Editor’s Spotlight/Take 5: Body Mass Index is Associated with All-cause Mortality After THA and TKA

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So many studies have been published linking obesity to complications after total joint arthroplasty that meta-analyses have been performed to aggregate their findings for easy use [8, 13]. It might be reasonable, therefore, to surmise that patients with obesity—particularly more-severe obesity—would also be at risk of death after these elective procedures.

It might be reasonable, but it seems that it also would be wrong.

Evidence is emerging in support of a so-called “obesity paradox,” wherein patients with obesity seem less likely to die shortly after elective joint surgery [16] or even in the years following it [2]. The study in this month’s Clinical Orthopaedics and Related Research® by Michelle M. Dowsey PhD and her colleagues at the Kaiser Permanente registry in the United States and the St. Vincent’s Melbourne Arthroplasty registry in Australia provide the most-robust evidence I have seen on this topic. This study combines vast numbers of patients’ experiences—more than 150,000 of them—from two arthroplasty registries on different continents, treated by more than 800 surgeons at 101 hospitals over the span of a decade.

The authors found that even patients with severe obesity (BMI of 40 kg/m² or more) were no more likely to die in the years following THA or TKA than were patients of normal body weight. They also found that patients with milder obesity (BMI between 30 and 39.9 kg/m²) in fact were less likely to die, and patients who were underweight were more likely to die after surgery. The study was robust and methodologically meticulous. The authors controlled extensively for confounding variables, and I believe we can have confidence in its findings, no matter how counterintuitive or “paradoxical” the results may seem.

As an important aside, this paper is one of several studies in this month’s CORR® that come from the latest proceedings of the International Society of Arthroplasty Registers, and is a great demonstration of the power of registry research to answer questions that will not be easily addressed any other way.

Although Dr. Dowsey’s paper was as rigorous as anything I’ve read on this topic, it is far from the only study to support the idea that patients with obesity are less likely to have life-threatening complications or death after orthopaedic surgery [3, 12, 16], and even after treatments for a number of diverse, nonorthopaedic conditions [9, 10]. Because this seemingly surprising finding has been replicated in many orthopaedic and nonorthopaedic studies, the results of the current study (and the interview that follows this commentary) are likely to be relevant to surgeons whether or not they perform arthroplasty surgery. And because the findings have persisted despite careful controlling for confounders, I don’t think we can easily...
wave them away. We need to begin to explain them, and to put them into practice.

Join me in the Take 5 interview that follows with Dr. Dowsey, in which she helps us to do so.

Take Five Interview with Michelle M. Dowsey PhD, first author of "Body Mass Index is Associated with All-cause Mortality After THA and TKA"

Seth S. Leopold MD: Congratulations on this important and well done study. Initially, many felt that the "obesity paradox" was most likely to be the result of selection bias or other kinds of confounding. Why do you believe this probably is not the case?

Michelle M. Dowsey PhD: We were initially surprised with the findings of our study, so we took great care to ensure our methodological approach was rigorous. While we cannot entirely rule out selection bias or other confounding, we have been unable to find a plausible alternate explanation for our seemingly paradoxical result. Interestingly, Yu and colleagues [15] proposed that the obesity paradox could be explained as a problem of reverse causation bias, whereby people tend to lose weight due to illness before death. The authors presented a longitudinal population-based study comparing mortality outcomes using the maximum BMI over a 16-year period to a single time-point and concluded that the paradoxical association between overweight and mortality is reversed in analyses incorporating weight history. We acknowledge that our data represent a snapshot in time and cannot comment on the patterns of weight loss or gain in our cohort; however, a person with illness-related weight loss before death is unlikely to undergo elective joint replacement surgery. We also know from our own research and that of others that weight gain after joint replacement is by far the more-common scenario, which suggests that factors other than reverse causation bias are at play.

Dr. Leopold: There remains great resistance to the idea that obesity can somehow be protective, and so another theory is that what studies have observed in terms of an association between increased BMI and longevity should really be construed as the "BMI paradox" [5]. In other words, it is not obesity, but elevated BMI, most likely in muscular patients, that may somehow confer the benefit. It seems unlikely to me that there would be enough very-muscular patients in these cohorts to drive the findings, but how do you see this?

