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CORR Insights®: What Host Factors Affect Aseptic Loosening After THA and TKA?

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Where Are We Now?

Aseptic loosening is a major cause of construct failure after THA and TKA [2, 4]. Studies suggest that loosening

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accounts for about 55% of the total failures in THA and 31% in TKA [5, 7]. Excessive production of wear particles induces osteoclast differentiation and macrophage production, leading to inflammatory-mediated osteolysis, which can progress to aseptic loosening [1, 3, 6]. The current systematic review suggested that two host factors (male gender and high activity level) were associated with an increased risk of aseptic loosening for THA, whereas the other two host factors they analyzed (obesity and tobacco use) were not. For TKA, the review did not find any host factors associated with loosening. However, many host (and other clinical) factors can be interrelated, making it difficult to quantitatively analyze how much a single host factor contributes to loosening. Additionally, statistical pitfalls can complicate matters, in particular insufficient statistical power, resulting in the failure to detect the influence of one or more factors that could result in an increased risk of loosening.

Where Do We Need to Go?

More detailed and definitive answers are still needed in order to determine how much host factors affect aseptic

loosening. We must first determine how much a single host factor contributes and how a combined effect of two or more host factors would react to the aseptic loosening of the prosthesis. Given the recent advances in arthroplasty materials and fixation techniques, studies should explore the factors affecting aseptic loosening under various conditions. Host factors such as activity level, obesity, and tobacco use are variables that can be quantified by activity level score, BMI, and pack-years, respectively. Researchers should try to identify the quantitative relationship among the most-important host factors. Finally, systemic reviews, as well as clinical studies, should be presented clearly and interpreted correctly using rigorous methodological and statistical approaches.

How Do We Get There?

Researchers with a background in statistics and data management are a valuable resource and their expertise can help guide us as we perform high-quality systematic reviews that pool data and handle heterogeneity appropriately. Observational or simple

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anecdotal studies likely will be of limited value.

We must acknowledge that future studies need better methodology, and researchers should consider a more quantitative approach. A study with a large number of subjects is not necessarily a better one. For example, the results of this systemic review showed that obesity is not found as a risk factor of aseptic loosening for both THA and TKA. Researchers divided the subjects into groups (obese versus nonobese) using a BMI cutoff. However, if the BMI levels are centered around the cutoff, the average BMI levels of the two groups (obese group and nonobese group) are not really different. And it is likely that the ratio of aseptic loosening of the two groups is not significantly different because the two groups have similar BMI levels.

Continuous variables should be analyzed as such, and not dichotomized, if possible. Inappropriately analyzing continuous variables as categorical parameters using an arbitrary cutoff can support false hypothesis. Although, 30 kg/m² in BMI and eight points in UCLA activity score may not be set arbitrarily, different cutoffs could produce different results. If it is necessary, a cutoff should be selected at the point representing the most abruptly changing point of the dependent variable. For example, if the ratio of aseptic

loosening increases the most at a certain BMI level, the level could be used as a cutoff.

Lastly, while both Type 1 and Type 2 errors should be considered as we evaluate hypotheses in this setting, the more common problem when considering low-frequency events (like loosening) is Type 2 error. Also called insufficient statistical power, this generally results from including too few patients in the analyses of interest. This results in an incorrect claim of “no difference,” and can be just as misleading or harmful as falsely concluding a difference when none is present, known as a Type 1 error. It seems likely to me, for example, that the no-difference findings in this study regarding obesity and activity level could be related to insufficient power, and as such, these findings should be considered provisional. Future studies, perhaps derived from national registries or large databases such as the Nationwide Inpatient Sample or the National Surgical Quality Improvement Program, may be better suited to answer some of these questions, if and when those sources are able to collect patient-level data on the risk factors of interest.

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