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Surgical Site Infection: A Review

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Infection of the spine may occur spontaneously, by direct hematogenous or contiguous spread from an area of infection, or secondarily to an inciting event such as trauma or spine operation. The overall rate of spine surgery has increased steadily over the last decade. Medicare spending on inpatient spine surgery has doubled over the same period with lumbar fusion representing the greatest percentage of spending.¹ Surgical site infection (SSI) after spinal surgery is not uncommon, leading to increased morbidity and mortality. The incidence of surgical site infection after spine surgery varies and depends on several factors including immune status of patient, surgical level, use of instrumentation and use of prophylactic antibiotic treatment. Multivariate logistic regression analysis identifies increased age of patient, long-term systemic use of steroids, insulin dependent diabetes, obesity, positive smoking status, preoperative hematocrit, disseminated cancer, fusion and operative duration as statistically significant predictors of postoperative infection.²⁻⁴ The incidence of SSI is less than 3% with simple procedures such as decompressive laminectomy and/or discectomy but the incidence increases to as high as 12% with the addition of instrumentation.⁵ The time of presentation of SSI can range from a couple of days post-surgery to several years after surgery.

The most common presenting symptom of SSI is new-onset or worsening back pain. In postoperative patients, wound drainage and erythema of the incision may also be present. Deteriorating physical findings such as weakness of extremities or development of new symptoms such as numbness or tingling sensations are also routinely experienced by patients with spine infections. There can be delays in diagnosis of SSI due to subtle presentations but several laboratory tests are used in patient evaluation. The average time from onset of symptoms to definitive diagnosis can range from several weeks to months. Pertinent laboratory studies may include complete blood count with differential, blood cultures, presence of fever or hypothermia, sedimentation rates, C-reactive protein levels, and plain radiographic imaging. These studies are screening tests and may or may not indicate the presence of an infection. Computed tomography-guided biopsy sampling of the vertebra or disc space may also be used to identify the presence of an infection and the organisms causing the infection. Magnetic resonance imaging (MRI) with gadolinium enhancement is the most reliable confirmatory test. It shows associated osteomyelitis, discitis, and may show the presence of an epidural abscess. A negative MRI should be repeated if infection is still suspected or in the presence of persistent or worsening physical symptoms. A diagnostic surgical deep wound exploration may also be performed for definite confirmation.

Prompt diagnosis is essential in spinal infections with timely medical management to include systemic antibiotics or anti-fungal therapy, as well as surgical debridement of the infection as indicated. Surgical intervention may be required to remove infected tissue, to ensure spinal stability and to prevent progression of neurological impairment. It is indicated where there is significant adjacent structural involvement, worsening neurological deficits, failure to identify source of infection by less invasive means, or failure of intravenous antibiotics alone to control the infection. Multiple incision and drainage with debridement of the surgical site may be needed if multiple organisms are present or if the infection persists, along with removal of any hardware and bone grafts. Pyogenic organisms are the most



T1-weighted sagittal MRI of the spine at 3 weeks post-operation reveals a collection of fluid, possibly indicating infection, at levels L3-5

common organisms responsible for SSIs. *Staphylococcus aureus*, especially methicillin-resistant *Staphylococcus aureus*, MRSA, is the most common bacterial agent identified.⁶⁻⁷ Other pathogens include natural skin flora such as coagulase-negative *Staphylococcus*, and in some cases, gram-negative organisms such as *Escherichia coli* and *Pseudomonas*. Infections may also be fungal and with the increasingly amount of immune-compromised patients needing spinal stabilization surgery, the rate of *Aspergillus* and *Candida* infection of the spine is rising. Other pathogens include viruses and parasites and granuloma causing organisms such as *Mycobacterium tuberculosis*, TB. TB infection of the spine is especially common in developing countries and a rise in the incidence of HIV infection in developed countries has contributed to an increase in TB associated spine infections.

The mortality rate of SSIs can be significant but prognosis is improved with empiric use of systemic antibiotics. Current evidence based clinical guidelines recommend pre-operative prophylactic antibiotics in spine surgery.⁸ Several randomized controlled trials have shown that peri-operative antibiotics can lead to lower infection rate in general spine surgeries.⁹⁻¹¹ There is however poor evidence to advocate post-operative prophylactic antibiotics to prevent infections even in patients with instrumentations. Literature on antibiotic treatment regimes in spine infections is sparse. The length of the antimicrobial treatment is patient dependent and based on clinical response and laboratory data. The minimum length of antibiotic by intravenous route is usually 4-6 weeks. In the presence of persistent symptoms, this can be followed by additional weeks of treatment, addition of a new antibiotic or a switch to oral antibiotics for a long-term period. Any benefits of long-term antibiotic use remain to be determined. Other recent treatment

options under investigation include hyperbaric treatment with oxygen, thoracoscopic spinal debridement, and local antibiotic treatment with antibiotic-coated calcium sulfate pellets.¹²

Treatment of post-operative surgical site infections must be aggressive to prevent poor clinical outcome such as chronic pain, systemic infection of other organs, worsened spinal instability, neurological deficits including paralysis, and even death. Although several factors, such as advanced age, that increase the risk of post-operative infection cannot be controlled, it is imperative that qualitative and quantitative care measures be applied in the operating room and recovery facilities to prevent spine infections. Current treatment protocols for surgical site infections require a multidisciplinary approach to include the expertise of spine surgeons, infectious disease experts, neuroradiologists, nurses and rehabilitation specialists. The best treatment approach should be patient based and offer medical and when necessary, surgical interventions.

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