

# CURRICULUM DEVELOPMENT FOR AN ADVANCED REGIONAL ANESTHESIA EDUCATION PROGRAM: ONE INSTITUTION'S EXPERIENCE FROM APPRENTICESHIP TO COMPREHENSIVE TEACHING

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## Abstract

Results of recent attitude survey studies suggest that most practicing physicians are inadequately treating postoperative pain. Residents in anesthesia are confident in performing lumbar epidural and spinal anesthesia, but many are not confident in performing the blocks with which they have the least exposure. Changes need to be made in the training processes to a comprehensive model that prepares residents to perform a wider array of blocks in postgraduate practice. Here, we describe one institution's approach to creating a standardized, advanced regional anesthesia curriculum for residents that follows the six core competencies of the ACGME. Residents received training in anatomy dissection, ultrasound-guided regional anesthesia, traditional nerve stimulation techniques, problem-based learning and simulation sessions, oral board presentation sessions, and journal club sessions. Residents kept a detailed log for their use of peripheral nerve block procedures. We have now redesigned and implemented an advanced regional anesthesia program within our institution to provide residents with experience in regional anesthesia at a competent level. Resident's knowledge in regional anesthesia did improve after the first year of implementation as reflected in improvements between the pre- and post-tests. As the advanced regional anesthesia education program continues to improve, we hope to demonstrate levels of validity, reliability, and usability by other programs.

**Conflict of interest:** None.

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## Introduction

Pain management is an important aspect of high-quality postoperative care. Multimodal analgesia techniques that include regional anesthesia and analgesia are essential to providing effective postoperative pain management with minimal side effects<sup>1</sup>. However, results of recent attitude surveys suggest that most practicing physicians are inadequately treating postoperative pain<sup>2,3</sup>.

Among the reasons that postoperative pain is undertreated are inadequate education in pain management for healthcare professionals<sup>4</sup> and lack of adequate exposure and proficiency in peripheral nerve blocks for residents<sup>5,6</sup>. In one national study, most third-year clinical anesthesia residents felt confident in performing lumbar epidural and spinal anesthesia. However, many are not confident in performing blocks for which they have less exposure, such as peripheral nerve blocks. Changes are needed in the training processes to enable residents to graduate with enough confidence to perform a wide variety of blocks in clinical practice<sup>5</sup>.

Deficiencies in resident training have led some programs to develop innovative methods to increase their residents' exposure to regional anesthesia and peripheral nerve block procedures<sup>7</sup>. The Accreditation Council for Graduate Medical Education (ACGME) has also made attempts to improve resident education by implementing standardized education performance objectives (i.e., competencies) and establishing minimum regional block numbers for anesthesia residents<sup>8</sup>.

Currently, there are no set educational standards or curricula for regional anesthesia training, but guidelines have been published for fellowship programs<sup>9</sup>. Until 2009, our institution did not have a didactic educational curriculum in regional anesthesia education for residents. Since that time we have redesigned and implemented an advanced regional anesthesia program within our institution to help residents graduate with a greater proficiency in regional anesthesia techniques. This article describes our institution's approach to resident education in regional anesthesia.

## Methods

With the support of the department chair and protected nonclinical time given by the division chief, we embarked on a 10-month faculty development longitudinal program to help develop a comprehensive and advanced educational program. We surveyed 26 existing regional anesthesia fellowship programs in the United States and Canada and asked the faculty basic questions regarding their own institutional experience (Table 1). The goal of this survey was to develop a short list of basic block techniques that we could focus on for the start of our curriculum. Individuals from only 11 programs completed the survey. Based on the survey results, we identified the six anesthesia blocks most often performed at their institution. We also identified the average number of blocks performed and the techniques most commonly used to perform the blocks. Most of the 11 programs identified interscalene, infraclavicular, supraclavicular, femoral, Labatt or subgluteal sciatic, and popliteal sciatic as the six most frequently used blocks. The average number of blocks performed varied among the programs and ranged from 100 to 800 per year for each block, with variability based on the size of the institution and volume of surgical procedures. The common techniques used were nerve stimulators and ultrasound techniques. An extensive literature search with the help of the librarian revealed very limited information regarding didactic educational regional anesthesia programs for fellows and residents.

*Table 1*

*Survey Questions Sent to Faculty of Adult Regional Anesthesia Fellowship Programs*

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| <ol style="list-style-type: none"> <li>1. What do you feel are the top 6 non-neuraxial blocks that are absolutely necessary for regional anesthesia fellows to learn during their year of training? (Upper and Lower extremity)</li> <li>2. What is your best estimate, from your experience, of the minimal number of blocks a fellow needs to do to achieve proficiency for each of those blocks?</li> <li>3. Currently, what modality/modalities are you teaching fellows to utilize (US, NS, Paresthesia, trans-arterial, loss-of-resistance, etc) for each of those 6 basic blocks?</li> <li>4. How many of each block are you currently doing?</li> </ol> |
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US: Ultrasound, NS: Nerve stimulator.

