tee on Medical Education).<sup>7</sup> This committee reviews the content of a medical school's curriculum in these areas as a component of the review of the educational program leading to the M.D. degree.

Medical school curricula have incorporated other methods to train and assess communication skills using more structured situations, such as the Objective Structured Clinical Exam. In addition, assessment of communication skills is now a component of the United States Medical Licensing Examination Step 2<sup>®</sup> (Philadelphia, PA) Clinical Skills Exam.<sup>6</sup> It is intriguing to consider the use of simulation, as exemplified in the study by Morgan *et al.*,<sup>1</sup> as another modality to teach communication skills.

Teamwork is also drawing increasing attention in medical schools as a component of patient safety and quality enhancement efforts. Students have the opportunity to participate in simulated clinical experiences and receive feedback on their performance as a team member. Increasingly, the importance of an early interdisciplinary approach has been recognized, and training has been implemented to ensure the development of interprofessional communication skills. Efforts are under way at a number of academic medical centers to develop courses in patient safety. At Creighton University, the Foundation in Patient Safety Course includes objectives that include interprofessional communication and a systems approach to understanding human performance fallibility. Similar examples of this curriculum emphasis exist at many medical schools.

The overall goal is to train physicians who will be well

grounded in essential communication and teamwork skills. The medical student education program will provide a foundation for further skill development in residency training. The importance of this issue to our patients will mandate that interdisciplinary communication and teamwork skills will be considered prerequisite skills for professional training. Research such as the study in this issue of ANESTHESIOLOGY will and must continue to identify more effective and efficient methods to assess these skills and provide feedback to facilitate improvement.<sup>1</sup> Our patients will expect no less.

David Murray, M.D.,\* Cam Enarson, M.D., M.B.A.† \* Department of Anesthesiology, Washington University School of Medicine, St. Louis, Missouri. murrayd@wustl.edu. † Department of Anesthesiology and Health Policy and Ethics, School of Medicine, Creighton University, Omaha, Nebraska.

#### References

1. Morgan PJ, Pittini R, Regehr G, Marrs C, Haley MF: Evaluating teamwork in a simulated obstetric environment. ANESTHESIOLOGY 2007; 106:907-15

2. Hayword RA, Hofer TP: Estimating hospital deaths due to medical errors: Preventability is in the eye of the reviewer. JAMA 2001; 286:415-20

3. Hofer TP, Hayword RA: Are bad outcomes from questionable clinical decisions preventable medical errors? A case of cascade iatrogenesis. Ann Intern Med 2002; 137:327-33

4. Thomas EJ, Sexton JB, Helmreich RL: Discrepant attitudes about teamwork among critical care nurses and physicians. Crit Care Med 2003; 31:956-9

5. Makary MA, Sexton JB, Freischlag JA, Holzmueller CG, Millman EA, Rowen L, Pronovost PJ: Operating room teamwork among physicians and nurses: Teamwork in the eye of the beholder. J Am Coll Surg 2006; 202:746-52

6. Functions and Structure of a Medical School: Standards for Accreditation of Medical Education Programs Leading to the M.D. Degree. Chicago, Liaison Committee on Medical Education, 2004, p 12

7. Report of the Ad Hoc Committee of Deans. Educating Doctors to Provide High Quality Medical Care: A Vision for Medical Education in the United States. Washington, DC, Association of American Medical Colleges, 2004, p 7

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## Neurostimulation/Ultrasonography

### The Trojan War Will Not Take Place

THE modern era of regional anesthesia began with a simple needle. Some pioneers believed it was not necessary to have an open surgical field to perform regional blocks; indeed, they were able to demonstrate that it was possible to successfully achieve regional blocks by inserting a needle transcutaneously and searching for paresthesias.<sup>1</sup> Despite positive results, this technique had

This Editorial View accompanies the following article: Casati A, Danelli G, Baciarello M, Corradi M, Leone S, Di Cianni S, Fanelli G: A prospective, randomized comparison between ultrasound and nerve stimulation guidance for multiple injection axillary brachial plexus block. ANESTHESIOLOGY 2007; 106:992-6.

