

G50: Does the type of wound closure (sutures vs staples vs glue) influence the rate of SSI/PJI in major orthopedic surgery?

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Recommendation: While no single method consistently outperforms others, evidence supports tailored approaches. A watertight multi-layer closure with the closure tool determined by surgical site would have the best outcomes.

Level of Evidence: Low

Delegate Vote:

Rationale

The relationship between wound closure methods and the risk of surgical site infections (SSI) or periprosthetic joint infections (PJI) in major orthopaedic surgery has been widely studied in literature but with mixed conclusions. Various factors, including the surgical site, patient comorbidities, and the specific wound closure technique, complicate effective statistical comparisons.

Current wound closure methods range from metallic staples to tissue adhesives, absorbable sutures, braided sutures, or antibiotic-coated sutures. Each method has unique advantages and potential drawbacks depending on the type of wound and surgical site. Low-tension wounds over the hip or spine are generally well-suited to sutures and tissue adhesives. In contrast, high-tension wounds, such as those around the knee or ankle, may benefit more from staples or barbed sutures[1].

Conventionally interrupted knotted sutures have been a mainstay of orthopedic wound closure. However, they have been criticized for increasing focal tissue ischemia, stitch abscess formation, and prolonged closure times.[2] Barbed sutures have emerged as an alternative, offering reduced closure times and eliminating knot-related complications.[3] However, the advantage of a barbed suture over conventional braided remains questionable. While closure in THA cases was reported to have higher wound-infection with braided sutures, in TKA closures a higher infection rate was observed after barbed sutures.[4, 5]

Metallic staples show varying infection rates depending on the procedure. In THA, staples are associated with a higher risk of SSI. In a large RCT of 535 THA patients, Mallee et al found a threefold increase in SSI risk with staples as compared to sutures, OR=2.8, p=0.057.[6] Similar comparisons have been noted by Van de Kuit, Krishnan, Rui and Smith, arguing that the infection could be attributed to soft tissue reaction to stainless steel or titanium of staples or improper surgical technique leaving overlapping or inverted wound edges causing persistent oozing and open skin entry points.[1, 7-9] Even traumatic proximal femur surgeries closed with staples reported higher wound infection rates compared to sutures.[10]

Conversely studies reporting on TKA cohorts have shown significantly lower infection rates with staples. Campbell et al. noted a 19.6% infection rate with sutures versus 7.2% with staples.[11] Similarly, Newman and Mudd also reported lower infection rates with staples, 0% versus 4%.[12, 13] Explaining that the greater space between staples may provide an advantage in terms of oxygenation, and therefore proper wound healing and lower infection risk.[3]

Some studies have also noted comparable infection rates between sutures and staples, reporting no significant differences in either THA or TKA.[14, 15] Multiple prospective randomised control trials have reported no significant differences in infection when compared between tissue adhesives, stapling and suturing.[16, 17] Glennie et al. and Khan et al. noted an increased wound discharge was associated after staple closure, but the risk of infection was comparable across techniques.[18, 19]

Tissue adhesives, such as cyanoacrylate, offer bactericidal properties and can form a mechanical barrier against microorganisms. However, while adhesives have been associated with improved cosmetic outcomes and patient satisfaction, their impact on infection rates has been inconsistent.[20] Studies have reported significantly lower infection rates with tissue adhesives in spinal procedures compared to sutures or staplers.[21, 22] However, in knee, hip or trauma surgeries adhesives may pose a higher infection risk, with Miller et al. reporting 3.2% infection rate with adhesive closure versus 2.4% with staples; and similar findings observed by Raja et al. and Lee et al.[20, 23, 24]

The importance of a layered closure in ensuring prevention of infection has been comprehensively described by Snyder et al in a systematic review of wound closure techniques reporting significantly lower infection rates with multilayer antimicrobial sutures, with the risk of deep SSI ranging from 0% to 1.1% and superficial SSI ranging from 0% to 1.3%.[25] Comparatively traditional closure methods either plain sutures, staples or adhesives had a 14.8% rate of superficial SSI and 3.9% rate of deep SSI. In a separate large observational study of 2000 arthroplasty patients with set integrated care protocols, Snyder et al reported 0% infection rate after using watertight multilayer closure with barbed sutures and tissue adhesives.[26]

Non-invasive closure systems, such as zipper-like devices, are gaining attention for their ease of use and minimal wound complications.[27] These systems offer comparable infection rates to staples and reduce operative time, providing an alternative for patients requiring a quicker recovery and self-removal capability.[28]

Conclusion

The influence of wound closure techniques on SSI and PJI rates in orthopaedic surgery depends on the surgical site, wound tension, and patient-specific factors. While no single method consistently outperforms others, evidence supports tailored approaches. Sutures and tissue adhesives are effective for low-tension wounds. Staples may be preferable for high-tension sites like the knee but carry higher infection risks in THA. Barbed sutures reduce closure time but have risk of higher infection. Tissue adhesives have mixed outcomes, with promising results in spine and small joint surgeries. Multilayer antimicrobial sutures provide the most reliable reduction in SSI rates.

References

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