

## Staggered Bilateral Knee Arthroplasty: Good or Bad?

To the Editor:

I read with interest the article by Memtsoudis *et al.*<sup>1</sup> in the recent issue of ANESTHESIOLOGY on perioperative outcomes after unilateral and bilateral total knee arthroplasty. When the authors discuss about the issue of benefits and risks of simultaneous *versus* staged bilateral total knee arthroplasty, they have quoted an article by Sliva *et al.*<sup>2</sup>

In the original article by Sliva *et al.*,<sup>2</sup> the authors have evaluated 332 patients who had bilateral knee replacement, of which 241 patients had staggered bilateral knee replacement with 4–7 days apart between the procedures during a single hospitalization. They found that patients who had sequential bilateral total knee replacement and staged bilateral knee replacement had 2.5 times more complications than the ones who had staggered bilateral knee replacement. The rates of complications for staggered bilateral knee replacement, sequential bilateral knee replacement, and staged bilateral knee replacement were 13, 35, and 31%, respectively. Major complications seemed to have occurred mostly in patients with staged bilateral knee arthroplasty. Hence, they had concluded that staggered bilateral total knee arthroplasty with procedures performed 4–7 days apart in a single hospitalization was a safe option.

In the article by Memtsoudis *et al.*,<sup>1</sup> the aforementioned article by Sliva *et al.*<sup>2</sup> has been quoted wrongly as “in a study including 267 patients who underwent bilateral total knee arthroplasty during the same hospitalization, Sliva *et al.* found that bilateral procedures performed 4–7 days apart were associated with higher risk of mortality and morbidity when compared with simultaneously performed procedures.”

I am surprised by how the main conclusions in the original article<sup>2</sup> could be completely misquoted.<sup>1</sup> I hope in future, such inaccurate statements will be addressed right at the editing stage.

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## References

1. Memtsoudis SG, Ma Y, Gonzalez Della Valle A, Mazumdar M, Gaber-Baylis LK, MacKenzie CR, Sculco TP: Perioperative outcomes after unilateral and bilateral total knee arthroplasty. ANESTHESIOLOGY 2009; 111:1206–16
2. Sliva CD, Callaghan JJ, Goetz DD, Taylor SG: Staggered bilateral total knee arthroplasty performed four to seven days apart during a single hospitalization. J Bone Joint Surg Am 2005; 87:508–13

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## Don't Patients Have Two Knees?

To the Editor:

The article by Dr. Memtsoudis *et al.* describing perioperative outcomes after unilateral knee arthroplasty (UKA) and bilateral knee arthroplasty (BKA) uses the technique of using a large database, the Nationwide Inpatient Sample (NIS), to undertake as described in the accompanying editorial a form of “comparative effective research.”<sup>1,2</sup> In their introduction, the authors state that to date, one of the major limitations of studies comparing UKA with BKA has been their small sample sizes. To avoid this problem, the authors use a large database to compare the outcomes of UKA *versus* BKA. However, in designing a study using a large database, it is important to define the population groups under study accurately.

In the total knee population, the authors defined a population of 670,305 admissions between 1998 and 2006 (9-yr period) requiring knee arthroplasty. In the “Materials and Methods,” the authors state that the NIS database contains information from approximately 8 million admissions per year. By using this number, we calculated that knee arthroplasty represented 0.93% of all admissions (670,305/72 million). Can the authors define the actual percentage that knee arthroplasty represents of all NIS database hospital admissions and more importantly of all NIS database surgical admissions for the period 1998–2006? Do the authors believe that this incidence is representative of the general population, and if not, how would this alter their results?

In the authors' article, the only significant benefit to the BKA group in this NIS population was the incidence of device-related complication, which was 0.52% in the BKA group compared with 0.86% in the UKA group. How do the authors account for this difference?

Of the 670,305 patients, 626,601 (93.75%) underwent UKA as defined by the code 81.55. This code does not differentiate between a first UKA and a second opposite-side UKA. In the BKA group, both knees require arthroplasty. Thus, should the authors include only patients who have undergone two UKA knee arthroplasties (opposite side) in the control group? If the control group consists of patients who have undergone two UKAs, should the morbidity of the two UKAs be combined? If the patient had the first UKA and then decided, for whatever the reason, not to have the second opposite-side UKA, should this be classified as a complication of the first UKA?

