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PRO and CON: The Future of Pain Medicine Fellowship Training

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Happy Spring! I am very pleased to report on the early and very successful Spring Meeting that took place March 15-18th at the beautiful Hilton San Diego Bayfront Hotel. We are extremely grateful to Program Chair Francis Salinas, MD, who planned a fantastic meeting with a wonderful selection of speakers and workshops. In addition to the usual great learning from Refresher Courses, General and Parallel Sessions, Problem Based Learning Discussions, Intensive Workshops, and Resident Program, there were also several social events including an evening aboard the Naval Aircraft Carrier, USS Midway. It was truly a spectacular event. At this year’s Spring Meeting, ASRA honored two special awardees during this annual meeting. Denise J. Wedel, M.D., presented the Labat lecture and received the Gaston Labat Award. This award is presented annually at the ASRA Annual Regional Meeting and Workshops to an individual for his or her outstanding contributions to the development, teaching, and practice of regional anesthesia in the tradition of Gaston Labat. James C. Eisenach, M.D., received the Distinguished Service Award which is presented annually to someone who has served the society in an innovative and significant way.

This particular Spring Meeting was also important because it was the first annual meeting held in cooperation with ASRA’s new management company – Kenes International. Kenes was founded in 1965 and is based in Geneva, Switzerland. Kenes specializes in the organization of scientific and medical meetings and has organized over 2800 congresses in over 100 countries. ASRA looks forward to working with this group to optimize the meeting and educational experience for all of our members during our annual Spring and Fall Meetings and weekend Intensive Workshops. I have no doubt that there will be some bumps in the road as we transition to this new management service, however, Kenes brings a wealth of talent and potential for growth to the ASRA team. One of the best things about our transition to the new management services is that we have been able to retain our Executive Director, Julie Kahlfeldt. Julie has been the Executive Director for ASRA for 3 years now. She is the driving force behind all of the day to day operations and problem-solving for the society. Working in collaboration with Julie and with Kenes, we are excited by the opportunities to evaluate and improve all of our membership services.

Together, Kenes and ASRA are actively planning for our Fall Annual Pain Meeting which will be held in Miami from November 15-18, 2012. Daniel T. Warren, M.D., will be the Program Chair for this meeting. Additionally, ASRA continues to work with the American Society of Anesthesiologists to provide the educational products for Maintenance of Certification for Pain Physicians and a Learning Portfolio for the use of Ultrasound for Regional Anesthesia. Each of these products should be beneficial to anesthesiologists in both academic and private practices. Finally, the ASRA Board of Directors will continue strategic planning for the society. This planning is essential to ensure that ASRA will be poised to provide the optimal education, research, and service products to our members not only for this year but for the future. We are optimistic that our working relationship with the experts at Kenes will enable us to make the wonderful services that we visualize a reality for each and every member of ASRA.
What are the optimal infusates, concentration, and infusion rate for continuous peripheral nerve blocks (CPNB) after total joint arthroplasty for pain control, preserving motor function, and maximizing physical therapy ability?

- There is not one “optimal” medication or delivery regimen that reliably optimizes analgesia while minimizing motor, sensory, and/or proprioception deficits.

- Ropivacaine is easier to titrate due to a shorter duration of action compared with bupivacaine.

- Bupivacaine is often dramatically less expensive than ropivacaine.

- Providing an adjustable basal infusion rate allows dose titration.

- Providing a patient-controlled bolus dose provides block reinforcement while permitting minimization of the basal rate (and motor/sensory block).

Successful post-operative management of patients after total joint arthroplasty is dependent on adequate analgesia and participation in physical therapy by preserving motor function. Although inhibition of pain fibers is the primary goal of CPNB after joint arthroplasty, currently-available local anesthetics approved for clinical use often decrease other afferent (non-pain-related sensory and proprioception) and efferent (motor) nerve fibers as well, resulting in undesired muscular weakness, loss of proprioception, or an insensate limb. Infusions for total knee and hip arthroplasty affecting the femoral nerve and lumbar plexus (femoral and psoas compartment catheters) carry the increased risk of impairing motor function of the quadriceps muscle and—for psoas—hip adductors, which are required for ambulation. Preserved motor function and ability to protect the affected limb are important for participation in physical therapy and to prevent limb injury as well as patient falls. One retrospective analysis of 3 randomized, double-masked, placebo-controlled studies found 7 falls in 6 patients receiving 4-day ropivacaine infusions (n=85) after knee and hip arthroplasty versus no falls in the control group receiving normal saline infusions (n=86). Despite publication selection bias limiting this analysis, it suggests the importance of minimizing the fall risk and including a discussion of this risk when obtaining informed consent for CPNB involving the lower extremities. To date, the published data suggest that there is not one “ideal” medication or delivery regimen that reliably optimizes analgesia while minimizing motor, sensory, and/or proprioception deficits; however, there is evidence available that can help guide the clinician in selecting an appropriate drug, concentration, rate and regimen for CPNB.

Infusates. The most common infusate is local anesthetic, and the most commonly-used local anesthetics are ropivacaine, bupivacaine, and levobupivacaine, due to their longer duration of action and favorable sensory:motor block ratio. Although available data suggest bupivacaine and levobupivacaine have higher potency than ropivacaine (their exact equipotent ratios remain unknown), all three provide similar analgesia in human trials. However, the ropivacaine concentration is often increased up to 50% to compensate for decreased potency. Although all three local anesthetics appear to provide equally effective analgesia, there are data to suggest that when the perineural infusion is discontinued, the sensory and motor effects of bupivacaine greatly outlast those of ropivacaine. Therefore, using ropivacaine may greatly facilitate titration of local anesthetic when a patient experiences an undesirable degree of motor or sensory block. For example, patients with femoral perineural infusion-induced quadriceps femoris weakness limiting ambulation, or an insensate extremity during infraclavicular or popliteal-sciatic infusion, may have...
faster attenuation of the block after the infusion is paused. The infusion can subsequently be restarted at a lower basal rate. One study of interscalene infusions demonstrated that ropivacaine 0.2% minimized finger paresthesias and hand weakness compared to bupivacaine 0.15%. However, similar studies using different concentrations of levobupivacaine and ropivacaine suggest that any differences in the induced motor block are minimal as long as the ropivacaine concentration is increased by approximately 50%. Animal studies suggest that both ropivacaine and bupivacaine induce tissue injury, although ropivacaine to a lesser degree. The clinical significance of these data—if any—remains undetermined. Unfortunately, in nearly all cases, ropivacaine costs more than bupivacaine; and, in some cases, there is a large difference in cost between the two medications.

Several medications are occasionally added to the local anesthetic during CPNB in an attempt to improve analgesia without increasing motor block. There are reports of adding opioids to perineural local anesthetics, but currently there are insufficient data to demonstrate efficacy. Although clonidine extends the duration of single-injection peripheral nerve blocks, it does not provide any clinically-relevant benefits during CPNB. In addition, one RCT found no benefit to adding epinephrine to perineural ropivacaine, and possible prolonged vasoconstriction is an added risk to this practice. There is no conclusive evidence of any adjuvant added to a local anesthetic CPNB improving analgesia or sparing motor function (in humans).

