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In Reply:

We thank Drs. Knezevic *et al.*, Gill *et al.*, and Vaughn for their letters in response to our Special Article on safeguards to prevent neurologic complications after epidural steroid injections.[1] It is important for clinicians to understand that the work that ultimately led to publication of the safeguards manuscript spanned over years, and despite the Knezevic *et al.*'s conjectures to the contrary, our work had no relationship to the Food and Drug Administration Drug Safety Communication issued in April 2014[2] regarding epidural steroid injections. Knezevic *et al.* were in agreement with many of the safeguards our consensus group recommended, but they questioned our recommendation for the initial use of the nonparticulate steroid dexamethasone for all transforaminal epidural steroid injections (TFESI). The issue of the nonparticulate *versus* particulate steroids for lumbar TFESI generated significant discussion among experts who worked together on the safeguards manuscript. Knezevic *et al.*'s objections stem from the belief that particulate steroids are more efficacious than nonparticulate steroids when administered *via* the transforaminal route and they refer to a recent systematic review[3] and cite two additional studies[4,5] to support this notion. These articles provide weak and conflicting evidence for the superiority of nonparticulate steroids. Just two studies from the review by MacVicar *et al.*[3] used dexamethasone. Only one of those studies compared particulate with nonparticulate steroid; 116 patients were randomized to receive TFESI with either triamcinolone or dexamethasone, and the investigators found that triamcinolone resulted in significantly greater pain relief, yet no significant changes in the McGill Pain Questionnaire and Oswestry Disability Index scores.[6] The study by Kim *et al.*[4] mentioned by Knezevic's group compared *translaminar* (not transforaminal) epidural injection of dexamethasone *versus* triamcinolone and noted no significant difference in the reduction in pain scores between the two groups and a nonsignificant trend toward shorter duration of action of dexamethasone. The multicenter, double-blind randomized trial of Kennedy *et al.*[5] demonstrated no difference between dexamethasone and triamcinolone in terms of pain relief and rate of surgery. As emphasized by Knezevic *et al.*, Kennedy *et al.* also reported that the percentage of patients requiring a third injection was 17% with dexamethasone compared with 3% in the triamcinolone group. This is in stark contrast to the findings of El-Yahchouchi *et al.*,[7] who noted that the percent of patients requiring repeat injection within 6 months were not different between different steroid preparations: 10% for triamcinolone, 6% for betamethasone, and 4% for dexamethasone. We did indeed consider these studies and others when comparing particulate and nonparticulate steroid. Knowing that catastrophic neural injuries can and do occur after administration of particulate steroids *via* the transforaminal route at both cervical and lumbar levels, the group came to the consensus that initial use of nonparticulate steroid for lumbar TFESI represents the safest approach to avoiding these injuries. Clearly, additional studies are needed to confirm the efficacy, duration of effect, and optimal dose of the nonparticulate dexamethasone.

Knezevic *et al.* tell us that they were vexed by the safeguard groups' "…inability to consider evidence that clearly indicates the published efficacy of parasagittal interlaminar epidural steroid injection…," and for that we do apologize. Their assertion on the equal efficacy of the parasagittal interlaminar approach to TFESI is correct based on their own published studies and those of others cited in their letter. Yet, there are other studies that demonstrated better efficacy of TFESI over the interlaminar approach[8–11] or equal efficacy between the two approaches.[12] Our group did not discuss alternative approaches to TFESI because our primary task was to improve the safety of epidural steroid injections and reserve comment on the relative efficacy of one technique over another.

Knezevic *et al.* also objected to the safeguard group's statement regarding the use of digital subtraction imaging, stating that digital subtraction cannot differentiate between intraarterial or IV injections. Intraarterial injections are uncommon, perhaps even rare, during the conduct of TFESI, so we are uncertain that intraarterial and IV injections cannot be differentiated because studies comparing the rate of detection of these two events are not available. Indeed, in one recent study of the use of digital subtraction, all of the intravascular injections were *via* IV.[13] Nonetheless, to avoid intravascular injection, one must first detect intravascular needle placement, whether it be IV or intraarterial. Several studies have demonstrated that digital subtraction is significantly more sensitive in detecting intravascular injection when compared with aspiration followed by injection of radiographic contrast

under "live" or "real-time" fluoroscopy.[13–15] It was on the basis of this superior sensitivity that one organization represented in the safeguards group called for the mandatory use of digital subtraction imaging; in the end, recognizing that this technology is expensive and not universally available, the safeguards group opted for a statement calling for TFESI to "…be performed by injecting contrast media under real-time fluoroscopy and/or digital subtraction imaging…"[1]

One of the safeguards proposed by the safeguards group was that cervical interlaminar epidural steroid injections (IL ESI) should be performed by using image guidance using images taken in multiple planes precisely determine the location of the needle tip during final positioning (anteroposterior and lateral or contralateral oblique views).[1] Gill *et al.*[16] call to our attention a study that they performed demonstrating that the contralateral oblique view is superior to the lateral view for judging the depth of needle placement during cervical interlaminar epidural access. The contralateral oblique view is easy to obtain and interpret and offers a good alternative to the lateral view, particularly in obese patients. Two of those involved in the safeguards effort (P.D. and N.B.) coauthored a description of the geometry of fluoroscopic views used for cervical interlaminar injections that explains the use of the contralateral oblique view.[17]

