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Total knee arthroplasty on the rise in younger patients: Are we sure that past performance will guarantee future success?

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Knee osteoarthritis (OA) is a highly prevalent and disabling problem affecting nearly 10 million adults in the United States.(1) As currently available therapies do not reverse cartilage loss and other structural abnormalities associated with OA, the disease process may progress insidiously. Many patients with advanced OA become candidates for total knee arthroplasty (TKA).TKA is remarkably effective, with perioperative mortality less than 1%, annual rates of failure leading to revision of less than 1%, and rates of symptom relief exceeding 85%.(2, 3) Over 600,000 TKAs were performed in the US in 2009, with inpatient costs exceeding \$9 billion.(4) Utilization of TKA is likely to increase further.

Data from the US indicate that the growth in use of TKA has occurred primarily in patients 45–64 years of age.(4, 5) In this issue of *Arthritis and Rheumatism*, Jarkko et al present results of a population-based study describing trends in TKA utilization among individuals less than 60 years old with knee OA in Finland. The authors used data from the Finnish Arthroplasty Registry, which currently includes more than 90% of all TKA cases performed in Finland. The authors demonstrated that in Finland, as in the US, TKA utilization increased dramatically in the age group 50–59 years of age. Over the course of 20 years, utilization of TKA in persons younger than 60 years of age increased more than 20-fold, with a 40-fold increase in females. The greatest increase in TKA utilization was observed in those 50–59 years of age, as compared with those less than 50. The dramatic increase in utilization of TKA was observed across all hospital volume strata, with low and medium volume hospitals showing 25% greater increase in TKA's performed over the study period than the high volume centers.

The study of Jarkko et al focused on the Finnish population younger than 60 years of age. It is important to note that despite the rapid growth of TKA use in this age group, the majority of TKAs continue to be performed on patients older than 60.(4) It would be of interest to compare the growth in TKA utilization documented by these authors in the younger Finnish population with the growth in older, 'traditional' Finnish users of TKA. It would also be useful to determine whether the dramatic increase in rates in younger persons is followed years later by a reduction in rates among older patients (suggesting patients are presenting for TKA earlier), or whether rates among older persons are unchanged (consistent with an overall increase in utilization across the board, most pronounced in younger persons). We note as well that the 'baby boomer' population is currently in the 50–60 age range; it will be

important to note whether the rate of TKA in this age stratum declines as the baby boomer generation ages.

These dramatic increases in TKA utilization among younger persons raise several issues. First, outcomes data on functional improvements, pain relief and failure rates following TKA are derived primarily from studies of more traditional TKA recipients, patients in their 60s and 70s. Since younger patients are likely to be more physically active, to have more strenuous physical demands and to make treatment choices that support an active lifestyle, the longevity or “survival” of knee implants in this group may be lower than in older patients. In fact, as data on this issue emerge it appears that rates of failure leading to revision in younger patients are two-fold higher than in older patients.(3) The greater risk of implant failure in younger patients, coupled with longer remaining life expectancy in this age group, will combine to produce even higher rates of revision TKA in this population of TKA recipients.

A large body of evidence suggests that adverse perioperative outcomes are inversely associated with hospital volume, with lower volume associated with greater rates of postoperative medical and surgical adverse events.(2, 6) The study of Jarrko et al, suggests that low volume hospitals experienced the highest growth in TKA utilization. This finding has important implications for the relationship between volume and outcome. If the ‘practice makes perfect’ hypothesis is correct, increasing volume of procedures in lower volume hospitals may improve the care of TKA patients in these centers, leading to a reduction in adverse events. However, if these centers continue to have worse outcomes despite an increase in volume, the disproportionate increases in TKA utilization in low volume centers may place a greater number of TKA recipients at risk for complications and early revision. Of note, the distribution of TKA case volume across hospitals may differ between Finland and other countries such as the US where most studies of the volume-outcome relationship have been performed.

The data presented by Jarrko et al provide insights into the utilization of unicondylar implants. The authors document that unicondylar implants comprised about 12% of knee arthroplasties among individuals less than 60 years old. While undergoing UKA may delay time to TKA,(7) a critical unanswered question is whether UKA is a more effective and more cost effective strategy in this population as compared with the alternatives, which typically include osteotomy, total knee replacement, or continued nonoperative therapy. Despite the paucity of data on this question, the rate of UKA utilization has increased markedly over time as documented by Jarrko et al., albeit not as steeply as the increased in use of TKA.

The data presented by Jarrko et al raise questions about the explanations for the rapid rise in TKA use in younger individuals. Growing rates of obesity have been proposed among potential explanations for increased use of TKA. While obesity is indeed a strong risk factor for knee OA, the secular growth in the obesity epidemic cannot explain the dramatic increase in TKA utilization.(8) Increased participation in sports and promotion of physical activity may also contribute to the development of post-traumatic knee OA with attendant need for surgery prior to age 60. But even assuming that obesity and injury make independent contributions to the rise in TKA rates, these two factors explain no more than a small portion of increased utilization rates.(8)

Jarrko et al comment on limitations that may lead to overestimation of the increase in TKA utilization over time. One is the completeness of the Finnish Arthroplasty Registry, which increased from 90% to 98%. A further limitation that the authors did not mention is the ecologic nature of the analysis. The denominator is derived from population census data and

it is impossible to ascertain how many persons in underlying population already have TKA. The direction of the resulting misclassification is hard to predict as it is unclear whether this source of misclassification affects earlier and later periods in similar fashion.

Direct to consumer advertising and greater experience and comfort with TKA among both surgeons and patients may contribute to the dramatic growth of TKA utilization. There is evidence that performing TKA earlier in the course of functional decline leads to higher levels of functional status following TKA.⁽⁹⁾ These data and the recommendations they have spawned are derived from studies of generally older TKA recipients. Whether similar recommendations hold for younger persons remains unclear.

The dramatic increase in TKA utilization prompts questions about financial feasibility from the payer perspective. TKA in the elderly population has been shown to be cost-effective. ⁽¹⁰⁾ Still, the question remains as to who should pay? Are patients ready to bear some of the cost of the procedure? Could government-based health care systems continue to cover all TKA without instituting wait lists? Should such wait lists be on a first come first served basis or prioritized by age and severity of functional limitation? The increased utilization of TKA in younger patients has spurred innovation in implant design. These innovations come at increased cost and the question of whether technical TKA innovations represent good value for younger patients undergoing TKA remains open. Answers for all these questions are needed for societies to sustain the increased utilization of TKA.

Ultimately, the appropriateness of elective surgery and the concept of “need” should be addressed in light of increased utilization of TKA. While TKA has been shown to dramatically improve functional status and reduce pain in persons with severe pain and functional limitation, would similar dramatic improvements be observed in those who decide to undergo surgery with less severe functional impairment? Does surgery in this setting result in unfulfilled expectations, additional utilization of health care and suboptimal satisfaction with surgery? As we close the first decade of the 21st century, TKA stands out as one of the most effective and cost effective interventions in medicine. This sterling record has been built primarily on the basis of the excellent outcomes of TKA in patients in their 60’s, 70’s and 80’s. As indications expand to include an increasing number of TKA recipients under 60 years old the outcomes of TKA in younger patients merits intensive study. We would be wise to heed the time-honored investment advice that past performance may not guarantee future success.

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