Dose. Optimizing infusion characteristics is a challenge because it is currently unclear if the primary determinant of CPNB effects is total drug dose (mass) or whether local anesthetic concentration and/or volume exert an additional influence. For psoas compartment and femoral perineural infusions, dose appears to be the prime determinant of infusion effects. However, to complicate the issue, in the clinical setting, patient-controlled bolus doses and/or an adjustable basal infusion rate are often provided, and therefore total local anesthetic dose varies depending on individual patient requirements. In these clinical cases, it appears that concentration and rate do influence infusion effects. Unfortunately, currently-published studies provide widely conflicting data, probably due to the multiple variables influencing infusion effects and analgesic requirements. For example, increasing local anesthetic concentration has differing effects on the incidence of an insensate extremity depending on the catheter site location: increased for infraclavicular, decreased for popliteal, no difference for axillary, and variable for interscalene. Therefore, no optimal concentration/rate combination may be recommended for all anatomic locations, and further study is warranted.

Delivery Regimen. Due to the various catheter types, insertion techniques and individual patient and surgical factors, there is little evidence for an ideal infusion regimen. Investigations looking at interscalene and infraclavicular infusions suggest that including a basal infusion improves baseline analgesia, decreases the incidence and severity of breakthrough pain, and decreases sleep disturbances and supplemental analgesic requirements. An adjustable basal infusion rate is advantageous because it allows for titration in case of excessive motor or sensory block, and may provide increased analgesia, or to maximize an ambulatory infusion duration. Importantly, all investigations report less total consumption of local anesthetic with regimens providing patient-controlled bolus doses. The use of bolus dosing reduces the required basal infusion rate and theoretically decreases motor block and the incidence of an insensate extremity. In addition, a decreased basal rate will lengthen the duration of infusion/analgesia for ambulatory patients discharged with a finite volume of local anesthetic. Therefore, adding a patient-controlled bolus to a basal infusion decreases total local anesthetic consumption and supplemental analgesic requirements, and may provide increased independent activity. The risks of local anesthetic toxicity, muscle weakness, falling, and inability of patients to protect their affected limb must be weighed against the desired level of analgesia and opioid avoidance.
Miscellaneous. Potent analgesia is most dramatic for surgical sites that are completely innervated by nerves affected by the perineural infusion, such as interscalene catheters for shoulder surgeries and sciatic catheters for many foot procedures. Femoral or posterior lumbar plexus infusion may result in unacceptable quadriceps femoris and hip adductor weakness when a high dose of local anesthetic is given to optimize analgesia. Until recommendations based on prospectively-collected data are available, practitioners should be aware that investigators have reported successful analgesia using the following regimens with dilute long-acting local anesthetics: basal rate of 4-8 mL/h (lower range for lower extremity catheters), bolus volume of 2-5 mL, and lockout duration of 20-60 min.

The maximum recommended hourly dose of local anesthetic during perineural infusion remains unknown. One study reported no toxicity signs or symptoms with perineural ropivacaine 0.2% administered at basal rates up to 14 mL/h with large, repeated boluses of ropivacaine 0.5% (10-60 mL) provided for up to 27 days. Other clinical studies have demonstrated a wide safety margin. As a rule of thumb, infusion regimens that limit the volume of ropivacaine 0.2% or bupivacaine 0.125% to 20 mL/h are within a safe range.

Also noteworthy is the association between perineural infusions affecting the femoral nerve and patient falls following hip and knee arthroplasty, possibly due to CPNB-induced sensory, proprioception, and/or quadriceps weakness. Correlation does not prove causation; however, until further evidence is published, practitioners should consider interventions that may decrease the risk of falls, such as limiting the local anesthetic dose/mass, providing crutches/walker and a knee immobilizer during ambulation, and educating surgeons, nurses, and physical therapists of possible CPNB-induced deficits and fall precautions.

References


At the ASRA Spring meeting after starting my first faculty job, I was so excited to attend lectures given by the biggest names in regional anesthesia - the trailblazers who established many of the techniques currently practiced around the world and whose books and articles formed the basis of my own practice of regional anesthesia. However, although the lectures themselves were fantastic, what impressed me the most was the approachability of the speakers who stayed after their lectures to answer questions, often moving out of the lecture hall surrounded by a crowd of people, myself included, to allow the next speaker to begin.

Today, ASRA is composed of over 5000 members, and I believe the newsletter is an important vehicle for communication among the membership and for maintaining the same level of approachability between ASRA leadership and its members. It has been quite an amazing experience for me to “grow up” within ASRA, participating in committees and eventually joining the ASRA faculty. As a member of the newsletter committee, then Associate Editor under Dr. McCartney for the past year, I have learned so much more than just how to put together a quarterly publication; I have received invaluable mentorship about balancing life, an academic career, and service to our professional societies.

During my term on Dr. McCartney’s Newsletter Committee, I also accepted the charge of starting the ASRA E-News bulletin, an all-electronic publication and new member benefit conceived by then-President, Dr. Vincent Chan. We recognized that ASRA members’ needs for, and access to, information are constantly evolving, and we wanted to offer an easily-digestible, one-stop source delivered bi-monthly to members who could view it on laptops, smart phones, tablets, and other wireless devices. With my transition to Editor of ASRA News, Dr. Raj Gupta has taken over the editorial duties for E-News, and I am confident that his expertise in social media and webcasting will keep ASRA members on the forefront of electronic communications.

It is my opinion that our ASRA publications, E-News and the ASRA News newsletter, are complementary. Under Dr. McCartney’s tenure, the newsletter has included thoughtful and thought-provoking articles on emerging, and sometimes controversial, topics that are not always found in the peer-reviewed literature. Authors have ranged from well-established internationally-recognized experts in the field to junior faculty and private practice clinicians, all of whom have important views to share with the membership. Recently, ASRA News underwent a major transition that very few people probably noticed. Before the February 2012 issue, the publishing infrastructure moved from ASA headquarters to a new publisher, The Martin Group, a graphics design and communications firm based in Schaumburg, IL. We are grateful to Roy Winkler and Heather Iselin at ASA headquarters for lending their talents to ASRA in recent years to produce such a fantastic newsletter, and we look forward to working with The Martin Group to further develop this product.

It is my distinct privilege to serve ASRA now as the Editor of ASRA News and carry on in the tradition of providing timely and stimulating information to ASRA members. Please send me an email if you have ideas for future newsletter content or questions for our “Ask the Experts” column.

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“Today, ASRA is composed of over 5000 members...”
Introduction
The number of applications for ultrasound in pain medicine for interventional axial, nonaxial, and musculoskeletal pain procedures are rapidly evolving and growing. As pain specialists introduce ultrasound guidance into their practice, it is important that a knowledge foundation exists for the appropriate coding, billing, and documentation for this imaging technique. Here, we will provide an overview of how to code for commonly-performed ultrasound-guided interventional pain procedures. In addition, we will highlight some of the issues and challenges surrounding payment.

