration for a suspected spine infection?

RECOMMENDATION: We recommend that prior to image-guided biopsy/aspiration for a suspected spine infection, all antibiotics should be withheld until after appropriate culture samples are obtained. Antibiotic administration, without aspiration/biopsy may be justified in patients who are critically ill and cannot withstand intervention or in patients with deteriorating neurological conditions.

LEVEL OF EVIDENCE: Consensus

DELEGATE VOTE: Agree: 93%, Disagree: 0%, Abstain: 7% (Super Majority, Strong Consensus)

RATIONALE

The definitive diagnosis of spinal osteomyelitis can be made only with isolation of the organism from a positive blood culture or biopsy and culture of the tissues from the region of the infection. Spinal biopsies may be performed using computed tomography (CT) or fluoroscopy for guidance in localizing the site of the suspected infection. The identification of the infecting organism is useful in directing antibiotic therapy. In suspected infection of the spine, biopsy and culture of the tissues from the affected site has been reported to be successful in the identification of the infecting organism in 46–91% of cases [1–5].

In real practice, there are some instances where antibiotic treatment is empirically instituted before the patient has been biopsied. Such cases may include patients who have been on antibiotics for other infections such as pneumonia or patients with surgical implants and prior deep wound infections who are on chronic antibiotic therapy. Theoretically, retrieval of a pathogen from the disc space or vertebral body may be compromised by previous or ongoing antibiotic treatment. However, we were unable to identify any high-quality randomized clinical trial comparing the culture results of the image-guided biopsy between patients who received empirical antibiotic treatment versus those who did not have any antibiotic treatment prior to biopsy.

There has been a general consensus of opinion that antibiotics should be withheld prior to biopsy of the site of suspected infection in an effort to improve the yield of culture [6,7]. A study by Rankine et al. found that the yield of biopsy in isolating the infecting organism was lower at 25% in patients who had received antibiotics compared to 50% yield in patients who had not received antibiotics [8]. It is important to note that not all studies agree with the notion of withholding antibiotics prior to biopsy of the infected site. A recent study by Sehn et al. [9] reported that four of 14 patients with a high suspicion for infection, who were confirmed to have been treated with antibiotics within 3 days of their biopsy, had positive cultures. The yield of culture was not different from the cohort of 92 patients who had not received antibiotics (28.6% vs. 30.4%, $p = 0.86$). Both of the reports were retrospective non-randomized studies with a relatively small sample size.

In the absence of randomized prospective data, and using the logic drawn from other fields of orthopaedic study related to this

issue, we recommend that empirical treatment with antibiotics be withheld in patients with suspected infection of the spine until biopsy of site of suspected infection can be carried out. There are, however, circumstances (such as situations involving critically ill patients and those with deteriorating neurological status) in whom antibiotics may be started prior to the performance of biopsy.

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QUESTION 8: What is the incidence of infectious bacterial meningitis (PBM) following spinal surgery? Does the use of instrumentation affect this?

RECOMMENDATION: The incidence of PBM following spinal surgery varies from 0.1–0.4%. There is insufficient evidence to make any observations as to whether the use of instrumentation affects the incidence of PBM following spinal surgery.

LEVEL OF EVIDENCE: Consensus

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

PBM is a potentially devastating complication following spinal surgery. It could occur after any primary elective spinal surgery with or without instrumentation, traumatic fracture-dislocation or surgical site infection after spinal instrumented surgery [1–3]. This also presents as a delayed complication after scoliosis surgery and through a dural tear with cerebrospinal fluid (CSF) leakage [4,5].

The early diagnostic differentiation from PBM and postoperative aseptic meningitis (PAM) is difficult and depends on CSF culture results [6–7]. The success in the treatment of patients with PBM depends on the stage of diagnosis, speed of diagnostic evaluation and appropriate anti-microbial and adjunctive therapy [8–9].

PBM is a potentially life-threatening infection with higher rates of mortality and significant disabling morbidity [9]. Pneumococcal meningitis is the most prevalent and is associated with a mortality of 30% [10]. PBM can also be caused by staphylococci [11], aerobic gram-negative bacilli (including *P. aeruginosa*) [12] and methicillin-resistant *Staphylococcus aureus* (MRSA) [13].

The incidence of PBM is rare after spinal surgery and is considered to be related to incidental durotomy [14]. Patients who have the triad of fever, neck stiffness and consciousness disturbance during postoperative period should be suspected and subjected to further evaluations [14]. In a large retrospective study, Lin et al. reviewed 20,178 lumbar spinal surgeries and reported a PBM rate of 0.10% [14]. Another retrospective study by Twyman et al. reported the incidence of PBM to be 0.18% after spinal operations with and without instrumentation [15]. The incidence could be as high as 0.4% after spinal surgery, when epidural abscess, subdural empyema, brain abscess, bone-flap infections and wound infections are combined [16].

In their sub-analysis, Lin et al. found that dural tears, pseudomeningocele and poor wound healing contributed to the majority of the complications [14]. The optimal management of PBM required reoperation to repair dural tears and administration of parenteral antibiotics [17]. The occurrence of pseudomeningocele is a sequela of dural tear, imperfect suture of the dura or fascia and inappropriate administration of antibiotics [14,18,19]. Zhang et al. reported surgical intervention to be an effective method of treating PBM where initial conservative measures failed. They proposed the idea that it is important to consider the possibility of PBM in any patient with CSF leakage after spinal surgery. They recommended early diagnostic imaging and CSF cultures to ensure prompt diagnosis and treatment [20].

Spinal instrumentation surgery usually involves longer operative time, greater blood loss and a higher incidence of subsequent SSI compared to decompression surgery alone. These features of spinal instrumentation surgery could influence the incidence of PBM. There is little literature examining the potential association of instrumentation with PBM with no supporting evidence linking the use of instrumentation to the incidence of infectious meningitis after spinal surgery [14,15,20]. Therefore, based on available evidence, it is not possible to link the use of instrumentation during spine surgery with PBM.

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