Finally, the comments in the third letter from Vaughn[3] highlight the vagueness of at least one of the safeguards statements that stems directly from a lack of published data. Our safeguards statement reads, "No cervical IL ESI should be undertaken, at any segmental level, without reviewing, before the procedure, prior imaging studies that show there is adequate epidural space for needle placement at the target level." The problem is in defining what constitutes "adequate space" for needle placement. Vaughn quite rightly points out the lack of adequate data on the "size" of the cervical epidural space. The anteroposterior distance of the epidural space (distance between the ligamentum flavum and dura) should be wide enough for a loss of resistance to occur and fluid injected with ease. Vaughn suggested that an epidural space of at least 1 mm and this seems reasonable. The bevel of both the 17- and 20-gauge Touhy needles (B. Braun Medical Inc., USA) measures 2 mm so an epidural space of 1 mm should be the bare minimum for an epidural needle to enter the epidural space without puncturing the dura. Regarding the age of the magnetic resonance imaging (MRI) in relation to the cervical epidural placement, most patients have a recent MRI (within 3 to 6 months) when they are referred to the pain clinic. For those who do not, a repeat MRI is warranted when new symptoms appear, the severity of pain increases without explanation, or when other red flags like infection of cancer are apparent—when contemplating repeat injection after a long interval, it is highly likely that one or more of these indications will exist to justify repeat imaging. Interpretation of computed tomography may be more challenging than interpretation of MRI studies, due to the lesser ability to differentiate soft-tissue structure from one another; nonetheless, estimation of the dimensions of the epidural space is possible and done in a manner similar to MRI. We realize that the expertise of the pain medicine physician does not approach that of a neuroradiologist. However, consultation with a neuroradiologist should be sought if the interventionalist has concerns about the dimensions of the cervical epidural space.

Vaughn correctly pointed out that all of the safeguards statements are just statements; the statements are the opinions of a large group of experts from many different disciplines, but they are just *opinions*. They are not guidelines, recommendations, mandates, or meant to represent the standard of care.

We greatly appreciate the close reading and comments from these letter writers. Their comments and questions will help to improve the statements from the safeguards group and ultimately to improve the safety of ESIs. Like us, these individuals clearly have their focus on the safety of patients.

Competing Interests

Dr. Rathmell is a Director of the American Board of Anesthesiology (Raleigh, North Carolina). Dr. Benzon is a member of the Board of Directors of the American Society of Regional Anesthesia and Pain Medicine (Pittsburgh, Pennsylvania). Dr. Dreyfuss is past president of the International Spine Intervention Society (San Rafael, California). Dr. Huntoon is a member of the Board of Directors of the North American Neuromodulation Society (Chicago, Illinois) and has industry-funded research with CNS therapeutics and spinal modulation paid to Vanderbilt University (Nashville, Tennessee). Dr. Bogduk is founding member of the International Spine Intervention Society. Dr. Wallace declares no competing interests.

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Developing Perioperative Physicians

To the Editor:

In their call for action, Kain *et al.*[1] advocate for changing the name of the specialty of Anesthesiology to Anesthesiology and Perioperative Medicine. In addition, they propose modifying the structure of training in this field to increase the number of out-of-the-operating room rotations and lengthening the duration of residency training in order to better prepare individuals to provide high-quality care before and after, as well as during, administration of anesthesia.

However, an additional option already exists in this regard. Medical school graduates can enter programs that offer combined training in internal medicine or pediatrics, as well as anesthesiology, leading to eligibility for certification by the American Board of Internal Medicine or the American Board of Pediatrics, as well as the American Board of Anesthesiology.[2] This can be accomplished in 5 yr, rather than taking 6 yr, which would be necessary if a residency in internal medicine or pediatrics was completed separately before training in anesthesiology commenced. A limited number of programs currently offer this combined training, but more would undoubtedly develop should the demand exist. Interestingly, the first individual to enter one of these combined programs (in pediatrics and anesthesiology) graduated this June and has begun fellowship training (in pediatric anesthesiology). Several other individuals are currently in various stages of combined training programs around the country.

Training in a primary care specialty addresses several of the competencies proposed for the Perioperative Surgical Home.[1] Combined residency training could help anesthesiologists become more comfortable and skilled in caring for patients, frequently with chronic and complex medical conditions, preoperatively in clinics and postoperatively in recovery areas, hospital wards, and even after discharge, as well as during anesthesia. Graduates of these programs should also be well prepared to serve as leaders of the Perioperative Surgical Home.

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Competing Interests

The author was a Director of the American Board of Anesthesiology (Raleigh, North Carolina) from 2000 to 2012 and during that time received travel expenses and honoraria. However, the opinions expressed in this letter reflect solely the author's viewpoint and not that of the American Board of Anesthesiology.

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This letter was sent to the author of the referenced article, who declined to reply.