CPT Codes and ICD Medical Classification
One of the first steps in appropriate coding and documentation is the understanding of current procedural terminology (CPT) codes and modifiers, as well as the International Statistical Classification of Diseases and Related Health Problems (ICD) classification. The CPT codes, which allow healthcare providers to report medical services and procedures, are maintained by the American Medical Association (AMA) and updated annually. There are three categories of CPT codes (Table 1). Currently, specific ultrasound procedures have been assigned Category III codes which were first introduced in 2002 and are currently utilized for emerging technologies to track the performance of new procedures. In addition to tracking, these codes allow physicians, insurers, researchers, and policy experts to evaluate new technologies for clinical efficacy, utilization, and outcomes. These codes are not referred to the AMA Relative Scale Update Committee for evaluation. Category III codes may be in effect for up to five years. At five years, if a Category III code is not accepted for placement as a Category I code, it may be renewed for another five years based on the recommendation of the CPT Editorial Panel, or the code will automatically “Sunset” and be removed from the CPT book. If a Category III code exists for a particular procedure, a Category I or unlisted procedure code should not be used for billing. In certain instances, modifiers are added to a CPT code in order to expand the information being provided. It is important to remember that the existence of a CPT code does not guarantee coverage or payment.

Table 1: CPT Code Definitions and Timeframe for Development, Including Release and Effective Dates

<table>
<thead>
<tr>
<th>Code Type</th>
<th>Definition</th>
<th>Release</th>
<th>Effective Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category I</td>
<td>Describes a procedure or service.</td>
<td>Late summer/early fall</td>
<td>January 1</td>
</tr>
<tr>
<td>Category II*</td>
<td>Supplemental tracking codes used for performance measurements</td>
<td>Three times yearly following the CPT Editorial Panel Meetings*</td>
<td>Three months after the release date</td>
</tr>
<tr>
<td>Category III</td>
<td>Emerging Technology</td>
<td>Biannually-January 1 and July 1</td>
<td>6 months after release date</td>
</tr>
</tbody>
</table>

*The AMA CPT Editorial Panel meets three times per year (March 15, July 15, and November 15). #The use of Type II codes is optional. E/M = evaluation and management

The International Statistical Classification of Disease and Related Health Problems is published by the World Health Organization to assist with morbidity and mortality statistics, reimbursement systems, and automated decision support. Currently, the system used in the United States is the ICD-9-CM (clinical modifications) classification created by United States National Center for Health Statistics. This system will be replaced in the future by ICD-10-CM. Since the passage of the Medicare Catastrophic Coverage Act of 1988, physicians have been required to include the appropriate diagnosis code when submitting claims to Medicare beneficiaries. The Centers for Medicare & Medicaid Services (CMS), has designated the ICD-9-CM as the required coding system. During the billing and payment process, payors will use these codes to assist in determining whether a performed procedure has been linked to an appropriate diagnosis.

CPT Codes for Ultrasound Guidance for Needle Placement and Important Modifiers
The CPT code for ultrasound guidance for needle placement (e.g., biopsy, aspiration, injection, localization device), imaging,
“Some of the interventional pain procedures performed with ultrasound guidance do not have a specific CPT code.”

Modifiers that are often incorporated when performing ultrasound-guided interventional procedures include -26 professional component and -50 bilateral procedure modifiers. The 76942 code is a global service code which includes a technical component as well as a professional component. Based on site of service payment rules, a modifier may be required. In a hospital-based setting, the code is billed by the facility with the technical component. Based on site of service payment rules, a modifier may be required. In a hospital-based setting, the code is billed by the facility with the technical component. Depending on the site of service and the provider, the modifier is not required and the global/non-facility fee may be billed.

Specific CPT Codes for Ultrasound-Guided Interventional Pain Procedures

Certain interventional pain procedures have been assigned specific CPT codes that incorporate ultrasound guidance into the definition. Examples include Category III codes for transforaminal epidural injections, anesthetic agent and/or steroid procedures (Table 3). Category III codes also exist for cervical, thoracic, or lumbar procedures targeting the facet (zygapophyseal) joint or the nerve innervating the joint (Table 4). The sunset date for these codes is January 2016.

Table 2: Documentation and Image Requirements for CPT Code 76942

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanently recorded image of the site to be localized</td>
<td></td>
</tr>
<tr>
<td>An image of the needle in the target is not specifically mentioned as one of the coding requirements. Although, most billing compliance departments recommend this practice.</td>
<td></td>
</tr>
<tr>
<td>The image should be retained in the patient record or an archival system</td>
<td></td>
</tr>
<tr>
<td>Must be billed in addition to the code for the primary procedure</td>
<td></td>
</tr>
<tr>
<td>Placement of modifier -26 when billing for the professional component only</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Transforaminal Epidural Injections*

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Fluoroscopic-Guidance or CT-Guidance</th>
<th>Ultrasound-Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical or Thoracic, Initial Level</td>
<td>64479</td>
<td>0228T</td>
</tr>
<tr>
<td>Cervical or Thoracic, Each Additional Level</td>
<td>67780</td>
<td>0229T</td>
</tr>
<tr>
<td>Lumbar or Sacral, Initial Level</td>
<td>64483</td>
<td>0230T</td>
</tr>
<tr>
<td>Lumbar or Sacral, Each Additional Level</td>
<td>64484</td>
<td>0231T</td>
</tr>
</tbody>
</table>

*Fluoroscopic and computerized tomographic (CT) guidance are bundled into the transforaminal epidural injection codes, requiring that either fluoroscopy or CT were used to perform these injections. Ultrasound is not used as part of the descriptor for these codes and therefore, if ultrasound-guidance is used, then one of the newly created Category III codes should be reported instead. These bundled codes are reported per level performed. However, if multiple injections are performed at a single level on the same side, the code can only be reported once. For bilateral procedures, report modifier -50. Caution is advised when performing transforaminal epidural steroid injections or nerve root blocks under ultrasound guidance due to the potential for devastating complications.

Table 4: Paravertebral Facet Injection Procedures*

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Fluoroscopic-Guidance or CT-Guidance</th>
<th>Ultrasound-Guidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical or Thoracic, Single Level</td>
<td>64490</td>
<td>0213T</td>
</tr>
<tr>
<td>Cervical or Thoracic, Second Level</td>
<td>64491</td>
<td>0214T</td>
</tr>
<tr>
<td>Cervical or Thoracic, Each Additional Level</td>
<td>64492</td>
<td>0215T</td>
</tr>
<tr>
<td>Lumbar or Sacral, Single Level</td>
<td>64493</td>
<td>0216T</td>
</tr>
<tr>
<td>Lumbar or Sacral, Second Level</td>
<td>64494</td>
<td>0217T</td>
</tr>
<tr>
<td>Lumbar or Sacral, Each Additional Level</td>
<td>64495</td>
<td>0218T</td>
</tr>
</tbody>
</table>

*Similar to transforaminal injections, ultrasound-guidance is not included in the paravertebral facet injection procedure descriptor, therefore, if ultrasound-guidance is used in place of fluoroscopic-guidance or CT-guidance, one of the bundle ultrasound-guidance Category III codes should be used.
Challenges and Correct Coding Initiatives for Ultrasound-Guided Pain Procedures

Many of the pain management codes are subject to the National Correct Coding Initiatives (NCCI) which were developed by the Centers for Medicare and Medicaid Services (CMS) in order to prevent inappropriate payment of services that should not be reported together. The NCCI are updated quarterly. Two edit tables exist, the Column 1/Column 2 Correct Coding Edit Table and the Mutually Exclusive Edit Table. The edit tables list pairs of CPT codes which are not separately coded and payable except under certain circumstances. The NCCI refers specifically to Medicare and Medicaid claims, although many other payors recognize them. Examples of procedures that are listed in the Column 1/Column 2 Correct Coding Edit Table with the fluoroscopic guidance codes (77002 and 77003) are the stellate ganglion block (CPT Code-64510) and intercostal nerve block (CPT Code-64421). Therefore, for these procedures, the fluoroscopic guidance code is not reimbursable. Currently, the ultrasound guidance code has not been listed in NCCI tables for these procedures; thus it can be billed in addition to the primary procedural code.

