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Postoperative Spinal Wound Infection in Neurosurgical wards at RIMS, a Single Centre Experience

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Abstract: *With modern surgical techniques and perioperative antibiotics, spinal infection after surgery is relatively uncommon. Certain patient and surgical treatments are however at higher risk and should be treated with extra caution. Surgical site infection (SSI) following spine surgery is a dreaded complication with significant morbidity and economic burden. SSIs following spine surgery can be superficial, characterized by obvious wound drainage or deep-seated with a healed wound. Staphylococcus aureus remains the principal causal agent. There are certain pre-operative risk factors that increase the risk of SSI, mainly diabetes, smoking, steroids, and peri-operative transfusions. Additionally, intra-operative risk factors include surgical invasiveness, type of fusion, implant use, and traditional instead of minimally invasive approach. A high level of suspicion is crucial to attaining an early definitive diagnosis and initiating appropriate management.*
The most common presenting symptom is back pain, usually manifesting 2–4 weeks and up to 3 months after a spinal procedure. Scheduling a follow-up visit between weeks 2 and 4 after surgery is therefore necessary for early detection. Inflammatory markers are important diagnostic tools, and comparing pre-operative with post-operative levels should be done when suspecting SSIs following spine surgery. Magnetic resonance imaging remains the diagnostic modality of choice when suspecting a SSI following spine surgery.

Keywords: *Surgical Site Infection,Spinal Wound Infection,post-procedural discitis, imaging, risk factors, Staphylococcus aureus, inflammatory markers.*

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I. Introduction

Surgical site infections (SSIs) following spine surgery comprise superficial and deep infections and were first described as a clinical entity by Turnbull in 1953(1). Superficial spine infections are localized to the skin and subcutaneous tissue. On the other hand, deep infections disseminate under the fascia and encompass discitis, epidural abscess, and spondylitis; this type of infections is characterized by inflammation of the intervertebral disks and associated soft and articular tissues(2).

Although SSIs following spine surgery can be prevented to a great extent using general measures intended to avert all potential SSIs, they remain a dreaded complication. Some of these general preventive approaches include adoption of aseptic techniques, optimization of patient status pre-operatively as well as intra-operatively, appropriate use of pre-operative antibiotics, and good post-operative follow-up(3-6). SSIs result in significant increase in morbidity and incur a substantial cost to the health care system(7). In one study, each episode of wound infection following spine procedure contributed to a mean increase in the cost of care compared to a non-complicated case(8). A high index of suspicion is compulsory in every patient presenting with back pain after any invasive diagnostic or therapeutic spinal procedure(9). Physicians may sometimes struggle with diagnosing SSI due to a number of difficulties, including the paucity of physical examination findings, mimicry of non-infective conditions, presence of minor symptoms leading to patients not seeking medical attention, inadequate follow-up strategies in some institutions, and the previous dependence on plain X-rays that lack sensitivity for diagnosing SSI(10).

However, the use of a well-defined systematic approach would help in establishing a definitive diagnosis in a timely manner. This would be based on a comprehensive history, thorough physical examination, detailed laboratory studies, blood cultures, and cultures of wound or computed tomography (CT)-guided aspirate material, and imaging studies.

II. Materials and Methods

This study was carried out at RIMS Ranchi Jharkhand,India ,During the period of February 2016 to January 2018.A total of 80 patients went spinal surgery during these period out of this 15(12%) get surgical site infection and 4(3.2%) patients have osteomyelitis.

The reported incidence of SSIs following spine surgery ranges from 0.5 to 18.8% (11–19). Such wide-ranging results from different reports are most probably due to significant variations in operative factors such as the use of implants, case complexity, and the surgical approach itself. Additionally, in some cases, the discitis may be self-limited and may not be reported to the surgeon, whereas in other cases, patients may suffer from fulminant sepsis with abscess development.

A crucial need exists for documentation of an exact incidence of SSIs at every center depending on the surgical procedure. This will direct pre-operative patient counseling, improve quality of care, enhance the effectiveness of infection control measures, and potentially alleviate medico-legal concerns.

