Surgical site infection prevention

- Impact of Dual Antibiotic Prophylaxis on 90-Day Surgical Site Infection Rates Following Posterior Spinal Fusion for Juvenile Scoliosis: A Single-Center Study of 296 Cases
- Less is More: A Cost and Environmental Waste Analysis in Nonadherence to Antibiotic Prophylaxis Guidelines in Clean Ambulatory Surgical Procedures
- Prevalence and Risk Factors for Surgical Site Infections among Patients in Referral Hospitals in Rwanda
- Factors That Increase the Risk of Prosthetic Joint Infection Within 90 Days After THA and TKA: A Nationwide Population-based Study
- Surgical site infections: a comprehensive review
- Additive Manufacturing, Thermoplastics, CAD Technology, and Reverse Engineering in Orthopedics and Neurosurgery-Applications to Preventions and Treatment of Infections
- Prophylactic and Therapeutic Usage of Drains in Gynecologic Oncology Procedures: A Comprehensive Review
- Superficial incisional surgical site infections experimentally induced by Staphylococcus aureus in mice: the effect of Bdellovibrio bacteriovorus containing dressing

---

There are three phases in prophylaxis of surgical site infections (SSI):

Preoperative Surgical site infection prevention

Intraoperative Surgical site infection prevention

Postoperative Surgical site infection prevention

There is lack of consensus and paucity of evidence with SSI prophylaxis in the postoperative period.

Use of postoperative surgical antimicrobial prophylaxis was not correlated with SSI rates at the hospital level after adjusting for differences in procedure mix and patient characteristics [1)]

To systematically evaluate the literature, and provide evidence-based summaries on postoperative measures for SSI prophylaxis in spine surgery Tan et al. published a systematic review, meta-analysis, evidence synthesis.

A systematic review conforming to PRISMA guidelines was performed utilizing PubMed (MEDLINE), EMBASE, and the Cochrane Database from inception to January 2019. The GRADE approach was used for quality appraisal and synthesis of evidence. Six postoperative care domains with associated key questions were identified. Included studies were extracted into evidence tables, data synthesized quantitatively and qualitatively, and evidence appraised per GRADE approach.

Forty-one studies (9 RCT, 32 cohort studies) were included. In the setting of pre-incisional antimicrobial prophylaxis (AMP) administration, use of postoperative AMP for SSI reduction has not

been found to reduce rate of SSI in lumbosacral spine surgery. Prolonged administration of AMP for more than 48h postoperatively does not seem to reduce the rate of SSI in decompression-only or lumbar spine fusion surgery. Utilization of wound drainage systems in lumbosacral spine and adolescent idiopathic scoliosis corrective surgery does not seem to alter the overall rate of SSI in spine surgery. Concomitant administration of AMP in the presence of a wound drain does not seem to reduce the overall rate of SSI, deep SSI, or superficial SSI in thoracolumbar fusion performed for degenerative and deformity spine pathologies, and in adolescent idiopathic scoliosis corrective surgery. Enhanced-recovery after surgery (ERAS) clinical pathways and infection-specific protocols do not seem to reduce rate of SSI in spine surgery. Insufficient evidence exists for other types of spine surgery not mentioned above, and also for non-AMP pharmacological measures, dressing type & duration, suture & staple management and postoperative nutrition for SSI prophylaxis in spine surgery.

Despite the postoperative period being key in SSI prophylaxis, the literature is sparse and without consensus on optimum postoperative care for SSI prevention in spine surgery. The current best evidence is presented with its limitations. High quality studies addressing high risk cohorts such as the elderly, obese and diabetic populations, and for traumatic and oncological indications are urgently required [2].

Surgical site infections are a common, multifactorial problem after spine surgery. There is compelling evidence that improved risk stratification, detection, and prevention will reduce surgical site infections [3].

Today’s health care environment demands more than ever of surgeons and the hospitals they work in. Payors, including Medicare, increasingly refuse to pay for treating complications deemed preventable, such as surgical site infections.

Surgical site infection prevention in neurosurgery

- Impact of Dual Antibiotic Prophylaxis on 90-Day Surgical Site Infection Rates Following Posterior Spinal Fusion for Juvenile Scoliosis: A Single-Center Study of 296 Cases
- Additive Manufacturing, Thermoplastics, CAD Technology, and Reverse Engineering in Orthopedics and Neurosurgery-Applications to Preventions and Treatment of Infections
- Surgical site infections with multi-drug resistant organisms in patients undergoing neurosurgery: a retrospective comparative cohort study from Turkey
- Effect of the number of door openings in the operating room on surgical site infections: individual-patient data meta-analysis
- Population pharmacokinetics of cefazolin in neurosurgical antibiotic prophylaxis
- Antibiotics consumption in neurosurgery versus appendectomy: a call for antibiotic stewardship initiatives
- Physician Awareness Combined With Perioperative Infection Prevention Bundles Results in Durable Neurosurgical Infection Control and Cost Savings

- Assessment of Therapeutic Decision-Making in Spontaneous Spondylodiscitis: A Retrospective Study Across 2 Neurosurgical Centers

---

Surgical site infections (SSIs) are a significant concern in neurosurgery due to the potential for devastating complications, including meningitis, brain abscess, osteomyelitis, and hardware infections. Preventing SSIs requires a multidisciplinary approach involving perioperative measures, sterile techniques, and postoperative management. Below is an evidence-based framework for SSI prevention in neurosurgical procedures.

Preoperative Measures

Patient Optimization - Screening & Eradication of Carriers:

1. Nasal decolonization with **mupirocin** and **chlorhexidine bathing** in patients colonized with *Staphylococcus aureus*.