## Curriculum Goals and Objectives

The newly designed advanced regional anesthesia curriculum is a one-year educational program customized with graduated responsibility for clinical anesthesia year 1 (CA1), CA2, and CA3 residents. The goals of the program are to (1) provide a standardized and advanced regional anesthesia curriculum for residents that follows the six core competencies of the ACGME (Table 2), (2) improve quality and patient safety by encouraging nontraditional training in a simulated environment, and (3) enhance communication and pain education within and between the departments of anesthesiology and surgery. The underlying focus was on improving patient-centered outcomes, quality of recovery, and patient satisfaction. The ultimate goal was to have residents graduate with greater proficiency in performing regional anesthesia by the end of their three years of training.

Table 2

*Components of the Advanced Regional Education Program and ACGME Competencies*

Advanced Program Component	Regional Education	ACGME Competency	Core
Anatomy dissection and workshop		MK, PC	
Nerve stimulator workshop		MK, PC	
Simulation sessions		MK, PC, ICS, P, PBL	
Oral board preparation sessions		MK, PC, ICS, P	
Journal club sessions		MK, PBL	
Web-based lectures		MK, PC, ICS, P, SBP, PBL	
Problem-based learning practice		MK, SBP, PBL	
Clinical and laboratory research		MK, SBP, PBL	
Teaching responsibilities		MK, PC, ICS, P, SBP, PBL	

MK, medical knowledge; PC, patient care; PBL, practice-based learning and improvement; ICS, interpersonal and communication skills; P, professionalism; SBP, systems-based practice.

## Curriculum planning and implementation

The novel educational program that our institution began allows for two fully protected education days (or “college” days) per month. Residents are subdivided into colleges (groups of 18–19 residents) in which nontraditional interactive teaching methods are used. All six ACGME core competencies are taught in this curriculum. Faculty members with expertise in regional anesthesia plan and teach advanced regional anesthesia to the residents on the college days. Most of this curriculum was adopted for the 2009–2010 academic year, with further expansion in the following years. The curriculum for the first year included the following 10 interactive sessions.

### A) Anatomy dissection:

Regional anesthesia is the practice of applied anatomy. Therefore, anatomy dissection and hands-on workshops are essential components of our regional anesthesia education program. A four-station anatomy workshop moderated by regional anesthesia educators, fellows, and anatomy lab experts covered the brachial, lumbar, and sciatic plexus as well as neuraxial and paravertebral dissections. The residents were divided into three groups according to their level of training (CA1, CA2, CA3), and each group was subsequently divided into smaller groups to facilitate hands-on practice.

### B) Ultrasound-guided regional anesthesia (UGRA):

UGRA became very popular in the last decade because it is thought to increase block efficacy and block duration, decrease block performance times, and improve patient safety and satisfaction<sup>10-12</sup>. We have incorporated ultrasound physics and sonography scanning into our teaching sessions. Residents practice these techniques on human and phantom gel models. The ultrasound mapping sessions provide hands-on practice with live models for the upper and lower extremity blocks.

#### C) Nerve stimulators and traditional techniques:

Familiarity with traditional techniques such as nerve stimulators and loss-of-resistance is encouraged despite the availability of ultrasound. We organized workshops to teach these traditional techniques by reviewing surface anatomy and identifying potential needle insertion points on live models.

#### D) Simulation sessions:

Simulation education improves patient safety and physician training by exposing residents to high-fidelity preclinical experiences that use advanced technology<sup>13-16</sup>. Each college of residents was divided into small groups to carry out scenarios in our well-equipped simulation center. Using high-fidelity manikins, Sim Man® 3G and HAL® S3201 Adult simulator, the groups practiced handling situations of local anesthetic toxicity, including seizure, cardiac arrest, and high-level spinal. Residents practiced other regional anesthesia scenarios, such as postoperative nerve injury, using standardized patients. Residents were given a detailed debriefing after every scenario by regional anesthesia faculty.

#### E) Oral board preparation sessions:

We used nontraditional classroom exercises, such as a question-and-answer format, to teach a variety of topics, including regional anesthesia in medically challenging cases, local anesthetics, and neuraxial pharmacology.

#### F) Journal club sessions:

The journal club part of our educational program was moderated by a regional anesthesia expert, while residents presented recently published articles related to regional anesthesia. Additionally, we have a monthly journal club for acute pain and regional residents, separate from the college day's curriculum, in which they discuss recent literature and controversies in the field of regional anesthesia and acute pain management.

