SH1: Is there evidence for sex/gender specific approaches to prevention of shoulder PJI?

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Response: Males have a significantly higher dermal burden of *Cutibacterium acnes* and a higher risk of shoulder PJI compared to females indicating that sex-based strategies to prevent PJI are indicated.

Strength of Recommendation: Limited

Delegate Vote: 49 (100%) agree; 0 disagree; 0 abstain

Rationale: A comprehensive literature review was performed to identify all studies that quest association between sex or gender and PJI. Different combination of search terms for "sex", "gender", "prosthetic joint infection", "periprosthetic joint infection", "prevention", "PJI" were performed using the search engines PubMed, Scopus and Google Scholar which were searched through December 2024. We identified 73 articles from PubMed, 61 articles from Scopus and 138 articles from Scholar after searching has been made. Inclusion criteria for our systematic review were all English studies (Level I-IV evidence) published between 1996 and 2024 that included patients undergoing arthroplasty (primary or revision), reported on periprosthetic joint infections (PJI), included data on sex or gender, and utilized clinical study designs (cohort, case-control, cross-sectional studies), meta-analyses, or systematic reviews. Exclusion criteria were non-English language articles, nonhuman studies, case reports, editorials, opinion pieces, studies without sex or gender data, studies unrelated to shoulder arthroplasty or shoulder PJI, studies that have patients less than 10, and technique papers without patient data.

After removing duplicate papers, seven papers matching the search criteria were reviewed. Out of seven articles, four were systematic reviews, two were prospective, and one was cross-section design. Before discussing gender-specific prevention strategies, we would like to mention the first systematic reviews. Two articles were investigating risk factors for shoulder PJI. These articles identified male gender as an important risk factor for PJI (1-2). While this article did not mention a gender-specific prevention strategy, it was mentioned because it recognized male gender as an important risk factor and was relevant to the topic.

Another systematic review about PJI after reverse shoulder arthroplasty also stated male gender is a risk factor (3). However, this review suggested prevention strategies for male patients as well. Their suggestions such as topical treatments, antibiotics and intraoperative prophylaxis have positioned potential solutions in the prevention of shoulder PJI. However, in a prospective study by Phadnis et al. (4), they found a statistically non-significant trend toward increased *C. acnes* incidence in males. Therefore, a *C. acne*-specific preoperative approach is not yet recommended for any gender by Phadnis et al.

Garrigues et al. (5) discussed role of topical skin treatments for shoulder PJI. They showed male gender as a risk factor for shoulder PJI, which they proposed *C. acnes* as the cause. They argued that sebum-rich pilosebaceous hair follicles make eradication of *C. acnes* difficult. Some other studies examined skin microbiota. Matsen et al. (6) conducted a cross-sectional design and revealed that males had a significantly higher dermal load of *C. acnes* compared to females (1.6 vs. 0.3, $p < 0.001$). Therefore, it can be concluded that men have a different skin microbiota than women.

Chalmers et al. (7) conducted a prospective, single-blinded cohort study demonstrating that the addition of hydrogen peroxide to the preoperative skin preparation remarkably decreased deep tissue contamination with *C. acnes* (10% in peroxide group vs. 35% in control, $p = 0.031$). Also, in subgroup analysis, male patients in the peroxide group revealed substantially fewer positive cultures from the glenohumeral joint (8% vs. 44%, $P = 0.044$). Both the high prevalence of *C. acnes* on skin surface of men (6) and the fact that men showed a significant benefit from hydrogen peroxide in the

subgroup analysis by Chalmers et al (7) provides evidence that skin preparation with hydrogen peroxide may decrease the risk of PJI, specifically in male patients.

The three studies mentioned above suggest that males may have a fundamentally higher microbial load and a different profile of skin microbiota, which may increase their risk of developing PJI. The use of hydrogen peroxide prior to surgery may have potential benefits in male patient populations.

References

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