Reply to Letter to the Editor

Tourniquet Use During Cementation Only During Total Knee Arthroplasty: A Randomized Trial

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To the editor,

I read the letter to the editor by Bamne et al. with great interest. My purpose will be to confirm our literature review and summarize the data for tourniquet use.

Kageyama et al. [3] showed blood loss data in the first 24 hours with or without tourniquet use in Table 2 of their study. Matziolis et al. [7] found a comparable drop in hemoglobin between study groups. Yang et al. [14] failed to differentiate between tourniquet use and no tourniquet use. In their *Abstract* and *Results* sections, Vandenbussche et al. [12] did not find significant differences in “measured blood loss or operating time”, but they did find more calculated blood loss with no tourniquet use. Overall, they did not claim blood loss as an advantage of tourniquet use. Kato et al. [4] are cited as a wound complication because bone injury is just as important as soft tissue injury, and the emboli from bone would not occur without bone injury. We concede this is an indirect complication, but it is a complication that arises from injuring the bone. We also concede that the conclusions of the two meta-analyses did not include pain and swelling in their endpoints.

(Re: Tarwala R, Dorr LD, Gilbert PK, Wan Z, Long WT. Tourniquet use during cementation only during total knee arthroplasty: a randomized trial. *Clin Orthop Relat Res*. 2014;472:169–174.)
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We performed a review of the meta-analysis because we were interested in pain and swelling data. There were a total of 13 articles reviewed in the two [2, 11] meta-analysis studies. Four [1, 10, 12, 13] of the thirteen studies (31%) showed no difference in pain. Three [6, 10, 13] of the thirteen (23%) studies measured swelling, and two [10, 13] of the studies showed no difference between patients with and without tourniquet use. One study [3] did not list clinical differences.

The citation for Tai et al. [11] in our study was incorrect and should have been Olivecrona et al. [10]. Olivecrona and colleagues found fewer wound complications and drainage when tourniquet pressure was limited to 225-mm Hg.

Bamne and colleagues correctly understood our decision for deflation of the tourniquet. Their theoretical concern with deflation prior to full polymerization of the cement, however, is without merit. No data exists to support their theoretical opinion in either basic or clinical science. Surgeons who perform total knee replacement without any tourniquet use will use lavage to transiently clear blood and debris from the trabeculae. Not one clinical study has been published that shows reduced fixation in their patients.

Two studies [5, 8] comparing operative tourniquet use with cementation tourniquet were published in parallel with ours. Therefore, we did not discover them with our literature search. Mittal et al. [8] aborted their study, which is certainly an outlier. Their preoperative patient care was not outlined. Therefore, we do not know whether the study authors had patients stop medications that interfere with coagulation, or whether or not they used tranexamic acid. Blood loss in patients with a tourniquet for cementation only was a mean 1795 mL compared to our mean 574 mL. The study by Kvedaras et al. [5] is well designed — preoperative medications (including alcohol) were factored into patient inclusion into the study. Results of the study

showed a mean operative tourniquet time of 37 minutes versus our mean of 43 minutes. The results also showed a mean cementation tourniquet time of 11 minutes versus our mean of 9 minutes. The results indicated a statistically lower blood loss with the operative tourniquet, but blood loss with this tourniquet use was similar to ours with cementation tourniquet only. Perhaps our use of tranexamic acid improved our blood loss data. We cannot comment on Kvedaras and colleagues' in-hospital functional differences between patients measured in postoperative days 2 through 6 because our patients are home on day 2.

We believe recent studies have proven the efficacy of tourniquet use. Perhaps just as important as tourniquet use is preoperative patient care with cessation of strong anticoagulants, herbal medications known to affect the clotting cascade, and alcohol use within 1 week of the operation. No matter the choice of tourniquet use, we believe the data are clear that tranexamic acid reduces blood loss [14]. Tourniquet use from incision through cementation is safe and effective if the tourniquet pressure is limited to 225-mm Hg [9]. Our tourniquet pressure was 250-mm Hg, but Olivecrona et al. [9] was a randomized study of tourniquet pressures. Consequently, their data is more specific for the correct number. Kvedaras et al. [5] had a third group with an inflated tourniquet at a mean of 60 minutes. This group had greater volume of blood loss and greater loss of red blood cells, but was not different from the tourniquet time of 38 minutes when body weight was included in the calculation.

A second safety factor with tourniquet use may be prolongation of the tourniquet beyond 60 minutes. In our study, the upper range of tourniquet use was 62 minutes with a mean time of 43 minutes. A study with a mean of 60 minutes provides more predictable data. The randomized studies we cited in our manuscript with a mean tourniquet time beyond 60 minutes have greater blood loss than our study and Kvedaras et al. For example, Mittal et al. [8] had a mean 1536 mL blood loss with a tourniquet time of mean 76.4 minutes.

Future studies should examine blood loss in patients with preoperative cessation of medications that influence bleeding and intraoperative use of tranexamic acid. Studies should also compare tourniquet times of less than one hour to those greater than one hour. Surgeons can make their decision on tourniquet use based on currently defined data.

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