A common question encountered when incorporating ultrasound-guided interventional pain procedures is whether it is appropriate to bill for both ultrasound and fluoroscopic guidance if both of these modalities are used during an interventional procedure. In Chapter 9 of the NCCI Policy Manual for Medicare Services for Radiology Services, it states that it is only appropriate to bill for one form of radiological guidance for needle placement at a single patient encounter, regardless of the number of needle placements performed. For example, if a pain physician performed an interventional pain procedure and utilized both ultrasound and fluoroscopic guidance for needle placement, only one form of radiological guided needle placement should be billed.

Some of the interventional pain procedures performed with ultrasound guidance do not have a specific CPT code. The transversus abdominis plane block is an example of a procedure that does not have a specified code. In this case, the CPT code 64450 (Injection, anesthetic agent; other peripheral nerve or branch) is often reported.

A final reimbursement challenge encountered with ultrasound-guided pain procedures is that certain medical coverage policies have deemed ultrasound not medically necessary (e.g., trigger point injections) or unproven for specific procedures (e.g., lumbar facet procedures and sacroiliac joint). Therefore, it is important that healthcare professionals and coders routinely review Local Coverage Determination (LCD) and National Cover Determination (NCD) policies as well as private insurers’ medical policies. In addition, it will be important that we further advance the scientific foundation of ultrasound-guided pain procedures.

Conclusion

This article should serve as a general introduction to coding, billing, and documentation for ultrasound-guided pain procedures. Practitioners and medical coders must remember that coding, reimbursement policies, and regulations are subject to change and may vary by locality and payor. We encourage practitioners to routinely check LCD and NCD policies, NCCI edit tables, and third party medical and reimbursement policies for further coding and billing guidance.

References
Complications of Intrathecal Drug Delivery Systems: Granulomas

Intrathecal drug delivery systems (IT-DDS) have gained acceptance beyond cancer pain therapy, most notably in patients with failed back syndrome and spinal arachnoiditis. As these devices are being used for more indications, and as the patients using these devices are living longer, more device-related complications are being discovered. One such complication is that of inflammatory mass formation, collectively described as intrathecal granulomas. 1-3

Reported cases reveal that a majority of diagnosed granulomas may be located at the catheter tip in the subarachnoid space. There are many proposed theories regarding the etiology of granuloma formation including infection, reaction to catheter material, implantation trauma, and the infusate itself. A majority of the cases published over the past 20 years have been associated with morphine as the infusate, and the consensus is that dose-dependent effects of morphine are the likely cause of granulomatous formation. 4-8 with some authors suggesting an association with morphine doses greater than 10 mg/d. 9 There have also been reports of granulomatous regression with discontinuation of morphine, which provides support to its identification as the causal agent. 8 Other drugs linked to granuloma formation include hydromorphone and fentanyl when combined with accumulation of high infusate concentrations in the local vicinity of the catheter tip. 2,10

We recently treated a patient who developed an intrathecal granuloma at the leakage site between a morphine pump and its proximal catheter. 11 The patient was initially maintained on an infusion of 10.5 mg/d of morphine sulfate and 5.3 mg/d of bupivacaine, which was titrated to a maximum of 15.0 mg/d of morphine sulfate and 9.0 mg/d of bupivacaine to achieve desired analgesia. Four years after implantation and adequate pain control, the patient began to have a recurrence of her previously-treated pain. An x-ray revealed a hub fracture in her IT-DDS. We treated the recurrent pain with oral analgesics and continued the intrathecal opioid infusion to achieve adequate analgesia. We planned to remove the device at a later date; however, she reported a resumption of pain relief after 12 weeks of conservative management. Months later, her pump was nevertheless extracted for low battery. On explantation, we found a granulomatous formation surrounding the pump nozzle and hub connector which had sealed the fractured hub and recreated a conduit, presumably allowing the patient to regain adequate analgesia after initial decline. 11 We believe the cause of the granuloma formation was due to the morphine infusate itself. The patient did not report or present with any signs of infection, trauma to catheter site, or reaction to the catheter material. Our conclusion was based on the fact that our patient required a higher than recommended daily dose of morphine (15.0 mg/d) although there have also been reports of granuloma complications at lower morphine doses when used in combination with bupivacaine. 12

Diagnosis:
Intrathecal granomas are usually clinically-relevant, with loss of therapeutic effect and/or symptoms related to spinal cord compression. Signs and symptoms to be aware of include loss of therapeutic efficacy, the need to adjust medications to achieve adequate pain control, and any new neurologic deterioration including, but not limited to, new onset motor weakness, sensory loss, and any new bowel or bladder sphincter dysfunction. 2,13 The gold standard for diagnosing intrathecal granulomas is a T1-weighted MRI which reveals the ring enhancing lesion. A CT myelogram is an alternative imaging modality that can be used to identify the level of the catheter tip, and is also utilized to distinguish the granulomatous mass from the spinal cord. 2,13

Treatment:
Once diagnosis of the granuloma is confirmed, treatment is dependent on the patient’s clinical symptoms. Conservative management, which includes discontinuing the patient’s current infusate, and converting to another therapeutic regimen, is appropriate if the granulomatous mass is an
incidental finding and the patient reports no symptoms.\textsuperscript{2,13} Patients should receive close follow up and serial MRIs to document resolution of the intrathecal mass if conservative management is chosen.

An alternate approach includes revising or replacing the catheter if the patient reports loss of drug effect but denies mass effect. Catheter revision should be performed in an awake patient and includes repositioning the indwelling catheter caudally one or two interspaces.\textsuperscript{2} If the patient reports neurologic sequelae, including loss of bowel or bladder function with significant motor loss, then neurosurgical consultation should be sought.

**Conclusion**

Intrathecal granulomas are a serious complication of IT-DDS, which can result in increased morbidity and mortality for patients. It is important for the implanting physician to have an understanding of the diagnosis, management, and appropriate treatment regarding these inflammatory lesions.

**References**


Christopher M. Bernards, M.D.

Chris Bernards died on January 12, 2012, slightly more than a year after being diagnosed with an inoperable brain tumor. He was 53 years of age.

One could fill a book simply repeating his accomplishments in regional anesthesia and pain medicine. Much of what we know regarding the migration of drugs from the epidural space to the spinal cord is because of Chris; he authored numerous original articles and books; he received the Bonica Award in 2003; he lectured far and wide. Chris was a fabulous athlete, a photographer, master gardener, and woodworker, a demanding teaching, and a superb clinician. For those of us fortunate enough to have been blessed by his wit and brilliance, Chris was a devoted friend and colleague who nourished our souls and challenged our minds. The regional anesthesia and pain medicine community has lost one of its brightest stars – researcher, teacher, scholar, and dear friend.