some major drawbacks, including active patient participation and elicitation of a paresthesia, a sensation that was later shown to be the most unpleasant part of the regional block procedure.<sup>2</sup> Science was injected into the art of regional anesthesia with the advent of neurostimulation. With the development of more reliable equipment and introduction of safer and more effective local anesthetics, needle guidance by neurostimulation enhanced the safety and efficacy of regional anesthesia.<sup>3,4</sup> More recently, a new method of performing regional block using ultrasound technology has been introduced in clinical practice. Whether ultrasound offers significant advantages over other aids to regional anesthesia represents a central issue in clinical research in the field. In this issue of ANESTHESIOLOGY, Casati et al.<sup>5</sup> make a substantial contribution to this question, demonstrating that in experienced hands, neurostimulation and ultrasonography have similar success rates and comparable inci-

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dences of complications after multiple injection axillary brachial plexus block. Moreover, patient satisfaction was similarly good with both techniques.

The authors investigated the challenging question of whether neurostimulation or ultrasonography will selectively affect success rate, incidence of complications, and patient acceptance after multiple injection axillary brachial plexus block. Axillary brachial plexus block was a good choice for such a study because this block is considered as one of the most unpleasant when performed with the use of neurostimulation.<sup>2</sup> This reflects the need at this site to perform three separate stimulations/injections to obtain a high success rate.<sup>6,7</sup> The results obtained by Casati et al.<sup>5</sup> will not surprise experts in regional anesthesia, who most likely would have predicted no difference between the two techniques in these clinically relevant outcomes, when the blocks are performed by experienced anesthesiologists. Recent progress in the science and application of neurostimulation to localize peripheral nerves has been rapid in many areas. Johnson et al.,8 for example, applied a computerized model of electrical stimulation of peripheral nerves and contributed new and unexpected important observations with direct clinical application. The increased sophistication of the application of neurostimulation, the availability of bevelled insulated needles, and the description of new approaches have made neurostimulation a highly successful technique in experienced hands (up to 95-97%<sup>4,9,10</sup>), associated with a low incidence of severe complications.

One of the most relevant issues would be to know whether ultrasound can still increase the high success rate observed with neurostimulation. In fact, observations in cadaver dissections or direct visualization during surgery indicate cases of a thick perineurium or a complex network of connective tissue between the cords at the infraclavicular level, for example. These anatomical variants may explain why a 100% success rate within 30 min will never occur, whatever technique is used. These considerations help to understand why a significant difference between the two techniques regarding success rate will most likely never be demonstrated because the required number of patients to show even a small difference will be tremendously large.

Another important question is to know whether ultrasound would decrease the incidence of the most feared complication—neuropathy—which occurs nevertheless in  $0.04-0.4\%^{3,4,10,11}$  with the use of neurostimulation. This low incidence of neuropathy in literature reports almost certainly includes some injuries due to surgery and suggests that some injuries in large surveys will always be observed. Given the extremely low incidence of serious neuropathy and its mixed causes, attempting to determine whether one technique to localize nerves for regional anesthesia is safer than another in regard to neuropathy would be a huge undertaking, requiring tens of thousands of patients to observe even small difference between techniques. Such studies will most likely never be performed. On the other hand, it is conceivable that visualization with ultrasound may further our understanding of the mechanisms of neuropathy after regional anesthesia. For example, Bigeleisen<sup>12</sup> performed axillary plexus blocks with his usual practice of seeking a paresthesia by needle manipulation. When a paresthesia was obtained, he assessed the spread of local anesthetic solution using ultrasound. His observations were astonishing: 85% of the patients had nerve puncture of at least one nerve, and 81% had an intraneural injection of at least one nerve.<sup>12</sup> Surprisingly, 6 months later, no neural damage was noted. This study suggests that injection through the epineurium is common with the use of the paresthesia technique and that some local anesthetics may be injected between the perineurium and epineurium without damaging the nerve.