#### G) Web-based lectures, e-learning:

During the residents' acute pain service rotation, daily lectures (16 lectures and four case studies) were

presented by regional anesthesia faculty who cover the pain service. Advanced educational lectures in regional techniques and pain management were added every year and made available online. A Web-based program is currently developed to incorporate all of these lectures and is expected to play an important role within the curriculum.

#### H) Problem-based learning practice:

In problem-based learning sessions, residents are encouraged to identify defects in clinical practice and develop a strategy to solve these problems with the guidance of a dedicated faculty member. As an example, a group of residents (CA1, CA2, and CA3) with an interest in regional anesthesia identified a premature discontinuation of thoracic epidurals in the intensive care units secondary to hypotension. They took on this issue as their problem-based learning project and formulated a plan to resolve it. Others are looking at ways to facilitate block performance in everyday practice.

#### I) Clinical and laboratory research:

Our residents are encouraged to present their research projects at national meetings such as the annual meeting of the ASRA. Nine posters, including oral presentations, were presented by residents and fellows at the 2010 ASRA meeting; 6 presentations were made at ASRA 2011.

#### J) Clinical case log:

A monthly case log and passport is already used by residents rotating through the acute pain service and advanced regional rotation to ensure that the clinical exposure of residents is diverse and of high quality.

We evaluated the efficacy of this educational program by asking the residents to take a test before and after the advanced education program. Twenty-five multiple choice questions (MCQ) and an objective structured clinical examination (OSCE) pretest were given before the start of the educational program. The post-test was given one month after the last regional anesthesia teaching session. In addition, the residents were asked to provide their opinions of the program itself.

**Results**

Pretest and post-test results for both the MCQ and the OSCE were compared by using a paired t-test for statistical means. Post-test results were significantly improved ( $P < 0.05$ ) across all clinical anesthesia years and for both the MCQ and OSCE (Table 3) examinations. Post-test results were also significantly improved ( $P < 0.05$ ) across all CA years for each of the three sections of the OSCE. The residents have rated the experience of the anatomy dissection and ultrasound life-model workshop as excellent and have requested that it be repeated.

*Table 3*  
*Summary of Pretest and Post-test Means for Multiple-Choice Question Examination and Objective Structured Clinical Examination.*

C A Year	MCQ Pretest (95% CI)	MCQ Post-test** (95% CI)	OSCE Pretest (95% CI)	OSCE Posttest** (95% CI)
1	8.32 (1.40)	16.68 (1.05)	31.21 (5.83)	69.74 (6.29)
2	10.86 (1.03)	20.32 (1.15)	48.09 (6.07)	90.32 (4.22)
3	12.87 (1.24)	22.07 (0.82)	57.27 (5.19)	93.60 (2.87)

CA, clinical anesthesia; MCQ, multiple choice questions; OSCE, objective structured clinical examination.

\*\* All differences between pretest and post-test scores were significant at  $P < 0.001$  for both MCQ and OSCE.

**Discussion**

Future advances in regional anesthesia and pain management are greatly dependent on the level of education in our residency program. In the last decade, interactive teaching has become more effective. After one year of implementation of the advanced regional curriculum, we were able to show that our new interactive educational program is superior to what it replaced. Results of the post-tests and OSCE at the end of the year showed great improvement in resident's

regional anesthesia knowledge (Table 3). Resident satisfaction with their regional anesthesia educational experience was also greatly improved.

Some barriers were encountered during the planning and implementation of our educational program. For example, the increased demand for regional anesthesiologists in private practice is making it difficult for our institution and other academic hospitals to retain regional anesthesia faculty. The recent developments in regional anesthesia alongside the required skills needed to perform UGRA restrict practice to providers who have advanced training. With a limited number of qualified regional anesthesia faculty members, it is difficult to maintain efficient clinical coverage while providing instructors to teach the regional curriculum to the residents. We overcame this problem by hiring more regional anesthesia fellowship-trained faculty in the following years.

Another constraint is that the residents in the regional anesthesia rotation do not have the autonomy to perform enough regional procedures to enhance their clinical experience. In the last two years, we have created an advanced regional anesthesia rotation in which the rotating resident was dedicated to doing regional anesthesia without being required to also providing anesthesia in the operating room. Another challenge we encountered was a culture among many surgeons at our institution to reject the use of regional anesthesia. Surgeons may believe that the quality of blocks lacks consistency or that nerve blocks interfere with the start time of surgical cases and the efficiency of the operating room. We have since facilitated the regional anesthesia process by having dedicated regional faculty members.

Additionally, implementation of a new training program for the residents does not allow for a prospective control group. It would be ideal to study resident confidence levels before and after the implementation of the new curricula. As the advanced regional anesthesia education program improves and develops, we hope to demonstrate levels of validity, reliability, and usability by other programs.

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