Chris is survived by his wife Elizabeth and their four children, his parents Walter and Jerry, and his four siblings.

Written by: Joseph M. Neal, M.D.
Anesthesiology Faculty – Virginia Mason Medical Center – Seattle, WA
According to the teachings of Gaston Labat, a regional anesthesiologist must have “a thorough knowledge of descriptive and topographic anatomy.” The intent of this article is to propose some clinical questions about anatomy and nerve blocks in the posterior triangle of the neck. The advent of ultrasound imaging and the application of cross-sectional anatomy and cryomicrotomography have challenged what we have been taught from early descriptions of regional block in the neck. References from a variety of anatomic resources have been included to attempt to answer these questions, or show a lack of consensus where it exists, and it is expected that additional questions and controversies may result from the interpretations expressed herein.

Question 1) Interscalene Block and Neuraxial Spread

• Employing the standard lateral approach to the interscalene block (ISB) introduced by Winnie in 1970, the needle enters behind the posterior border of the sternocleidomastoid muscle at the level of the cricoid cartilage, and is inserted “mesiad, dorsad, and slightly caudad.” The rationale for the caudad angulation is to minimize the potential for the needle entering the intervertebral foramen and causing epidural or spinal anesthesia, but numerous cases of just such an occurrence have been reported. Do the dural root sleeves extend beyond the intervertebral foraminae, such that a properly placed interscalene block needle can still lead to injection into the subdural or subarachnoid space causing total spinal anesthesia? If they do not, can we assume epidural or spinal block from ISB requires needle passage into or through the intervertebral foramen?

Based on the anatomy, it appears that neuraxial spread may occur even with the needle outside the intervertebral foramen. A number of investigators have described the gross and microscopic anatomy of the spinal nerves. From the spinal cord, the dorsal and ventral rootlets form respective roots at each segmental level, which pierce the dura and carry their own dural sheath distally, the dorsal root identified by its ganglion. These roots join in the intervertebral foramen to form a single mixed spinal nerve (Fig 1A). Within the foramen and along the gutter of the transverse process, the nerve has attachments to the margins of the foramen. Just distal to the foramen, the spinal nerve divides to a smaller dorsal ramus which curves posteriorly around the articular process, and a larger ventral ramus which receives sympathetic fiber contribution from the gray ramus communicans and continues beyond the gutter of the transverse process to join other ventral rami and form the cervical and brachial plexuses (Fig 1B). There is some controversy as to whether the dura is continuous with the epineurium with others contending the dura is continuous with the perineurium. If dura is continuous with perineurium, then a needle placement outside the foramen, but deep to the perineurium of the cervical “roots” (ventral rami) could produce neuraxial block. This central spread of injection from intra-fascicular, intraneural sciatic injection in rabbits was shown at the sacral level by Selander in 1978. If, on the other hand, the dura is continuous with the epineurium rather than the perineurium, then even subepineurial, extrafascicular injection into the cervical roots could result in central spread of local anesthetic. In addition, arachnoid projections and meningeal cysts extending beyond the foramen have been described, as another potential mechanism for neuraxial block with ISB.

With regard to the motor and sensory fascicular arrangement of the ventral rami of the cervical spinal nerves, additional controversy exists. Certainly, within the intervertebral foramen at the juncture of the dorsal and ventral roots, the dorsal root fibers are situated posteriorly and superiorly to the ventral fibers. Beyond the division of the spinal nerve into dorsal and ventral rami, and past the transverse process; however, histologic studies of the ventral ramus in humans, and fluorescent pigment transport studies in rats have shown a mixing of sensory and motor fascicles. Others have contended that sensory fibers remain dorsal, and motor fibers are ventral in the ventral ramus of the spinal nerve.
beyond the transverse process,” but this does not address where fascicular crossover occurs which is necessary before formation of the anterior and posterior divisions of the plexus destined for the flexor and extensor portions of the upper limb, respectively.

**Fig 1A:** Horizontal section through the cervical spine at C7 showing the dorsal root ganglion and ventral root forming the mixed spinal nerve. Particulate green ink was injected into the thoracic epidural space prior to section (Image provided courtesy of Quinn Hogan, MD).

**Fig 1B:** Diagrammatic representation of a cervical spinal nerve at C5, with dorsal and ventral roots, then dorsal and ventral rami. The text comments that “the dura mater . . . forms the root sheath . . . which is continuous with the epineurium of the nerve” (Reproduced with permission from Gray’s Anatomy, British Edition, 35th ed. Philadelphia: W. B. Saunders, 1973).

**Question 2) The Brachial Plexus Sheath**

- Dr. Winnie also popularized a concept of a tubular fascia surrounding the brachial plexus from transverse processes to the axilla. Is such a tubular fascia demonstrated on microscopic sections? If not, is there still a confined anatomic space through which nerves and vessels pass and created by the posterior fascia of the anterior scalene, and the anterior fascia of the middle scalene?

A defined, cylindrical, sheath-like layer of fascia is not apparent on horizontal sections of the cervical spine; the fascial layers are more convoluted and complex. The anatomic text Gray’s Anatomy discusses the cervical fascia in detail, with the superficial cervical fascia described as a region of loose connective tissue containing the platysma muscle and extending between the dermis and deep cervical fascia. In contrast, the deep cervical fascia has both loose and dense fibrous tissue which invests the muscles, nerves and blood vessels of the neck, and has two layers (superficial and deep). The superficial layer of deep fascia runs from the midline anteriorly, covers the anterior triangle, divides to surround the sternocleidomastoid muscle, forms the “floor” of the posterior triangle, envelopes the trapezius, and continues to the spinous processes posteriorly. The deep layer of the deep cervical fascia begins anteriorly as the prevertebral fascia, but laterally thickens to become the carotid sheath, and further laterally invests the scalenes, cervical roots, omohyoid, and levator scapulae. This deep layer is not a single cylinder of fascia, but a complex system of connective tissue continued around vessels, nerves and muscles as they migrate embryologically (Fig 2). The brachial plexus, dorsal scapular and long thoracic and phrenic nerves originate deep to the prevertebral fascia and remain there throughout the neck unlike the spinal accessory nerve which is superficial to this layer. Although there is no tubular fascia, local anesthetic injected next to the brachial plexus is still confined by muscular, bony, and fascial structures and follows the course of the nerves and vessels within those boundaries. This was demonstrated by dye injection through brachial plexus catheters with CT scanning. The concept of the brachial plexus “sheath” continues to be debated in the literature, however, and such a tubular structure was described.
grossly with dissection and injection in embalmed and unembalmed cadavers.\textsuperscript{11}

**Question 3) Superficial Cervical Plexus (SCP) Block with ISB**
- The superficial cervical plexus (SCP) travels around the midpoint of the posterior border of the sternocleidomastoid (SCM) prior to dividing into the terminal nerves including the supraclavicular, greater auricular, and other branches. It appears common with the lateral approach to the ISB that the SCP is blocked, even though the local anesthetic (LA) is injected deep to the cervical fascia superficial to which the SCP runs.