In the article, the authors refer to four different groups in the BKA population. The first is the total BKA population of 43,703 (6.52% of 670,305). The second is a subtotal BKA population of 34,015 patients (the total BKA group minus a

group of 9,688 [22.3%] that could not be defined). The third and fourth are subgroups and consist of simultaneous BKAs 25,443 (74.8% of 34,015) and staged BKAs of 8571 (25.2% of 34,015). Except for the length of stay, the authors refer to percentages and not actual “n” values in most of the results, and without stating which of the BKA groups, it makes it difficult to discern the actual values. Can the author supply the reader with actual value for mortality in the simultaneous BKA group and how this compares directly with the UKA group?

Based on the NIS database and the definitions used by the authors, the number of patients required to undergo BKA compared with UKA to cause one additional mortality is 625, that is, 625 people need to undergo BKA to cause one additional death that would not have occurred if they had only received a UKA. The evidence as demonstrated by the authors may be compelling; however, their results are based on how the authors defined the BKA and UKA groups and the NIS database studied.

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## References

1. Memtsoudis SG, Ma Y, Gonzalez Dellas Valle A, Mazumdar M, Gaber-Baylis LK, MacKenzie CR, Sculco TP: Perioperative outcomes after unilateral and bilateral total knee arthroplasty. *ANESTHESIOLOGY* 2009; 111:1206-16
2. Khetarpal S: Perioperative comparative effectiveness research. *ANESTHESIOLOGY* 2009; 111:1180-2

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## In Reply:

We thank Drs. Gurnathan and Harrison *et al.* for their interest in our publication. To address Dr. Gurnathan's comments, we would like to point out that in making our statements we did not purely adopt or quote the findings presented by Sliva *et al.*,<sup>1</sup> but we critically reviewed and interpreted them in the context of our study. Although the total number of patients in the study by Sliva *et al.* was 332, only 267—as reported in our paper—had their procedure performed during the same hospitalization ( $n = 241$  staggered [*i.e.*, 4–7 days apart] and  $n = 26$  sequential [*i.e.*, during the same anesthetic]). Because our study focused only on patients whose procedures were performed during the same hospitalization, we correctly identified this subgroup of interest ( $n = 241 + 26 = 267$ ).<sup>2</sup>

Importantly, major complications occurred in four patients in the staggered group, whereas none occurred in the sequential group. Although the numbers in the study may not be sufficient to show statistical significance, ma-

ior adverse events in the perioperative period are of great clinical concern. This is the reason why mortality was chosen as the primary outcome in our analysis. The importance of mortality and major complications is appropriately made evident by Dr. Gurnathan's comment, regarding their highest incidence in the staged bilateral knee arthroplasty patients, despite not reaching statistical significance as well. This issue gets to the heart of the problem when studying low-incidence outcomes, such as mortality, in studies with limited numbers because often authors conclude that the procedures can be considered safe based on underpowered results failing to show statistically significant differences between groups. With perioperative mortality being the primary outcome in our study, we tried to overcome the problem of small sample size by using the largest all-payer database available in the United States. Although our interpretation regarding the study of Sliva *et al.* may have not been in line with the authors' conclusion, who based their statements of safety on the occurrence of overwhelmingly minor complications, we believe that our independent interpretation of their findings regarding mortality and major complications is correct. We do not dispute, however, that by being more precise in our presentation, we could have avoided this miscommunication.

The sentence should read: “...in a study including 267 patients who underwent bilateral knee arthroplasty during the same hospitalization, Sliva *et al.* found that bilateral procedures performed 4–7 days apart were associated with higher incidence of mortality and major morbidity when compared with simultaneously performed procedures. No statistical difference could be shown however, likely because of low numbers.”

Dr. Harrison *et al.* posed questions regarding the validity of the Nationwide Inpatient Sample and its ability to produce nationally representative data for total knee arthroplasty procedures. We would like to refer the interested reader to the publication “Introduction to the Healthcare Cost and Utilization Project Nationwide Inpatient Sample” published by the Agency for Healthcare Research and Quality\* for general background information on this database.

To answer their specific questions:

1. The total number of entries for hospitalizations for the years between 1998 and 2006 was 68,836,152. This means that of all hospitalizations, 0.97% were associated with primary knee replacement. One of the stated goals of the Nationwide Inpatient Sample is to provide data that allow for national estimates, which confirm confidence in this data source as shown by its wide use in the medical research field when seeking to provide nationally representative data. Further, the frequencies for a specific time frame published and derived from another nationally representative database—the Na-

\* www.hcup-us.ahrq.gov/db/nation/nis/NIS\_2007\_INTRODUCTION.pdf. Accessed March 3, 2010.