The largest study by Smith et al. included a total of 108,419 patients from 2004 to 2007. The primary endpoint of the study was to estimate the incidence of SSIs and the secondary endpoint was to assess risk factors for infection (20). Infections were deemed to be superficial in 0.8% and deep in 1.3% of cases. Other studies in heterogeneous surgical conditions between 2001 and 2012 reported infection rates from 0.15 to 7.2% (20–33).

Infection rates vary greatly according to type of initial surgical intervention(16, 20, 34). Notably, surgeries for spinal trauma are associated with the highest SSI rates, reported to be 9.4% in one study (20). Patients undergoing spine surgeries for metastatic tumor and acute osteodiscitis constitute two other subgroups with high infection rates of around 5%. On the other hand, surgeries for degenerative disease have the lowest reported infection rate of 1.4%. Moreover, minimally invasive spinal procedures seem to be associated with a much lower infection rate than open procedures(20). In the study by Smith et al., the overall rate of infection among adults varied depending on the location of spine surgery. The highest rates were for thoracic procedures (2.1%), followed by lumbar (1.6%) and cervical procedures (0.8%) (20). Other factors that affect infection rates include the nature of the surgical procedures. Spinal fusion had a 33% higher risk of infection than procedures without fusion (20). In addition, infections rates vary depending on the approach to spinal fusion. For instance, cases with anterior fusion only showed significantly lower infection rates (0.6%) compared to the overall rate of infection associated with fusion cases. This lower infection rate with the anterior approach may be explained by less extensive muscle dissection for bone exposure and the better vascularity of the anterior spine. For the other types of fusion, significantly higher infection rates were reported. These included combined anterior–posterior fusions (3.2%), posterolateral-only fusions (3.0%), and interlaminar facet-only fusions (2.8%) (20).

The presence of implants is another factor that significantly increases SSI risk. Cases with instrumentation have resulted in a 28% higher infection rates than cases without implants (20). Implants provide an avascular surface for the bacteria to form a biofilm and constitute a nidus for microbial growth, hence escaping antibiotic activity and the host immune system.

In addition, revision cases are associated with a 65% higher rate of infection compared with primary cases. This significant increase in infection rates was even more evident for deep wound (2.2 vs. 1.2%) compared with superficial wound infections (1.1 vs. 0.8%) (20).

III. Discussion

The incidence of SSIs is determined by both pre-operative and intra-operative risk factors. Several pre-operative patient factors have been incriminated in significantly increasing SSI risk. Diabetes (35) and cigarette smoking (28) for instance, are both associated with tissue ischemia and small vessel damage, predisposing to increased risk of infection. In addition, obesity constitutes a risk factor for SSI due to the thick layer of adipose tissue in obese patients, characterized by poor perfusion and presenting a large space for potential infective processes (28). Other identified peri-operative risk factors for SSI include steroid use (23, 36), alcohol abuse (28, 37), extremes of ages (28, 36, 37), and transfusion of blood products (38).

In addition to pre-operative risk factors, multiple surgical factors have been assessed for their association with the occurrence of spinal infections(20, 28, 34).

Confirming the microbial etiology of SSI following spine surgery is of paramount importance to appropriately guide antimicrobial therapy. This is specifically important in the era of increasing antimicrobial resistance. Empirical antibiotic therapy is highly discouraged before obtaining the proper specimens for cultures. Blood and wound cultures are recommended in patients presenting with suspected SSIs. When a deep collection is localized, obtaining a CT-guided specimen for Gram stain and culture is highly recommended.

Surgical site infection following spine surgery usually occurs through direct inoculation during the surgical procedure. The other two possible routes of infection are hematogenous spread and early post-operative contamination. *Staphylococcus aureus* remains the leading agent of SSI responsible for around 50% of cases, although estimates in various studies range from as low as 12–65% (12, 28,). A history of intravenous drug use has also been associated with an increased risk of Gram-negative pathogens (9,). Recognizing all these risk factors would help in guiding empirical antimicrobial therapy pending culture results.

Thus, when this organism is suspected, several deep tissue specimens should be obtained and cultured for extended periods.