Is this due to LA tracking along the needle into the subcutaneous tissue, or can the LA spread in the interscalene groove superiorly to anesthetize the C2-4 roots which give origin to the SCP as described by Winnie in 1975?\textsuperscript{12}

Does the interscalene “groove” or space remain defined by fascia as high as C2, or does the lower origin of the anterior scalene muscle constitute the most proximal level of the interscalene groove?

The cross sections of the neck at C5 shown in Figure 2 (Gray’s Anatomy) and Grant’s Atlas (Fig 3) do not show a defined interscalene groove, particularly above C5, and the fascia of the anterior and middle scalene do not clearly delineate an intervening trough of areolar tissue through which the cervical nerves travel. Muscle slips and vessels cross through this “groove” (Fig 4 at the C6-7 level). Of course, the superficial cervical plexus must originate from cervical nerves C2-4 below the deep fascia, and Figure 3 shows the cervical plexus below the deep cervical fascia at the C5 vertebral level. Local anesthetic (LA) injected close to the 5th cervical nerve during ISB would likely spread to anesthetize the superficial cervical plexus (and the phrenic nerve as well).

**Question 4) Phrenic Block during SCP Block**
- The proximity of the phrenic nerve to the C5 root has been well-described\textsuperscript{13} and is presumed to be the reason for unavoidable hemidiaphragmatic paralysis with the standard lateral approach to the ISB.

Since a block of the SCP is performed in nearly the same location and injection made at the posterior border of the SCM, what is the expected likelihood of phrenic block when SCP is blocked?

The cross section from Grant’s Atlas shown above (Fig 3) makes it appear likely a volume of LA used for SCP block could spread to include the phrenic nerve. Having said this, a relatively lower volume of dilute LA is typically injected compared to the higher volume and concentration used for ISB, which might make phrenic block less likely with SCP block. Phrenic block following SCP block does not appear to have been studied.

**Question 5) Posterior ISB at C7 – Proximity to Vertebral Vessels**
- An ultrasound guided approach to ISB from posterior, with the needle placed close to the posterior tubercle of C7 has been described, with a significantly reduced incidence (13%) of phrenic block using 10 ml LA.\textsuperscript{14}

What is the proximity of the needle to the vertebral and segmental arteries when it is placed just posterior to the C7 root as described by these investigators?
Referring to Gray’s Anatomy (Fig 5) below, a needle inserted close to the posterior tubercle of C7 would be only a “nerve-width” away from the vertebral vein(s) and artery. The segmental vessels may also be close to the needle placement site. References using this approach, however, had no reported incidence of blood aspiration or toxicity, and the use of ultrasound would aid in identifying these vessels.

**Fig 5:**

Horizontal section through the neck at C7 showing deep cervical fascia and the proximity of the C7 ventral ramus to the vertebral vessels (Reproduced with permission from Gray’s Anatomy (British Edition), 35th ed. Philadelphia: W. B. Saunders, 1973).

**Question 6) Variant Course of C5,6 through the Anterior Scalene**

- The literature contains reference to anatomic variation of the interscalene brachial plexus in which the roots to the upper trunk pass anterior or through the anterior scalene before entering the interscalene groove more distally, or in which a scalenus intermedius or accessory anterior scalene is described.

How commonly is this variant seen, and would it be likely to lead to failure to block the upper trunk if the LA is injected at the C7 level?

A number of references describe a relatively common variation of the brachial plexus/scalene muscle relationship where the C5 and C6 roots pass through the anterior scalene. In this study of 102 neck dissections, the C5 or C6 roots or both passed through the anterior scalene in 34%, and in 3% the C5 root passed anterior to the anterior scalene. A lower, but still significant 13% incidence of C5 passing over or through the anterior scalene was reported in a bilateral ultrasound study on 23 adults. This frequency suggests that blocks at the C5 level might fail to extend to the C7 level, but does not necessarily lead to the converse. Since the C5 and C6 roots join the C7 root to pass superior or posterior to the subclavian artery, a block at the C7 level would be likely to extend to C6 and C5. These dissections also confirm the finding from cross sections that muscle slips are often present between the roots of the plexus (see Fig 4,5 above).

The most common variations of the brachial plexus described are, in fact, attributed to a significant extradural contribution from C4 (prefixed – approx 48%) or contribution from T2 (post-fixed – approx 0.5-4%), although these percentages vary somewhat between investigators.

**Question 7) Will High-Volume ISB Reliably Block the Lower Trunk?**

- Some authors claim that the ISB will reliably provide anesthesia of C5-T1 if a large volume (40-45 ml) of LA is injected, but 5 ml is sufficient to provide block using ultrasound guidance.

If a large volume is injected, what is the likely anatomic spread of the LA, and is spread to the lower trunk of the plexus to be expected, or is there an anatomic barrier responsible for the more common result of ISB limited to C5-7 roots?

**Fig 6:**

6A: Para-Sagittal section through the base of the neck showing spacing of C5,6,7 from C8,T1 ventral rami. Left is anterior and upward is cranial; Asc – anterior scalene, Msc – middle scalene, SA – subclavian artery, arrow shows deep cervical artery (Reproduced with permission from Groen GJ, Krediet AC, Moayeri N, Bruhn J, van Geffen GJ. European Journal of Pain Supplements 2010;4:303-311).

6B: Para-Sagittal section showing C5-7 roots between the scalene muscles, separated by muscle slips from the more horizontally oriented C8 and T1 roots (Image provided courtesy of Quinn Hogan, MD; Modified with approval).

The C5-7 ventral rami are characterized by an intermuscular
(interscalene) position with a significantly more oblique, caudal angulation, and are separated by some millimeters from the C8-T1 spinal nerves which are close to the subclavian artery (Fig. 6A, B) and have a more horizontal course after exiting the transverse process. In addition, arteries and nerves may cross between upper and lower trunks of the plexus (see below), but neither these vessels nor other structures create a true anatomic barrier to LA spread. The LA will likely spread along the path of lowest resistance, which may be around the anterior surface of the anterior scalene and into the prevertebral space, rather than caudad to reliably surround the entire plexus. This could be evaluated by ultrasound, but has not as yet been investigated.

**Question 8) With Posterior ISB, where are the Spinal Accessory, Dorsal Scapular and Long Thoracic Nerves?**

- Ultrasound guidance has produced many variations on common techniques for nerve block, and a posterior approach to the ISB for single-shot or continuous blockade has been described. With this approach, the needle is inserted at the anterior edge of the trapezius, and passes through the levator scapulae and middle scalene muscles to reach the interscalene groove. Some authors have suggested this posterior needle insertion puts certain nerves at risk, including the long thoracic and dorsal scapular nerves.

What are the anatomic course of the spinal accessory, dorsal scapular and long thoracic nerves, and how close might a needle pass to these nerves with the posterior approach?

