

When the Statistics Steal the Show

To the Editor:

We read the publication by Farag *et al.*¹ entitled “Comparison of Three Techniques for Ultrasound-guided Femoral Nerve Catheter Insertion: A Randomized, Blinded Trial” with interest and feel compelled to share our views with the readership of *ANESTHESIOLOGY*.

The intention of this letter is not to criticize the study, but to reflect on an increasingly common problem where a complex statistical analysis obscures the clinical relevance of a simple question. This large study was conducted like a National Institutes of Health clinical trial using the analytic capabilities of Ph.D.-level statisticians. We appreciated the statistical treatment of measurements *taken over time*. For instance, the verbal response scale was averaged for each patient using a time-weighted formula, and opioid administrations were converted to morphine equivalents and totaled. This statistical approach ideally would be followed even in studies with smaller sample sizes. We also appreciated the authors’ recognition that not all variables are normally distributed and that they took appropriate steps to account for this in their statistical analysis. Specifically, the distribution of total opioid requirement was found to be lognormal; hence, the effect of catheter insertion technique estimates “the ratio (or percent difference) of geometric means.”¹ In addition, opioid requirement was tested in “a linear regression model of log-transformed total intravenous morphine equivalent observations as the response and randomized catheter insertion technique as the treatment of interest.”¹

Nonetheless, although the study aimed to answer a simple clinical question, the article is so heavily statistical that clinicians are likely to gloss over much of it in search of what is relevant to their practice. For instance, the juxtaposition of “noninferiority” and “superiority” throughout the article is a challenge to read and keep track of, particularly for those without a strong background in statistics. Although crucial to the statistical approach, we believe that many clinicians may gloss over these terms without truly understanding their meaning. Moreover, although the authors appropriately document and cite the newer (Mascha & Turan) and older (Holm, O’Brien) statistical procedures that are less likely to be familiar to the readership, we remain doubtful that these would be meaningful to the average clinician who may be interested in applying these findings to their clinical practice.

Despite the complex and comprehensive statistical analysis, we feel that the study design does not actually allow for any clinically meaningful conclusions on the choice of catheter. This is because most patients having total knee

arthroplasty with femoral nerve block alone have residual pain in the sciatic territory²; something the authors did not control for in a systematic way.¹ Because nearly all patients will have pain, the methodology is inherently biased toward finding no difference between groups. Moreover, there is no information about the success or duration of the blocks as this was not tested at all—without information on sensory or motor distribution, it is not possible to draw conclusions on the success of the technique.

Most fundamentally, the research questions asked are of little relevance for today’s anesthesiologist. The study was conducted over several years during which time substantial changes in techniques and technology have occurred. The question of whether or not to stimulate *via* the catheter was relevant before the advent of ultrasound guidance in regional anesthesia. However, with ultrasound, the primary determinant of whether a catheter is adequately positioned is not the presence or absence of evoked motor response but visualization of anesthetic spread in the desired tissue plane.^{3,4} In addition, it seems obvious that techniques that require extra steps and more equipment will take longer to perform and have additional costs. So, testing hypotheses of increased block performance time and costs focuses on significance or nonsignificance based on the *P* value and takes us away from appreciating that a difference in mean block performance time of approximately 1 min may not have a whole lot of clinical relevance.

Finally, the design and conclusions seem “to close the door” to further novel research—for example, with respect to different techniques (in-plane *vs.* out-of-plane), equipment (different needle gauges and catheter designs), volume of injectate, and research outcomes such as safety. Indeed, by advocating the use of ultrasound alone for femoral catheter placement, the authors ignore the potential safety benefits of using nerve stimulation to warn the clinician of potentially harmful needle-nerve contact and intraneural injection.⁵ In summary, this article demonstrates that even when meticulous data collection and advanced statistical analysis are applied to a research design with little clinical relevance, the practicing clinician may be left without any data of significance to their clinical practice.

Competing Interests

The authors declare no competing interests.

Matt Levine, M.B.Ch.B., F.A.N.Z.C.A., Thomas Halaszynski, M.D., D.M.D., M.B.A., Xavier Capdevila, M.D., Ph.D., Imran Ahmad, M.B.B.S., F.R.C.A., Giorgio Ivani, M.D., Catherine Vandepitte, M.D., Admir Hadzic, M.D., Ph.D. Wellington Regional Hospital, Wellington, New Zealand (M.L.). mattlevine14@gmail.com

References

1. Farag E, Atim A, Ghosh R, Bauer M, Sreenivasalu T, Kot M, Kurz A, Dalton JE, Mascha EJ, Mounir-Soliman L, Zaky S, Ali Sakr Esa W, Udeh BL, Barsoum W, Sessler DI: Comparison of