Supporters of the ultrasound technique will point out that in Casati's study, minor outcomes such as onset of sensory block or number of needle passes favored the ultrasound method over neurostimulation. Supporters of the neurostimulation technique will counter that only three stimulations are really required, rather than four, making the procedure less unpleasant than in Casati's study, and that thinner needles than used in this study may be used and would further reduce patient discomfort. Regardless, patient acceptance was similar with these methods, and perhaps the important point is not to contrast these conceptually different methods<sup>13</sup>-neurostimulation, an analytic tridimensional technique, and ultrasonography, a descriptive bidimensional one-but rather to understand that combining the two may help to improve our understanding regarding the interactions between the distance between needle and nerve as it relates to muscle response and spread of local anesthetic solution. The dynamic visualization of regional anesthesia will undoubtedly contribute to further refine the scientific basis of regional anesthesia.

Should one technique be chosen over the other? Casati *et al.*<sup>5</sup> clearly demonstrated that in experienced hands, the major outcomes for performing a single-shot nerve block are similar between the two techniques. Individual practitioners may certainly have different success rates and hence preferences for one technique over another.

Finally, whether these results inform us regarding continuous perineural catheter techniques is worth a comment. Single-shot regional anesthesia does not significantly alter clinical outcomes compared with general anesthesia. McCartney *et al.*,<sup>14</sup> for example, demonstrated that pain severity, morphine consumption, and incidence of nausea and vomiting were similar after ambulatory hand surgery between single-shot peripheral nerve block and general anesthesia. On the contrary, continuous local anesthetic infusion by perineural catheters has significantly improved outcome.<sup>15-18</sup> Its placement with the use of neurostimulation is well standardized,<sup>19,20</sup> the search for specific muscle response is well defined,<sup>3,9,21</sup> and the incidence of infection, a crucial issue in this context, is low.<sup>3,4</sup> Some of these concerns, particularly the issue of sterility, must be further investigated regarding ultrasound-guided perineural catheters. In any case, as written by J. Giraudoux, the Trojan War will not take place.<sup>22</sup>

Alain Borgeat, M.D., Ph.D.,\* Xavier Capdevila, M.D., Ph.D.,† \* Department of Anesthesiology, Orthopedic University Clinic Balgrist, Zurich, Switzerland. alain.borgeat@balgrist.ch. † Department of Anesthesiology, Centre Hospitalier Universitaire de Montpellier, Montpellier, France.

#### References

1. Moore DC: Regional Anesthesia. Springfield, Illinois, Charles C. Thomas, 1953

2. Koscielniak-Nielsen ZJ, Rasmussen H, Nielsen PT: Patients' perception of pain during axillary and humeral blocks using multiple nerve stimulations. Reg Anesth Pain Med 2004; 29:328-32

3. Borgeat A, Dullenkopf A, Ekatodramis G, Nagy L: Evaluation of the lateral modified approach for continuous interscalene block after shoulder surgery. ANESTHESIOLOGY 2003; 99:436-42

4. Capdevila X, Pirat P, Bringuier S, Gaertner E, Singelyn F, Bernard N, Choquet O, Bouaziz H, Bonnet F: Continuous peripheral nerve blocks in hospital wards after orthopedic surgery: A multicenter prospective analysis of the quality of postoperative analgesia and complications in 1,416 patients. ANESTHESIOLOGY 2005; 103:1035-45

5. Casati A, Danelli G, Baciarello M, Corradi M, Leone S, Di Canni S, Fanelli G: A prospective, randomized comparison between ultrasound and nerve stimulation guidance for multiple injection axillary brachial plexus block. ANESTHESIOLOGY 2007; 106:992-6

6. Coventry DM, Barker KF, Thomson M: Comparison of two neurostimulation techniques for axillary brachial plexus blockade. Br J Anaesth 2001; 86:80-3

7. Sia S, Bartoli M: Selective ulnar nerve localization is not essential for axillary brachial plexus block using a multiple nerve stimulation technique. Reg Anesth Pain Med 2001; 26:12-6

8. Johnson CR, Barr RC, Klein SM: A computer model of electrical stimulation of peripheral nerves in regional anesthesia. ANESTHESIOLOGY 2007; 106:323-30

9. Borgeat A, Blumenthal S, Karovic D, Delbos A, Vienne P: Clinical evaluation of a modified posterior anatomical approach to performing the popliteal block. Reg Anesth Pain Med 2004; 29:290-6