Establishing the diagnosis of SSI can be very challenging, and a high index of suspicion should always be maintained for any patient presenting with back pain within a window period of 3 months after the procedure. A number of difficulties may delay the confirmation of SSI. Although the usual duration between the invasive procedure and the occurrence of the infection ranges from 2 to 30 days, There remains a need for large multi-center clinical studies to address the optimal diagnostic approach for SSI. In this section, we will analyze currently available diagnostic modalities and the controversies that surround them.

The most common presenting symptom for SSI following spine surgery is back pain, usually 1 month after the procedure with a range of 2 days to over 3 months post-intervention . The pain is characteristically localized, continuous, and not relieved by pain medications. It can radiate to the hip, leg, scrotum, groin, abdomen, or perineum. It has a slow, insidious onset, which can cause diagnosis to be delayed. It could appear after a pain-free interval for as long as 3 months (29). Other characteristic clinical features are wound drainage and constitutional symptoms such as fever, present in 40% of the cases, fatigue, and weight loss (28,).

Additionally, physical examination may reveal localized tenderness, warmth, erythema, and edema at the site of surgery with or without purulent wound drainage (9). Purulent wound drainage occurs in around two-third of SSIs with instrumentation and is the most frequent indicative sign of instrumented spine surgery infections.

Deep infections present more commonly with constitutional symptoms, and in rare cases, patients might suffer from severe sepsis and end organ failure. Deep infections often lack impressive superficial features making their diagnosis solely presumptive.

Imaging is considered a key element for the diagnosis and follow-up of SSI following spine surgery. Even though magnetic resonance imaging (MRI) remains the technique of choice, plain X-ray has always been the first to be ordered when suspecting an SSI. However, this imaging lacks sensitivity in detecting SSI, which can cause delays in the establishment of a definitive diagnosis (12,). In fact, post-operative plain radiographs performed up until 4 weeks post index procedure, are expected to show normal or unchanged spinal structure compared to pre-operative images (2,). The first pathologically defining change to appear between the fourth and sixth weeks post-operatively is a decrease in intervertebral height. Other plain radio film manifestations, including osteolysis, deformity, and endplate destruction, are only expected to appear after 6 weeks (2,).

MRI is both the most sensitive (93%) and specific (96%) technique to evaluate SSIs following spine surgery. The diagnostic features of SSI can be detected as early as days 3–5 post-operatively. Characteristic findings include diminished disk height, vertebral body, and disk space, decreased intensity on T1-weighted images, increased signal intensity on T2-weighted imaging secondary to edema, and endplate definition loss. These vertebral disk changes are accompanied by increased bone marrow intensity signaling due to edema .

The isolation of a specific pathogen is of crucial importance in the diagnosis and management of SSIs following spine surgery. Blood cultures (two to four sets) constitute the simplest procedure to detect the pathogen. When the blood culture yields a highly pathogenic organism such as *S. aureus, P. aeruginosa,* and no other sites of infections are obvious, then this is diagnostic of the causative agent. However, blood cultures lack both sensitivity and specificity in detecting the pathogen.

Three main recommendations may help in improving the diagnostic yield and avoiding false negative cultures. First, the use of a large bore needle is encouraged. Second, histopathological examination should be requested as an adjunct to cultures if adequate tissue can be safely obtained, since this can help identify pyogenic from granulomatous changes in tissues. The use of additional staining for fungi and mycobacteria is highly advised, especially with previous negative culture results . Third, a delay in antibiotic therapy is recommended in order to achieve a better culture yield of aspirated specimens. This should be balanced with potential consequences of delayed treatment. In patients with normal neurologic examination and normal hemodynamic status and who had been started on antibiotics before the performance of CT-guided aspiration, withholding therapy for 1 week before performing the procedure is advisable. However, for patients with neurological compromise, broad-spectrum empiric antibiotic therapy and immediate surgical intervention are warranted.

IV. Conclusion

Although The rate of surgical site infection in our study is much higher then the previous studies these might be due to so many factors including bad hygens in postoperative wards. Surgical site infection following spine surgery is a major cause of increased morbidity following spine interventions and an immense burden on the health care system. A high index of suspicion should be kept in the first 3 months after the procedure. The diagnosis is usually suspected based on the symptoms and physical exam findings. However, a number of laboratory and imaging techniques are available to speed up the confirmation of the diagnosis and the recovery of the offending organisms, which would allow early targeted therapy.

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