- three techniques for ultrasound-guided femoral nerve catheter insertion: A randomized, blinded trial. *ANESTHESIOLOGY* 2014; 121:239–48
2. Abdallah FW, Chan VW, Gandhi R, Koshkin A, Abbas S, Brull R: The analgesic effects of proximal, distal, or no sciatic nerve block on posterior knee pain after total knee arthroplasty: A double-blind placebo-controlled randomized trial. *ANESTHESIOLOGY* 2014; 121:1302–10
 3. Marhofer D, Marhofer P, Triffterer L, Leonhardt M, Weber M, Zeitlinger M: Dislocation rates of perineural catheters: A volunteer study. *Br J Anaesth* 2013; 111:800–6
 4. Gandhi K, Lindenmuth DM, Hadzic A, Xu D, Patel VS, Maliakal TJ, Gadsden JC: The effect of stimulating *versus* conventional perineural catheters on postoperative analgesia following ultrasound-guided femoral nerve localization. *J Clin Anesth* 2011; 23:626–31
 5. Wiesmann T, Borntäger A, Vassiliou T, Hadzic A, Wulf H, Müller HH, Steinfeldt T: Minimal current intensity to elicit an evoked motor response cannot discern between needle-nerve contact and intraneural needle insertion. *Anesth Analg* 2014; 118:681–6

(Accepted for publication December 6, 2014.)

Cost Effectiveness of Continuous Femoral Blocks for Total Knee Replacement

To the Editor:

I read with great interest the article by Farag *et al.*¹ Undoubtedly, the authors tried to address a very important concern related to the use of peripheral nerve blocks as a part of comprehensive acute perioperative pain management. However, it seems that they failed to recognize the specificity of the patient population they studied. Functional recovery is the main determinant for patients undergoing total knee replacement. The goal of perioperative pain management in patients undergoing total knee replacement is not to minimize pain at rest, it is to minimize pain during physical therapy while optimizing quadriceps function and minimizing the postoperative risk of falls. Effective pain control during physical therapy has been established to facilitate functional recovery,² and excessive postoperative quadriceps weakness has been shown to be a significant cause of falls.³ Unfortunately, none of these endpoints were considered in the article by Farag *et al.* The authors should recognize that the ability to recover motor function after surgery and the absence of a fall represents an important determinant of the patient length of stay in the hospital, which is estimated to cost thousands of dollars⁴ *versus* tens of dollars as studied by Farag *et al.* In my institution, most patients start active physical therapy on the day of surgery and are discharged on postoperative day 2. Optimizing functional recovery hours after surgery is essential because if the patients cannot participate actively in physical therapy, their length of stay increases and with it the overall cost of the surgery.

I was also surprised by the authors' choice of 0.1% ropivacaine at 8 ml/h because even 4 ml/h of ropivacaine 0.1% has been well established to lead to significant motor blockade.⁵ In my experience, 3 ml/h or less of ropivacaine 0.1% or bupivacaine 0.0625% seems to be optimal to preserve motor function postoperatively in most patients undergoing total knee replacement.

If the interest is on cost, consideration should be given to the cost of the local anesthetic solution when choosing a continuous block technique. In my institution, we switched from ropivacaine 0.1% to bupivacaine 0.0625% and saved \$30 per bag. These cost savings are substantial for my institution, as we use more than 35,000 bags annually.

In the discussion, the authors raised another important point, for example, the time required to perform a continuous block using each technique. These data were missing from the article and would be most interesting, especially as it relates to the use of ultrasound alone *versus* ultrasound combined with a stimulating needle. In my experience, the difference in the time required for each technique should be insignificant, especially in the hands of an experienced regional anesthesiologist.

In conclusion, anesthesiologists should recognize the specific surgical requirement when comparing different approaches. In patients undergoing total knee replacement, optimizing pain during physical therapy, functional recovery, and minimizing the risk of falls should represent the primary concern.

Competing Interests

The author declares no competing interests.

Jacques E. Chelly, M.D., Ph.D., M.B.A., University of Pittsburgh Medical Center Shadyside Hospital, Pittsburgh, Pennsylvania. chelje@anes.upmc.edu

References

1. Farag E, Atim A, Ghosh R, Bauer M, Sreenivasalu T, Kot M, Kurz A, Dalton JE, Mascha EJ, Mounir-Soliman L, Zaky S, Ali Sakr Esa W, Udeh BL, Barsoum W, Sessler DI: Comparison of three techniques for ultrasound-guided femoral nerve catheter insertion: A randomized, blinded trial. *ANESTHESIOLOGY* 2014; 121:239–48
2. Munin MC, Rudy TE, Glynn NW, Crossett LS, Rubash HE: Early inpatient rehabilitation after elective hip and knee arthroplasty. *JAMA* 1998; 279:847–52
3. Wasserstein D, Farlinger C, Brull R, Mahomed N, Gandhi R: Advanced age, obesity and continuous femoral nerve blockade are independent risk factors for inpatient falls after primary total knee arthroplasty. *J Arthroplasty* 2013; 28:1121–4
4. Ilfeld BM, Mariano ER, Williams BA, Woodard JN, Macario A: Hospitalization costs of total knee arthroplasty with a continuous femoral nerve block provided only in the hospital *versus* on an ambulatory basis: A retrospective, case-control, cost-minimization analysis. *Reg Anesth Pain Med* 2007; 32:46–54
5. Ilfeld BM, Loland VJ, Sandhu NS, Suresh PJ, Bishop MJ, Donohue MC, Ferguson EJ, Madison SJ: Continuous femoral nerve blocks: The impact of catheter tip location relative to