Dr. Dowsey: I would agree that elevated BMI in muscular patients is an unlikely explanation for our findings. In fact, a systematic review and meta-analysis of physical-activity levels in people with hip and knee osteoarthritis (OA) found that most failed to meet physical activity guidelines [14]. Inactivity is more common among overweight and obese individuals with OA than in normal weight patients, with a recent study noting in a cohort of adults with radiographic knee OA (n = 1089), in those with a BMI > 30 kg/m², 96% had either low activity levels (35%) or were inactive (61%), as measured by accelerometer [7].

Dr. Leopold: What sorts of studies might be most promising to investigate the potential mechanisms for the findings you observed if there is an element of causality here? What mechanisms seem most likely to you?

Dr. Dowsey: Perhaps a study of dual-energy x-ray absorptiometry to measure the correlation between measures of fat and muscle mass and mortality may shed some light, but I imagine that this would be challenging and costly. I think we need to better understand the dietary habits and weight patterns over time in patients who have undergone joint replacement surgery. It’s well known that low-carbohydrate, high-protein diets are effective for short-term weight loss, however in the longer-term, a diet low in carbohydrates or high in proteins has been associated with an increased risk of all-cause mortality [6, 11]. Low-carbohydrate/high-protein intake is likely more prevalent in those who are within normal or overweight categories compared to those in overweight categories. This might in part explain the obesity paradox and warrants investigation. An interesting aspect of modern perioperative medicine is the strategy of risk minimization. Recognizing that obesity is over-represented in patients presenting for joint replacement, there has been a greater emphasis on ensuring that there is better management of the comorbidities related to obesity. Moreover, advances in anesthesia, particularly, the use of selective regional blocks has also made surgery safer for patients with obesity. It is interesting to speculate as to whether the additional efforts to improve patient fitness for surgery in
this group has had a positive impact on mortality as compared to individuals of normal weight.

**Dr. Leopold:** How should we use your findings to counsel patients? Should it change our threshold for performing arthroplasty in patients with obesity or who are underweight? Do these findings justify softening of the stance most physicians take that obesity is unhealthy? Or are there still enough harms associated with that condition to be concerned?

**Dr. Dowsey:** I think when considering how we counsel patients, we need to distinguish between healthy life expectancy and years lived in poor health. When using mortality alone as an endpoint, we simply are measuring years lived, but not the quality of years lived. The purpose of joint replacement surgery is to increase the number of years lived free from serious illness, pain, and disability. Certainly, we need to counsel patients who are underweight about the increased risk of death, and given our study findings, nutritional interventions should be equally important for patients who are underweight and normal-weight as they prepare for joint replacement surgery. The stance that obesity is unhealthy has not been challenged by our study findings, and given the established link between obesity and surgical complications, the estimated benefits of joint replacement surgery must be balanced carefully against the potential risks. Ample health concerns remain about patients who are obese, particularly for those who are severely obese.

**Dr. Leopold:** Your study is a wonderful example of the power of registry-driven research to tackle questions that we will be unlikely to approach in any other way. What are the next few topics your team hopes to take on that use registries to answer big questions?

**Dr. Dowsey:** We are keen to examine the association of BMI and all-cause mortality in people with OA, comparing those who undergo joint replacement to those who do not. This may help with our understanding of the role of joint replacement in patients with OA. Our group also has an interest in exploring opioid use amongst people who undergo joint replacement surgery. There has been a rapid increase in opioid use since the 1990s to the point where it is now considered an epidemic. I recently read that 6% of patients who are opioid-naive who receive opioids for acute pain relief following surgery remain on opioids well beyond what is clinically recommended [1]. The study did not include joint replacement surgery, and considering the number of these procedures performed each year, joint replacement may be a major contributor to chronic opioid use, if a similar risk is identified in that group. We are currently establishing a collaboration with several registries to compare patterns of opioid use amongst people undergoing joint replacement, the findings of which should be useful to clinicians and healthcare professionals.

**References**


