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QUESTION 1: Does the presence of skin lesions (i.e., boils, grazes, folliculitis, etc.), either in the proximity or distant to the surgical site, predispose patients to surgical site infections/ periprosthetic joint infections (SSIs/PJIs)? If so, is it necessary for patients with these skin lesions to undergo treatment prior to elective total joint arthroplasty (TJA)?

RECOMMENDATION: The presence of active skin infections, either in the proximity or distant to the surgical site, can potentially increase the risk of SSIs/PJIs in patients undergoing elective TJA. Therefore, surgery should be delayed until these lesions are treated and/or resolved. Placing surgical incisions through eczematous or psoriatic lesions should be avoided as well, whenever possible.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 95%, Disagree: 3%, Abstain: 2% (Unanimous, Strongest Consensus)

RATIONALE

Optimization of the host is effective in minimizing the risk of PJIs/SSIs prior to elective total joint arthroplasty.

Presence of Active Infection

Bacterial Infection

For most SSIs after total hip and knee arthroplasties, the source of pathogens is the endogenous flora of the patient's skin [1,2]. The presence of bacterial infection of the skin, such as boils, folliculitis and erysipelas, is encountered in patients undergoing total hip and knee arthroplasty, although the incidence is not clear.

Folliculitis is most commonly caused by *Staphylococcus aureus* in all geographic regions, according to an international survey [3]. Nasal carriage of *S. aureus* was found in 58% of patients with folliculitis/furuncles overall and was associated with chronic furunculosis [4]. There is a concern that the prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) is increasing for these patients, with the overall MRSA rate in the skin and subcutaneous tissue infections reaching as high as 36% in North America [3].

Erysipelas affects predominantly adult patients in the sixth or seventh decade, a similar demographic to those considered for total joint arthroplasty, and occurs on the lower limb in more than 80% of cases. It is often caused by the disruption of the cutaneous barrier (e.g., leg ulcer, wound, fissured toe-web intertrigo, pressure ulcer), lymphedema, chronic edema or local surgical operations. The condition is most commonly caused by β-hemolytic streptococci of group A, less so by group B, C or G streptococci and rarely by staphylococci [5]. Impetigo consists of discrete purulent lesions that are nearly always caused by β-hemolytic streptococci and/or *S. aureus*. Resistance to fusidic acid in the European strains of *S. aureus* causing impetigo has increased in recent years [6]. MRSA is a major nosocomial pathogen that may also cause impetigo [7].

As the causative organisms for these bacterial skin infections are also common pathogens in SSIs/PJIs following TJAs [8–11], if such skin lesions are in the proximity of the surgical site, the risk of SSIs/PJIs could potentially increase.

These bacterial skin infections may also have some risk of bacteremia [12]. Although it is well-accepted that seeding of the operative site from a distant focus of infection can be a source of SSI pathogens [13], literature regarding the impact of remote skin infection on SSIs from a clean wound is scarce. In a retrospective study [14] on 2,349 patients with clean surgical wounds, the wound infection rate in the 53 patients with remote skin infections was 20.7% compared to the 6.9% in the 2,141 patients without remote infections ($p < 0.001$). It should be noted that most of the procedures in that study were not orthopaedic procedures. Theoretically, for patients who have a prosthesis or other implant placed during the operation, such a remote seeding could be particularly important because such devices provide a nidus for attachment of organisms [15].

Fungal Infection

Dermatophytosis (i.e., tinea) of the feet and inguinal area is not only contaminated by bacteria, but also can be a portal of entry for bacteria through rhagade [12,16]. If it is in the proximity of incisions, there might be the risk of contaminating the tissue in the surgical wound [17]. PJI with fungal pathogens is a rare but challenging clinical problem [18]. Therefore, elective TJA should not be performed until these infections are eradicated, no matter whether they are in proximity of or distant from the surgical site.

Special attention should be paid to *Cutibacterium acnes* (*C. acnes*) (formerly *Propionibacterium acnes)*. This organism is not only found in facial acne lesions but also on the trunk. Skin areas rich in sebaceous glands are a particular risk for *C. acnes* surgical site infections [19]. In shoulder arthroplasty, a higher incidence of *C. acnes* inducing periprosthetic joint infections have been reported [20–22] and routine local preoperative treatments have been described as not being sufficient in reducing *C. acnes* loading [23]. New strategies like preoperative use of benzoyl peroxide (known from topical therapy for acne vulgaris) have proven to be effective in reducing the risk of infection by *C. acnes* [24,25].

Skin Disorders with the Potential for Enhanced Microbial Load

There are no existing studies evaluating the risk of SSIs when incisions are placed through eczematous or psoriatic lesions. Psoriatic plaques have been shown to harbor increased concentrations of bacteria compared with unaffected skin, causing concern for an increased risk of infection [26,27]. However, some studies have demonstrated that there is no such association [28,29].

Patients with atopic dermatitis have higher levels of bacterial colonization on both the affected and normal skin [30,31]. In non-affected normal skin, *S. aureus* colonization was found in 19 of 30 (63%) atopic dermatitis patients compared with 6 of 25 (24%) in nonatopic eczema patients and 1 of 30 (3%) in the healthy control group, respectively ($p < 0.05$) [32]. That means that even when the incision is made in the normal skin, the risk of implant infection remains high, as the normal skin of atopic dermatitis patients is more heavily colonized than the skin of healthy patients. Lim et al. reported two cases of PJI related to remote atopic dermatitis [33].

The degree of *S. aureus* colonization may also depend on the severity and duration of the eczematous lesions. The colonization rates in acute and chronic skin lesions of patients with atopic dermatitis are significantly different, with a colonization rate of more than 70% in acute lesions and about 30% in chronic lesions [34,35].

Therefore, patients with active skin disease should see their dermatologist preoperatively, and every attempt should be made to manage skin plaques before surgery to decrease bacterial burden. Placing surgical incisions through eczematous or psoriatic lesions should be avoided if possible.

Ulcerations

Venous leg ulcers and diabetic foot ulcers usually have bacterial contamination and might be a source of systemic bacterial spread [36,37]. In general, ulceration of the skin (including neoplasm) is a substantial risk factor for surgical site infections [38]. It was recommended that elective arthroplasty not be carried out in patients with active skin ulcerations (active ulcerations being defined as breaks in the skin barrier, excluding superficial scratches) [39].

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