- **Glycemic Control:**

1. Maintain blood glucose <180 mg/dL in diabetic patients.

- **Nutritional Optimization:**

1. Correct hypoalbuminemia and address malnutrition preoperatively.

- **Smoking Cessation:**

1. Encourage cessation at least 4 weeks before surgery to improve wound healing.

- **Preoperative Antibiotic Prophylaxis:**

1. **First-line:** Cefazolin 2 g IV (3 g if ≥120 kg) within 60 minutes before incision.
2. **Beta-lactam allergy:** Clindamycin or vancomycin.
3. **MRSA colonization:** Vancomycin in addition to cefazolin.
4. **Redosing:** Repeat antibiotics in procedures lasting >4 hours or with excessive blood loss.

Intraoperative Strategies

Sterile Techniques & Infection Control - Standardized Surgical Preparation:

1. Skin antisepsis with **chlorhexidine-alcohol** (preferred over povidone-iodine).
2. Avoid hair removal if unnecessary; if needed, use clippers instead of razors.

- **Strict Aseptic Technique:**

1. Proper hand hygiene, sterile gloves, and gowning.
2. Double gloving for CSF-contact procedures.
3. Limiting operating room (OR) traffic to reduce contamination.

- **Intraoperative Antibiotics:**

1. Ensure redosing if the surgery is prolonged (>4 hours) or excessive bleeding occurs.

- **Minimize Operative Time & Tissue Trauma:**

1. Precise hemostasis and reduced retraction to minimize tissue damage.

- **Use of Antimicrobial-Impregnated Devices:**

1. **Ventriculostomy catheters:** Silver- or antibiotic-coated catheters reduce external ventricular drain (EVD) infections.
2. **Dural substitutes:** Prefer autologous dura or antimicrobial-treated synthetic substitutes.

- **CSF Leak Prevention:**

1. Ensure a **watertight dural closure** and use sealants where needed.

- **Normothermia:**

1. Maintain patient temperature to prevent hypothermia-induced immune suppression.

Postoperative Management

Wound Care - **Dressing Management:**

1. Use occlusive or antimicrobial dressings for 48–72 hours.
2. Avoid frequent dressing changes to prevent contamination.

- **Early Drain Removal**

1. External drains (EVD, lumbar drains) should be removed **as soon as clinically feasible** (preferably within 5 days).

- **Antibiotic Duration:**

1. Prophylactic antibiotics should be **discontinued within 24 hours postoperatively** unless there is an active infection.

Monitoring & Early Intervention - **Regular Wound Inspections:**

1. Monitor for signs of SSI (erythema, swelling, discharge, fever).

- **Early Diagnosis & Treatment:**

1. Consider MRI with contrast if deep infection is suspected.
2. CSF analysis if meningitis or ventriculitis is a concern.

—

Special Considerations in High-Risk Patients

- **Cranioplasties & Hardware-Implant Procedures:**

1. Antibiotic-impregnated bone cement for cranioplasty.
2. Consider staged procedures in cases of contaminated wounds.

- **Spinal Instrumentation:**

1. Extended antibiotic coverage in high-risk spinal fusion cases.
2. Local vancomycin powder application in spine surgery may reduce infection rates.

- **Reoperations:**

1. Higher risk of SSI; meticulous debridement and wound closure are essential.

Conclusion

A **multimodal** approach incorporating **preoperative screening, strict intraoperative sterile techniques, and vigilant postoperative care** significantly reduces SSIs in neurosurgery. Implementing **evidence-based guidelines and standard protocols** in neurosurgical practice ensures optimal patient outcomes and reduces morbidity related to infections.

A study found that patient body mass index and male sex were associated with an increased risk of SSI. Operating room personnel turnover, a modifiable, work flow-related factor, was an independent variable positively correlated with SSI [4].

Triclosan-containing sutures

Triclosan-containing sutures

References

1)
He K, Nayak RB, Allori AC, Brighton BK, Cina RA, Ellison JS, Goretsky MJ, Jatana KR, Proctor MR, Grant C, Thompson VM, Iwaniuk M, Cohen ME, Saito JM, Hall BL, Newland JG, Ko CY, Rangel SJ. Correlation Between Postoperative Antimicrobial Prophylaxis Use and Surgical Site Infection in Children Undergoing Nonemergent Surgery. JAMA Surg. 2022 Oct 19. doi: 10.1001/jamasurg.2022.4729. Epub ahead of print. PMID: 36260310.
2)
Tan T, Lee H, Huang MS, Rutges J, Marion TE, Matthew J, Fitzgerald M, Gonzalvo A, Hunn MK, Kwon BK, Dvorak MF, Tee J. Prophylactic Postoperative Measures to Minimize Surgical Site Infections in Spine Surgery: Systematic Review and Evidence Summary. Spine J. 2019 Sep 23. pii: S1529-9430(19)30977-5. doi: 10.1016/j.spinee.2019.09.013. [Epub ahead of print] Review. PubMed

PMID: 31557586.

3)

Radcliff KE, Neusner AD, Millhouse P, Harrop JD, Kepler CK, Rasouli MR, Albert TJ, Vaccaro AR. What's New in the Diagnosis and Prevention of Spine Surgical Site Infections. Spine J. 2014 Sep 25. pii: S1529-9430(14)01495-8. doi: 10.1016/j.spinee.2014.09.022. [Epub ahead of print] Review. PubMed PMID: 25264181.

4)

Wathen C, Kshettry VR, Krishnaney A, Gordon SM, Fraser T, Benzel EC, Modic MT, Butler S, Machado AG. The Association Between Operating Room Personnel and Turnover With Surgical Site Infection in More Than 12 000 Neurosurgical Cases. Neurosurgery. 2016 Dec;79(6):889-894. PubMed PMID: 27465846.