First, the spinal accessory nerve crosses the posterior triangle from above the midpoint of the sternocleidomastoid to enter the trapezius muscle just deep to its anterior surface (Fig 7). The long thoracic nerve to the serratus anterior originates posteriorly from the ventral rami of C5-7, and these branches may pass anterior, through, or posterior to the middle scalene muscle with the C7 branch most likely anterior to the middle scalene. The dorsal scapular nerve originates primarily from C5 and pierces the middle scalene muscle coursing posteriorly on the deep surface of the levator scapulae which it innervates, before continuing on to innervate the rhomboids. The innervated muscles elevate the shoulder, and a stimulating needle advanced toward the brachial plexus at C5 may cause shoulder elevation when posterior to the C5 root. All these nerves are at some risk of needle proximity when a needle is introduced at the anterior edge of the trapezius and advanced through the levator scapulae and middle scalene muscles (Fig 8), although the dorsal scapular is the most medial and deep and least likely of the three to be contacted. The course of these nerves may justify nerve stimulation during posterior approach to the interscalene brachial plexus even when the plexus is easily visualized by ultrasound; stimulation may alert the anesthesiologist to proximity to these non-target nerves and a need for needle redirection.

**Question 9) What Arteries and Veins are at Puncture Risk during ISB (and Supraclavicular Block)?**

- A number of relatively large named arteries (and veins) cross from anterior to posterior in the posterior cervical triangle in

![Fig 7: Dissection of the posterior triangle in an unembalmed cadaver, showing the spinal accessory nerve and its course from under the sternocleidomastoid, over the levator scapula and then under the anterior edge of the trapezius muscle.](image-url)

![Fig 8: Horizontal section through the left half of the neck at C5, with identification of the spinal accessory nerve (Reproduced with permission from Gray's Anatomy, British Edition, 35th ed. Philadelphia: W. B. Saunders, 1973).](image-url)
close proximity, and sometimes passing through the brachial plexus. These vessels include the suprascapular, transverse cervical and dorsal scapular arteries.

What are the common courses of these vessels, and the risk of puncture with ISB (and supraclavicular) nerve block? Conversely, why don’t we seem to hit these vessels more often with “blind” techniques?

Branches of the subclavian artery and thyrocervical trunk course superficial to, and through the brachial plexus routinely (Fig 9, 10). The thyrocervical trunk gives branches which pass around the anterior border of the anterior scalene. It gives origin to the ascending cervical artery which runs close to the phrenic nerve, and also the suprascapular artery which cross superficial to the plexus low in the neck or retroclavicular, and is joined by the suprascapular nerve before entering the suprascapular notch. The transverse cervical, also known as the superficial cervical artery, also arises from the thyrocervical trunk and crosses the posterior triangle of the neck cephalad to the suprascapular, and superficial to, or through the brachial plexus. The dorsal scapular artery, also known as the deep cervical artery, commonly arises directly from the subclavian and passes most often between the C8 and C7 rami of the plexus, posterior to the subclavian artery before coursing dorsally to anastomose with the superficial cervical artery along the medial border of the scapula. Pressure from palpating fingers or from a transducer may compress these vessels and make them less likely to be punctured during brachial plexus block, and short bevel needles may be less likely to puncture arterial walls, but it is not obvious why these moderate-sized arteries and accompanying veins are not punctured more regularly.

Conclusions:
The regular use of ultrasound during regional anesthesia, as well as the availability of sophisticated techniques of anatomy and histology, has led to a re-evaluation of the tenets of earlier regional anesthesia teaching. In addition, the application of this anatomic knowledge to empiric clinical findings during regional blockade may help us better understand the results of our blocks, and perhaps even modify our approaches with a goal to enhance safety and/or success. Engaging anatomists in such discussions is the next step, and applying this question-and-answer approach to other block regions is encouraged.

References:
7. Boezaart AP. That which we call a rose by any other name would smell as sweet—and its thorns would hurt as much. Reg Anesth Pain Med. 2009; 34:3-7.

For the full reference list, please see the online version at: http://www.asra.com/publications-newsletters.php.

Fig 9: Para-sagittal sections at the neck base demonstrating the location of the superficial cervical artery (sca) and suprascapular artery and vein (ssa, ssv). ASM – anterior scalene, MSM – middle scalene, SA – subclavian artery, SV subclavian vein (Reproduced with permission from Groen GJ, Krediet AC, Moayeri N, Bruhn J, van Geffen GJ. European Journal of Pain Supplements 2010;4:303-311).

Fig 10: Horizontal section of the neck at C7 showing Deep Cervical Artery and Vein crossing between the rami of the brachial plexus (Source: U.S. National Library of Medicine’s Visible Human Project).
Extending Pain Medicine Fellowship Training:
The Time is NOW.
Pain medicine fellowship training must be extended to graduate physicians who provide exceptional clinical care and advance the field of pain medicine.

Our current 1-year pain medicine fellowship-training curriculum and requirements are built on a model for 18-24 month training. With the institution of the revised curriculum in 2007, pain medicine fellows are gaining LESS clinical experience in the core of pain medicine training. This is in a time when MORE clinical treatments are becoming readily available to patients. As trainees are asked to devote clinical time to the core rotations in anesthesiology, neurology, physical medicine and rehabilitation (PM&R), psychiatry/psychology and acute/inpatient pain, there is less opportunity for fellows to provide clinical care for patients with chronic and cancer pain. Although these “outside” rotations may provide meaningful clinical exposure, extra time is needed to evaluate and treat patients with chronic pain that are more similar to who they will be treating upon completion of their fellowship.

The stated goals of the revised curriculum are honorable and important:
1. Develop better pain physicians
2. Unify training across specialties
3. Open training in Pain Medicine to more physicians

1 Year versus 2 Year Pain Fellowship – Is it an issue of time or of priorities?
Is there ever enough medical training? Is training ever done? The answer to these questions is clearly no and never, respectively. The more important question may actually be when the appropriate transition point between learning through apprenticeship and independent practice occurs. Another question is whether we offer additional benefit to our fellows by mandating a second fellowship year.

My position in this article is that the current condition of pain medicine fellowships is not ideal. This imperfect condition results from a series of compromises resulting from the need for education expansion of pain fellowships to include a more multidisciplinary curriculum. The move away from anesthesiology-pain focus reflects the need for a more balanced approach to pain medicine. This appropriate and correct goal of comprehensive pain medicine directly competes with legacy commitments to pain clinics and hospitals. Fundamentally, it is a conflict between pain medicine education with pain medicine service. Therefore, the question I raise is whether an expansion to two years is necessary or good for the education of the fellows and the discipline of pain medicine if it means the educationally-flawed status quo continues over a two-year period.
In creating the most recent curriculum requirements (effective 2007), the anesthesiology residency review committee (RRC) asked:

“How could the program requirements be made stringent enough to prevent the continual reaccreditation of programs that offer nothing more than technical training in acute postoperative pain management without exposing trainees to the broad scope of the multidisciplinary management of chronic pain?”

Unfortunately, the implementation of these requirements into a 12-month pain medicine fellowship has limited the amount of time devoted to core pain medicine training. Initially, the plan for the “new” program requirements (2002-2004) was to develop a 2-year pain medicine fellowship; however, polling of anesthesiology residents at that time found that they would be less likely to enroll in fellowship training upon completion of their residency. Subsequent attempts to create an 18-month curriculum that integrated with the fellows’ core residency program proved challenging. This would have required possible revisions in the core curriculum of the 4 residency programs (anesthesiology, physical medicine and rehabilitation, neurology, psychiatry). When neither option seemed attainable, we ended up with our current 1-year curriculum.

