Abstract

Background and Objectives. The purpose of this survey was to determine the current teaching practices of regional anesthesia and the prevalence of ultrasound use in guiding peripheral nerve blocks in the academic institutions across the United States.

Methods. A survey was distributed to all American Board of Anesthesiology-accredited residency programs via email and/or the U.S. postal service. The survey was designed to determine the number of peripheral nerve blocks (PNBs) performed, the role of the ultrasound guidance, the barriers to its use, and the methods by which teaching physicians acquired their ultrasound skills.

Results. We received 82 responses (62%) of the 132 programs surveyed. Eighty-eight percent of the responding programs performed more than 20 PNBs/week and 46% performed more than 40 PNBs/week. Three-fourths of the respondents relied on ultrasound to guide the majority of single injection and continuous PNBs. When using ultrasound, most programs (79%) used real-time ultrasound without nerve stimulator. Most teaching physicians supervising ultrasound-guided PNBs received their training via workshops and/or from other colleagues. The three main reasons for using ultrasound were to 1) achieve a higher success rate; 2) improve safety; and 3) teach anesthesia trainees. However, the three main barriers to using ultrasound were 1) lack of training; 2) perceived decreased efficiency; and 3) the lack of immediate availability of equipment. Overall, ultrasound was less utilized to guide lower extremity vs upper extremity PNBs.

Conclusions. Ultrasound-guided PNBs are universally taught across residency programs in the United States. Most teaching physicians believe that ultrasound increases PNB’s success and improves safety of regional anesthesia. Barriers to ultrasound use are lack of faculty training and unavailability of ultrasound equipment.

Key Words. Nerve Block; Education; Continuing; Ultrasound

Introduction

Selective peripheral nerve blocks (PNBs) are commonly used as anesthesia for procedures involving the extremities and to improve postoperative pain control. The safety and success of these procedures are high with the use of nerve stimulators and recently with ultrasound guidance for needle and catheter placements. Among the plausible benefits of the use of ultrasound are superior efficacy and safety [1].
This survey was undertaken to develop an improved understanding of the structure and organization of teaching regional anesthesia and ultrasound utilization in accredited residency programs in the United States. We hypothesized that the degree of utilization of ultrasound in teaching regional anesthesia varied considerably among teaching programs due to multiple factors.

**Material and Methods**

After obtaining approval from Vanderbilt University Institutional Review Board, we surveyed all American Board of Anesthesiology-accredited residency programs (132) in 2010. We obtained the number of residents (clinical anesthesia 1, 2, and 3) in each program by using the Fellowship and Residency Electronic Interactive Database Access (FRIEDA) maintained by the American Medical Association [2]. The individual program’s Website served as an alternative source when data were missing in the FRIEDA database.

The survey was developed after consultation with experienced regional anesthesiologists in teaching programs. A pilot survey was administered at three teaching institutions for testing in order to correct ambiguities and misinterpretations. The survey was then distributed to all programs using both email and the U.S. Postal Service. The director of regional anesthesia or a delegate answered the survey. The survey (Supporting Information Appendix S1) was also available online for point-and-click submission (Survey Monkey, http://www.surveymonkey.com, March–September 2010). Nonresponders were recontacted by email twice, and the remaining nonresponders were contacted by U.S. mail. While responding programs could be identified by the institution they represented, the data were made anonymous for the purpose of the analysis and reporting.

The survey consisted of 13 questions. The first five questions intended to evaluate the number of PNBs performed weekly, the location (upper vs lower extremity), type (single injection vs continuous catheter), and technique (ultrasound guided vs not). Two questions inquired about the primary reasons for using and/or not using ultrasound. Other questions focused on how the teaching physicians acquired their ultrasound skills and demographics (age and years in practice). The remaining questions evaluated ultrasound use for common blocks.

**Statistical Analysis**

The survey responses were tabulated and percentages derived. Narrative responses were analyzed and organized into categories. Data validation and outliers were detected by visual data frequency distribution analysis. Data analysis was carried out using SPSS version 16 statistical packages (SPSS Inc., Chicago, IL, USA). Responses analysis of the first five questions was done for the 82 programs. There were two programs with missing data for the remaining questions and their analysis was done on the remaining 80 programs (N = 80). The demographics of the teaching physicians were reported by 76 programs and were aggregated for analysis (N = 390 anesthesiologist). The difference between responders and nonresponders in regard to the number of residents in each program (program size) was evaluated using the Mann-Whitney test. Kendall’s tau test was used to examine association among nonparametric variables.