10. Borgeat A, Ekatodramis G, Kalberer F, Benz C: Acute and nonacute complications associated with interscalene block and shoulder surgery: A prospective study. ANESTHESIOLOGY 2001; 95:875-80

11. Auroy Y, Narchi P, Messiah A, Litt L, Rouvier B, Samii K: Serious complications related to regional anesthesia: Results of a prospective survey in France. ANESTHESIOLOGY 1997; 87:479-86

12. Bigeleisen P: Nerve puncture and apparent intraneural injection during ultrasound guided axillary block does not invariable result in neurological injury. ANESTHESIOLOGY 2006; 105:779-83

13. Marhofer P, Greher M, Kapral S: Ultrasound guidance in regional anaesthesia. Br J Anaesth 2005; 94:7-17

14. McCartney CJ, Brull R, Chan VW, Katz J, Abbas S, Graham B, Nova H, Rawson R, Anastakis DJ, von Schroeder H: Early but no long-term benefit of regional compared with general anesthesia for ambulatory hand surgery. ANES-THESIOLOGY 2004; 101:461-7

15. Capdevila X, Barthelet Y, Biboulet P, Ryckwaert Y, Rubenovitch J, d'Athis F: Effects of perioperative analgesic technique on the surgical outcome and duration of rehabilitation after major knee surgery. ANESTHESIOLOGY 1999; 91:8–15

16. Singelyn FJ, Deyaert M, Joris D, Pendeville E, Gouverneur JM: Effects of intravenous patient-controlled analgesia with morphine, continuous epidural analgesia, and continuous three-in-one block on postoperative pain and knee rehabilitation after unilateral total knee arthroplasty. Anesth Analg 1998; 87: 88-92

17. Ilfeld BM, Vandenborne K, Duncan PW, Sessler DI, Kayser Enneking F, Shuster JJ, Theriaque DW, Chmielewski TL, Spadoni EH, Wright TW: Ambulatory continuous interscalene nerve blocks decrease the time to discharge readiness after total shoulder arthroplasty. ANESTHESIOLOGY 2006; 105:999–1007

 Borgeat A, Ekatodramis G, Schenker CA: Postoperative nausea and vomiting in regional anesthesia. Anesthesiology 2003; 98:530-47

19. Hadzic A, Vloka J, Hadzic N, Thys DM, Santos AC: Nerve stimulators used for peripheral nerve blocks vary in their electrical characteristics. ANESTHESIOLOGY 2003; 98:969-74

20. Jochum D: Stimulateur de nerf: 10 ans d'expérience, Evaluation et traitement de la douleur 2002. Editions scientifiques et médicales. Edited by Bonnet F. Paris, Elsevier SA, et SFAR, 2002, pp 7-20

21. Borgeat A, Ekatodramis G, Dumont C: An evaluation of the infractavicular block *via* a modified approach of the Raj technique. Anesth Analg 2001; 93: 436-41

22. Giraudoux J: La guerre de Troie n'aura pas lieu. Livre de poche, Hachette Paris, December 1998

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# Drug-eluting Coronary Stents

## What Are the Risks?

DESPITE the initial enthusiasm regarding the efficacy of drug-eluting coronary stents (DES) in the care of the patient with cardiovascular disease, there now seems to be a growing concern about the risk of adverse outcomes related to stent thrombosis. This initial risk became apparent in the perioperative period through a case series in which patients with a recent stent placement (less than 90 days) were at markedly higher risk of

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reinfarction or death after presenting for noncardiac surgery.<sup>1</sup> The risk of stent thrombosis has also been debated recently in a series of articles and presentations in which the general utility of DES *versus* bare metal stent placement for decreasing the long-term risk of myocardial infarction and death has been questioned. In this issue of the Journal,<sup>2</sup> the authors describe a case of very late thrombosis of a DES occurring in the postanes-thesia care unit, 12 months after completion of a course of dual antiplatelet therapy. This case and recent evidence in the literature highlight unresolved questions regarding the risks and benefits of interventions aimed at improving cardiovascular outcomes in patients undergoing planned or unplanned noncardiac surgery.

Drug-eluting stents were initially popularized because these stents were thought to remain patent for a longer period of time compared with their bare