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Total joint replacement outcomes in patients with concomitant comorbidities: A glass half empty or half full?

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Over 1 million total hip and knee replacements (THR and TKR) are performed annually in the US and countless more worldwide. Utilization of these procedures is increasing rapidly, especially among younger individuals.[1] These procedures add substantially to the health care bill. In the US alone, the number of persons who have had at least one knee replaced is estimated to exceed 4 million.[2] Expenditures related to TKR exceed $11B annually,[3,4] approaching 0.07% of gross domestic product.[5] Prompted by accelerating growth in the use of knee and hip replacements, payers, providers, and policy makers focus increasingly on defining the appropriate indications for THR and TKR.

Guidelines for non-operative management of osteoarthritis (OA) of the hip and knee have been developed and updated by major professional societies,[6–10] yet guidelines for the appropriate indications for total joint arthroplasty are vague at best. The decision to offer and undergo total joint replacement (TJR) is essentially left to the discretion of referring physicians, surgeons and patients and is typically based on impressionistic data from surgeons' practices or published literature. The latter is drawn primarily from data on high volume practices and suggests that 80–90% of persons undergoing TJR receive substantial functional improvement and pain relief.[11]

In this issue of the Journal, Hawker and colleagues present outcomes of THR and TKR in a community-based cohort of individuals with hip and knee OA in Ontario, Canada. The authors identified 202 subjects in their longitudinal cohort who had TJR in the course of follow up. Improvement was calculated as the difference between the preoperative score obtained closest to surgery (median 10 months preoperatively) and the first postoperative score obtained at least six months after surgery (median 16 months following TJR). The authors characterized successful outcomes as those achieving an improvement of >0.5 standard deviation (SD) in the global WOMAC score (a clinically important difference) and observed that only 53% of subjects met this threshold. The authors conducted several thoughtful and comprehensive analyses to identify preoperative predictors of a successful outcome. The results revealed that less pain preoperatively and a greater number of painful joints reduced the likelihood of achieving a satisfactory outcome. To underscore the robustness of the results to the choice of outcomes, the authors also considered as outcomes changes in the WOMAC Pain and Function Scales and achieving the Patient Acceptable Symptom State (PASS).[12]

A key side finding of the study is documentation of the multiple sources of musculoskeletal disability in this community-based sample of individuals with arthritis. Four out of five

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study participants reported at least two painful joints, and one third reported having at least three painful joints. More than half of study participants reported having low back pain. The widespread nature of musculoskeletal symptoms in this cohort raises important questions about the value of a single procedure or treatment aimed at a single joint among persons with multiple sources of musculoskeletal disability.

The overall proportion of subjects achieving a successful outcome was lower than the 80–90% success rates typically quoted or documented in literature syntheses of patient reported outcomes of TJR.[11] The authors offer a number of possible explanations, including the use of a version of the WOMAC that asked about pain and function in both knees and hips, thus taking into account the status of joints outside the index hip or knee. The cohort also included subjects with inflammatory arthritis who tend to have more modest improvement. As the authors point out, subjects were not enrolled in a TJR study per se and thus may have been less vulnerable to social desirability bias in reporting outcomes. Finally, subjects were enrolled a median of 10 months preoperatively. For some patients in the cohort, this window may have missed the worsening of pain and function that prompted patients to elect TJR.

The predictors of outcome are clinically resonant and suggest that those with the most to gain indeed gain the most following TJR, while medical and musculoskeletal comorbid conditions blunt the response to surgery. If the primary outcome was expressed in terms of the Patient Acceptable Symptom State (PASS), rather than a threshold level of improvement, the analyses would have shown that subjects with *less* pain and *better* functional status are more likely to achieve the PASS. (Thus, while those with the most to gain indeed gain the most, those who start the best finish the best). In stratified analyses, the authors found that outcomes in study participants with single joint involvement were similar to those reported in literature, approaching an 80% success rate. Outcomes were dramatically worse in those with multiple painful joints and in the presence of multiple comorbidities. These results are defined by the authors as the ‘worst case’ scenario.

We highlight two critical findings of this elegantly reported study that are particularly pertinent to public policy. First, when outcome is defined in terms of pain and function in the lower extremities rather than in the index knee, and when subjects with multiple medical and musculoskeletal conditions are included, improvements are more modest following TJR than typically reported in surgical cohort studies. The authors suggest, and we agree, that this broader construction of outcome is more pertinent to clinical and public policy. Focusing on the operated knee without considering the broader array of threats to mobility may help to understand the performance of a particular implant, but likely overstates the effect of the surgery on the outcomes that matter most to patients – overall pain, mobility and quality of life. This observation -- that more generic assessments of outcome yield less striking rates of success -- represent ‘the glass half empty’ view of TJR outcomes.

On the other hand, successful TJR will reduce the number of painful joints in a population affected by multiple sources of musculoskeletal pain and disability, such as that reported here. This incremental gain may lead to a greater likelihood that subsequent procedures or treatments will be successful in reducing disability. Furthermore, neither the global WOMAC score nor the pain or function scores necessarily conveys the patient’s perception of change. While the minimal clinically important difference (MCID) is a meaningful metric at the group level, it is less pertinent to understanding the threshold for improvement for a particular individual. Metrics focusing on patients’ perception of benefit might document that some subjects who did not achieve the MCID or PASS are nonetheless gratified to have one fewer problem that limits their mobility. Such patients may become able to perform activities they view as critical as a direct result of TJR even though they exhibit modest improvements in traditional scores. This represents the ‘glass half full’ point of view that

may not be captured with typical metrics. Furthermore, if the patient considers TJR as even a 'partial' success, he or she may be more apt to accept other surgical and non-operative treatments to address additional painful joints.

Second, the 'sweet spot,' as the authors aptly term the optimal level of preoperative pain and functional limitation, is intimately intertwined with the definition of outcome. If we define success in terms of improvement, patients who wait longer until they are more limited and symptomatic will have a greater probability of a successful outcome.[13,14] On the other hand, if success is defined in terms of achieving an acceptable symptom state, patients with less pain and fewer limitations preoperatively will be more likely to have successful outcomes.[15]

Which is a more appropriate metric for success, improvement or the final status? The journey or the destination? Restoration of function or preservation? We submit that this determination is ultimately a judgment we need to make as a society. As Hawker and colleagues suggest, a policy of operating upon patients with less pain and fewer limitations will result in more operations and greater investment in TJR. Patients who undergo surgery earlier in the course of functional decline tend to improve less but achieve higher levels of function than those who undergo surgery when they have advanced functional limitations.[13,14] Our analyses suggest that operating upon patients with fewer limitations is more cost effective. But cost effective interventions are nonetheless costly. We encourage continued debate on this question of whether to strive for functional restoration or preservation with costly, yet remarkably effective, reconstructive surgeries. More population-based evaluations of patients undergoing TJR, including both disease-specific and generic function and pain assessments, and scales measuring quality of life, satisfaction with surgery and realization of expectations, will further inform the question of whether the glass is half empty or half full. The paper by Hawker et al. makes an important contribution to this debate.

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