**Results**

Eighty-two programs (62%) responded out of the 132 programs surveyed. The average number of residents (clinical anesthesia years 1–3) was 39 ± 20 and 35 ± 21 in the responding and nonresponding programs, respectively. There was no significant difference between responders and nonresponders in regard to program size (P = 0.20). Seventy-two programs (88%) performed more than 20 single injection PNBs/week, and 38 programs (46%) performed more than 40 PNBs/week. Forty-one (50%) of respondents performed more than 10 continuous PNBs/week (Figure 1). Sixty-three (77%) and sixty (73%) pro-

![Figure 1](https://academic.oup.com/painmedicine/article-abstract/13/10/1342/1933513/1343)
grams usually used ultrasound to place single injection and continuous catheter PNBs, respectively. When using ultrasound to place PNBs, 63 (79%) programs used real-time ultrasound without the use of nerve stimulator to place PNBs. Fifteen (19%) programs used ultrasound in combination with a nerve stimulator. However, only two programs used ultrasound to only assess anatomy before the procedure.

There was an overlapping multitude of ways by which teaching physicians acquired their ultrasound skills. Regional anesthesia workshops (79%) and learning from other colleagues (74%) were the two most popular methods of learning. Learning ultrasound skills during residency and fellowship training was reported by (42%) and (31%) of respondents, respectively.

In general, the primary reason for ultrasound use in placement of PNBs was: 1) to achieve a higher success rate (34%); 2) to improve safety (29%); and 3) for teaching purposes (16%). Six programs (7%) stated that the primary reason for ultrasound use was that it is considered “a standard of care.” Only two programs used ultrasound mainly for difficult block circumstances (e.g., obesity, coagulopathy, etc.) (Figure 2). In 34 programs (41%), anesthesiologists always utilized ultrasound to guide PNBs. Of those who did not routinely use ultrasound, the main reasons were: 1) lack of expertise; 2) belief that ultrasound guidance will require more time; 3) ultrasound equipment was not immediately available; and 4) need to teach alternative techniques for PNBs (Figure 3). Regarding the use of ultrasound to guide specific PNBs, it was usually utilized in 91% of brachial plexus blocks. The most commonly performed PNBs utilizing ultrasound were: 1) supraclavicular brachial plexus block (94%); and 2) interscalene PNB (80%). Ultrasound was less utilized for lower extremity PNBs.

Seventy-six programs reported on 390 (mean = 5 ± 2) teaching physicians demographics. There was a weak negative association between ultrasound use and the teaching physicians’ age and years in practice \( (r = -0.15, r = -0.14, \text{ respectively}, \ P < 0.005) \). Also there was a moderate correlation between the number of single injection PNBs performed and the number of anesthesiologists on the regional team \( (r = 0.29, \ P < 0.005) \). There was moderate association between number of single injection PNBs and the number of continuous catheter PNBs performed \( (r = 0.42, \ P < 0.005) \).

Discussion

As recently as two decades ago, PNBs were predominately placed utilizing peripheral nerve stimulator. This survey confirms the recent dramatic increase of ultrasound utilization in placing PNBs. We believe that our results are representative of all teaching programs as a response rate approximating 60% is optimal to minimize nonresponders bias [3]. Also, there was no significant difference in program sizes between responders and nonresponders. Eighty-five percent of the responding programs performed more than 20 single injection PNBs a week. Continuous PNBs were used less frequently as only 50% of programs surveyed performed more than 10 procedures weekly. Anesthesia residents in 85% of accredited teaching programs perform over 80 PNBs a month.

Many peer-reviewed publications support the use of ultrasound suggesting decreased time to perform most blocks, decreased onset of surgical anesthesia, decreased local anesthetic volume, improved patient comfort, enhanced block success rate, and improved the quality of blocks performed [1,4–7]. Ultrasound may also facilitate the placement of PNBs in patients with challenging anatomy (i.e., scarring from previous surgeries and obese patients) and in those for whom PNBs has relative contraindications (i.e., anticoagulation) [8–12]. Based on our survey, most anesthesiologists involved in regional

Figure 2 The main reason for using ultrasound in placement of PNBs.

Figure 3 The main reason for not using ultrasound in placement of PNBs. US = ultrasound.
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References

12. Sites BD, Beach ML, Chinn CD, Redborg KE, Gallagher JD. A comparison of sensory and motor loss...


Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1 A survey of teaching ultrasound guided peripheral nerve blocks in the United States.

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