

Femoral Nerve Block for Analgesia in Patients Having Knee Arthroplasty

IN this issue of ANESTHESIOLOGY, Paul *et al.* report results of their meta-analysis on femoral nerve block (FNB) analgesia and outcome after total knee arthroplasty.¹ The authors conclude that FNB (plus patient-controlled analgesia) is a good alternative to patient-controlled analgesia alone or epidural for postoperative analgesia in patients having total knee arthroplasty and that the current evidence does not support using either a sciatic nerve block or continuous FNB (CFNB) in addition to a single-injection FNB in this patient population.

The report in this issue of ANESTHESIOLOGY by Paul *et al.* is likely to create controversy because their conclusions are at odds with current practice in many centers where CFNB is an apparent “gold standard” for postoperative analgesia in patients having total knee arthroplasty. Regardless, with clearly defined inclusion criteria, the authors identified 23 randomized controlled trials (1,016 patients) that compared FNB with opioid-based patient-controlled analgesia or epidural analgesia, but surprisingly only two randomized controlled trials that directly compared CFNB with single-injection FNB. To examine theoretical differences between the single FNB and CFNB, the authors used a Bayesian random-effects model that allows estimation of comparative treatment effects for interventions that were not directly compared in the original studies (sometimes called “indirect comparisons”). This sophisticated analytical approach relies on several assumptions, including that the groups are similar in respect to other possible confounding factors; yet even when this is the case, indirect comparisons are not randomized comparisons and, as Paul *et al.*, suggest, carry with them the limitations of observational data. Regardless, the authors cannot be criticized for being forced to impute data (variability and ranges) because the available original studies were simply not available or forthcoming with this information.

Although there is a plethora of literature on the efficacy of various FNB and CFNB techniques and their modifications on quality of analgesia, there are only a few randomized controlled trials that compare a single-injection FNB (or its equivalent) with CFNB.^{2–4} The lack of randomized controlled trials on FNB *versus* CFNB is particularly surprising,

given their widespread practice in patients having total knee arthroplasty. With regard to analgesic outcome, the two relevant studies reported significant improvements in analgesia at rest and movement as well as the opioid-sparing benefits of CFNB.^{3,4} Ilfeld *et al.* reported shorter time to discharge readiness in patients receiving CFNB.³ However, actual “length of stay” was not shorter as this is a difficult outcome variable to assess, and studies may not have been designed to look at early discharge. For instance, in Ilfeld *et al.*, mean (\pm SD) duration of hospitalization was 3.6 (\pm 0.6) days in the CFNB group and 3.5 (\pm 0.6) days in the single-injection FNB (placebo) group ($P = 0.74$). However, patients treated with 4 days of perineural ropivacaine attained three major discharge criteria in a median (25th–75th percentiles) of 25 (21–47) h compared with 71 (46–89) h for those in the placebo group (estimated ratio = 0.47, 95% confidence interval: 0.32–0.67; $P < 0.001$). Unfortunately, their study protocol required patients to remain hospitalized until at least postoperative day 3, even if they were discharge-ready before then.³ Salinas *et al.*, also included in the meta-analysis, did not find a difference between treatment groups in actual discharge because their physical therapists and surgeons were simply not prepared to discharge patients early.⁴ In addition, the analgesic benefits of the CFNB were likely lessened by their study protocol where the CFNB infusion (48 h) was provided after a single injection of ropivacaine 0.5% which often lasts more than 24 h.

Two important trials did not meet the criteria for inclusion in the meta-analysis by Paul *et al.* The first is a randomized, double-masked, placebo-controlled trial comparing a single-injection FNB (equivalent) to a single-injection FNB plus 4 days of perineural infusion³; the second is a comparison of epidural, CFNB, and intravenous patient-controlled analgesia on surgical outcome and duration of rehabilitation.⁵ Because Paul *et al.* included studies that “compared the analgesic effects of epidural or patient-controlled analgesia opioid analgesia *versus* FNB (single-injection or continuous) on analgesia outcomes after total knee arthroplasty” (intervention), the aforementioned study of Ilfeld *et al.* did not

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make it to the meta-analysis because the comparison group received an overnight perineural infusion in addition to the initial mepivacaine FNB. Likewise, the report by Capdevilla *et al.* was disqualified probably because it included knee surgeries (arthrolysis) other than arthroplasty.⁵ Of note, both Ilfeld *et al.* and Capdevilla *et al.* reported analgesic and/or outcome advantages of CFNB. The issue of single-injection FNB *versus* CFNB should also be viewed from a logic of the clinical practice. A single injection of predetermined concentration and type of local anesthetic in FNB results in quadriceps muscle weakness and inability to ambulate for most of the analgesic duration. In contrast, the ability to control the concentration or local anesthetic dose, type of local anesthetic, and infusion regimen theoretically should allow better preservation of the quadriceps function with CFNB. Therefore, an injection of a long-acting local anesthetic may be well suited for the duration of surgery and postanesthesia care unit stay, but the use of shorter-acting local anesthetic, followed by adjustable CFNB, allows mobilization of the patients the afternoon of surgery. This is important because there is an increasing trend to decrease time to early ambulation (even the same day of surgery). As an example, the study by Hirst *et al.* (included in the meta-analysis) used bupivacaine 0.5% with epinephrine for the initial surgical blocks, followed by only 48 h of perineural infusion.² Because the duration of nerve blockade with bupivacaine is very long, the difference between treatment groups was (predictably) small. Therefore, although the Hirst *et al.* study met the criteria for inclusion in the meta-analysis, it does not really contribute clinically relevant data on whether CFNB provides patient benefits over a single-injection FNB in today's orthopedic environment.

In conclusion, the meta-analysis by Paul and colleagues is well conducted and presented and includes a well-designed systematic review of the literature. The authors appropriately conclude that analgesia after single-injection FNB is superior to intravenous patient-controlled analgesia in patients having total knee replacement, as well as that the available data

are unclear as to whether CFNB and/or sciatic nerve block confers additional analgesic and rehabilitation benefits when added to a single-injection long-acting FNB. Paul *et al.* should be commended for setting a nice standard for the reporting of Bayesian meta-analysis and identifying the need for randomized controlled trials examining CFNB and single-injection FNB.

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