G44: Does the Size and Extent of Soft Tissue Dissection Influence the Incidence of Surgical Site Infection (SSI)/Periprosthetic Joint Infection (PJI) After Major Orthopedic Surgery?

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Response/Recommendation:

Yes. The extent and size of soft-tissue dissection during major orthopedic surgery significantly influences the risk of developing surgical site infections (SSIs) and periprosthetic joint infections (PJIs).

Strength of Recommendation: Strong

Delegate Vote:

Rationale:

Soft-tissue dissection impacts postoperative outcomes, particularly infection risk. Factors such as incision length, wound perfusion, depth, and tissue condition influence SSIs and PJIs. Key considerations include surgical approach, tissue handling, operative duration, and dead space management(1–5)..

This systematic review was conducted to investigate the relationship between the extent and size of soft tissue dissection and the subsequent risk of surgical site infection (SSI) or postoperative joint infection (PJI). The search strategy was designed to identify human-based studies published between 1990 and the present. The search was limited to English-language publications, with the exception of randomized controlled trials (RCTs), for which no date restriction was applied. PubMed identified 238 potentially eligible publications. After screening by two independent reviewers, 206 publications were excluded, leaving 32 studies for comprehensive review and data extraction.

Surgical Factors

There are several studies evaluating the depth of the soft-tissue envelope (which intuitively would require a longer skin incision for surgical exposure) adjacent to the surgical site and its effect on developing an SSI or PJI. In the region of the hip, a lateral soft-tissue-tissue thickness of > 5cm was associated with a higher rate of SSI, PJI, and the need for revision (6). The same group reported that lateral approaches encountered more adipose tissue than anterior based approaches and was more likely to be associated with female patients and correlate with body mass index (BMI) (7). Bell et al. reported the contrary that radiographic measurement of subcutaneous fat thickness was not a valid tool to predict return to the OR for wound complications (8).

The subcutaneous location of the knee has resulted in more studies looking specifically at the soft-tissue envelope surrounding the knee and its relationship with SSI and PJI. Several authors have demonstrated that patients with a deeper subcutaneous adipose layer anterior to the knee are associated with a significantly increased risk of early reoperation, wound complications, and PJI (9–11). The role of BMI alone is unclear as studies have shown that BMI alone is not associated with the same risk (9,11) but others have demonstrated that BMI is a better predictor of PJI than anterior soft-tissue thickness (12).

Other procedures such as posterior cervico-thoracic fusion and open reduction and internal fixation of acetabular fractures has not demonstrated a clear relationship between soft-tissue envelope thickness and PJI (13–15). Several studies clearly demonstrate that longer operative times are associated with higher rates of patient morbidity, readmission rates, blood loss, need for blood transfusion, SSI, and longer hospital length of stay (16–18). The longer the wound is open to room air, the higher the rate of SSI and PJI. In the setting of

extensile surgical approaches and prolonged surgical time, a repeat dose of prophylactic antibiotics may be warranted.

Unaddressed voids can result in seromas or hematomas, which may facilitate infection. The correlation between soft tissue defects and PJI is paramount in orthopedic surgery, especially after total knee arthroplasty (TKA). Complications related to wound healing, such as infections, have a significant impact on patient outcomes, with infection rates post-TKA ranging from 0.33% to 10.5% (19). Effective management of these complications requires prompt assessment and intervention, including debridement and appropriate soft tissue coverage (19). Various reconstructive techniques, including perforator and free microvascular flaps, are critical for addressing soft tissue defects while also considering infection control (20). Furthermore, the timing of surgical interventions is essential in preventing additional complications (4). The collaboration between orthopedic and plastic surgical specialists is crucial for optimizing outcomes in patients with soft tissue defects associated with PJI, underscoring the necessity for a multidisciplinary approach in treatment planning (4,20).

Patient-Specific Factors

Preoperative soft tissue conditions, including scarring and prior surgical interventions, significantly influence PJI rates, particularly in extended surgical approaches (21). Factors such as obesity, diabetes, and prior surgeries are linked to increased infection risk, with compromised tissue integrity heightening wound complications (10,21). Optimizing modifiable risk factors and meticulous surgical techniques are essential, especially for managing complex defects in irradiated areas.

Tissue perfusion plays a crucial role in surgical site infection (SSI) risk, particularly in total knee arthroplasty (TKA). Wyles et al. demonstrated that laser-assisted indocyanine green angiography (LAICGA) enhances surgical decision-making by visualizing real-time perfusion, reducing complications such as wound necrosis (5). Similarly, adequate preoperative soft tissue coverage, including prophylactic perforator flaps, has been associated with improved outcomes and lower implant infection rates (23).

Managing comorbidities is vital in reducing PJI risk, especially in extensive procedures. Diabetes, obesity, and malnutrition have been identified as key contributors to SSI (21,24). A retrospective review found that preoperative prognostic nutritional index (PNI) and subcutaneous fat thickness were independent risk factors for deep SSI after posterior lumbar interbody fusion (PLIF) (25). Moreover, optimizing soft tissue coverage timing did not significantly reduce complications, reinforcing the importance of comprehensive preoperative assessments (4,21). Addressing modifiable factors such as smoking and anemia further improves wound healing and surgical outcomes (21).

Nutritional status also plays a critical role in SSI risk. Lower preoperative PNI, increased fat thickness, and poor serum albumin levels are independent predictors of deep SSIs following PLIF (25). Obesity and malnutrition consistently correlate with higher SSI rates across orthopedic procedures (25). Targeted nutritional interventions could enhance outcomes and reduce healthcare costs associated with postoperative complications.

Wound Factors

The presence of concurrent wounds complicates periprosthetic joint infection (PJI) management by increasing infection risk and necessitating complex surgical interventions (20). Wound closure techniques, including muscle and perforator flaps, improve soft tissue coverage and reduce infection rates (20). Early reconstructive intervention enhances prosthesis retention, while bacterial contamination from other wounds underscores the need for thorough debridement and meticulous soft tissue management (24). Collaboration between plastic and orthopedic surgeons has proven beneficial in addressing these challenges, ensuring

comprehensive care for compromised knee arthroplasties (20). Tailored, timely management strategies are essential for optimizing outcomes in PJI cases with concurrent wounds (24).

Perioperative Factors

Preoperative nutritional status significantly influences surgical site infection (SSI) risk, potentially leading to prosthetic joint infections (PJI) (24). Lower prognostic nutritional index (PNI) values and increased fat thickness are associated with higher SSI rates following posterior lumbar interbody fusion (PLIF) (25). Obesity, diabetes, malnutrition, surgical invasiveness, and procedure duration further contribute to SSI risk. Addressing modifiable risk factors during surgical planning is essential for reducing PJI incidence, improving patient outcomes, and minimizing healthcare costs.

Procedural Innovations and Adjuncts

Innovations in surgical techniques have improved periprosthetic joint infection (PJI) prevention, particularly in total knee arthroplasty (TKA) (26). Prophylactic soft tissue augmentation with perforator flaps enhances coverage and reduces infection risk (23). Technologies like laser-assisted indocyanine green angiography (LAICGA) aid in evaluating tissue perfusion, minimizing wound necrosis (5). A multistep extremity salvage protocol, emphasizing collaboration between orthopedic and plastic surgeons, further optimizes soft tissue management (20). Additionally, antibiotic-laden cement or spacers provide infection control in high-risk cases.

In conclusion, and based on our understanding of the current literature, there appears to be a direct correlation between the extent of soft tissue dissection and subsequent risk of SSI/PJI. There are numerous reasons that could potentially explain this correlation that was discussed above.

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