Although the integrative fellowship proved unsuccessful at that time, similar programs exist in anesthesiology and critical care integrative residency/fellowship programs. Recently, the American Board of Anesthesiologists (ABA) approved the template for an innovative combined anesthesiology residency and pain medicine fellowship program. This program provides an additional 12 months of training spread throughout the continuum of education between the clinical based year (CBY) and CA-3 years followed by a final 12 months focused on training in Pain Medicine with expanded options for elective rotations and/or conduct of meaningful research, for a total of 22 months of training in Pain Medicine (Tables 1 and 2, courtesy of James Rathmell, MD). Exposure to the core disciplines of neurology, physical medicine & rehabilitation, and psychiatry is provided through one-month rotations in these disciplines during the CA-1 through CA-3 years. Specific rotations in the care of patients with chronic and/or cancer-related pain are included in each year of the 5-year training continuum. There is certainly the potential for parallel integrative residency/fellowships in the other core disciplines.

Currently, a handful of “2-year fellowship” programs exist. Essentially, most of these programs consist of a 12-month fellowship program followed by a second year devoted to limited (typically 20%-50%) clinical care as junior faculty and the remainder as academic time. Given the dearth of current pain medicine research, this is an important endeavor; however, even in a 2-year program, there is limited time available to get a quality clinical trial approved through an institutional review board, initiated, and completed.

Although other organizations (AAPM/ABPM) have proposed a completely separate specialty of Pain Medicine with its own training program, it is important to note that a 3-year residency would result in at least 2 years LESS clinical medicine exposure than the current system (4 year residency + 1 year fellowship). If the goal is to increase depth and breadth of exposure, this will fall short. Also noteworthy, this same group does not currently require ANY advanced training beyond residency, rewarding those with certification that is recognized as American Board of Medical Specialties (ABMS)-equivalent in some states (California, Florida, Texas, and Oklahoma). Although the ABPM provided an alternative pathway to certification when Pain Medicine was only available to anesthesiologists in the 1990s, this has not been true over the last decade. Yet, this group continues to exist and provides an “alternate path to training” for those who have not completed training in an ACGME-accredited pain medicine fellowship. It is worth noting that accredited programs have opened training to physicians in other primary fields outside of the core disciplines, including trainees from family medicine, internal medicine, emergency medicine, and radiology among others.
Table 1: Yearly Rotation Allocation for Conventional and Innovative Programs

<table>
<thead>
<tr>
<th>Year of Training</th>
<th>Anesthesiology Program (Conventional) Followed by Pain Medicine Fellowship</th>
<th>Combined Anesthesiology and Pain Medicine Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Required Months of Specialty Rotations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anesthesiology</td>
<td>Pain Medicine</td>
</tr>
<tr>
<td>CBY</td>
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<td>0</td>
</tr>
<tr>
<td>CA-1</td>
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<td>1</td>
</tr>
<tr>
<td>CA-2</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>CA-3</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>CA-4/Fellowship</td>
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<td>12</td>
</tr>
<tr>
<td>Total (CA1-4)</td>
<td>33</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 2: Detailed description of training requirements at each level of training in the combined Anesthesiology and Pain Medicine Program

<table>
<thead>
<tr>
<th>Year of Training</th>
<th>Specific Description of Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBY</td>
<td>Two (2) months of training in Pain Medicine in a hospital or ambulatory setting responsible primarily for the care of patients with chronic or cancer-related pain. Two (2) months in specialty specific training (neurology, psychiatry, or physical medicine &amp; rehabilitation). Eight (8) months meeting all other requirements for CBY level of training in Anesthesiology.</td>
</tr>
<tr>
<td>CA-1</td>
<td>Two (2) months of training in Pain Medicine to include: One (1) month in a hospital or ambulatory setting responsible primarily for the care of patients with chronic or cancer-related pain, on an acute postoperative pain service, or on a rotation designed to focus on regional anesthesia. One (1) month in specialty specific training (neurology, psychiatry, or physical medicine &amp; rehabilitation). Ten (10) months meeting all other requirements for CA-1 level of training in Anesthesiology.</td>
</tr>
<tr>
<td>CA-2</td>
<td>Two (2) months of training in Pain Medicine to include: One (1) month in a hospital or ambulatory setting responsible primarily for the care of patients with chronic or cancer-related pain, on an acute postoperative pain service, or on a rotation designed to focus on regional anesthesia. One (1) month in specialty specific training (neurology, psychiatry, or physical medicine &amp; rehabilitation). Ten (10) months meeting all other requirements for CA-2 level of training in Anesthesiology.</td>
</tr>
<tr>
<td>CA-3</td>
<td>Four (4) months of training in Pain Medicine to include: One (1) month in a hospital or ambulatory setting responsible primarily for the care of patients with chronic or cancer-related pain, on an acute postoperative pain service, or on a rotation designed to focus on regional anesthesia. One (1) month in a hospital or ambulatory setting responsible primarily for the care of patients with pain near the end of life (palliative and/or hospice care). One (1) month in specialty specific training (neurology, psychiatry, or physical medicine &amp; rehabilitation). Eight (8) months meeting all other requirements for CA-3 level of training in Anesthesiology.</td>
</tr>
<tr>
<td>CA-4/Fellowship</td>
<td>Ten (10) months of training in Pain Medicine to include: Ten (10) months in a hospital or ambulatory setting responsible primarily for the care of patients with chronic or cancer-related pain. Up to four (4) months of the twelve (12) month fellowship year may be devoted to advanced clinical electives and/or conduct of research. Two (2) months of clinical anesthesiology in an operating room environment for maintenance of skills during fellowship training</td>
</tr>
</tbody>
</table>

References:
Rathmell JP. Next steps in improving subspecialty education in pain medicine. ASA Newsletter October 2010; 74(10): 12-14.

Where does this leave us? With an abundance of needs - clinical, educational, and research-oriented - that cannot be satisfied within a 12-month period. Although an integrative 18-month curriculum could satisfy the first 2 needs, the logistics of revising the core curriculum of 4 residency-training programs may prove insurmountable. Of note, anesthesiology is the ONLY one of these training programs that requires ANY documented exposure to pain medicine. As highlighted above, an integrated residency and fellowship has recently been approved through the ABA as an innovative project for programs. Clearly, the biggest limitation to extending the fellowship is allocating funding, especially at a time when continued graduate medical education (GME) funding has been threatened. This makes an integrative position even more desirable.

If innovative programs cannot be created through anesthesiology and the other core disciplines, then pain medicine fellowship training must be extended to a 2-year curriculum.
Pain medicine fellowships should focus on the development of comprehensive pain physicians (CPPs). It is time to reassess what our fellows need to know to practice comprehensive pain medicine in 2000 and beyond. Pain as a specialty has continued its shift from inpatient and operative care to the care of ambulatory patients. Why then do so many pain medicine fellows spend months (up to four months) on inpatient or hospital-based pain services caring for acute-on-chronic operative or chronic pain inpatients? Although it is important for these fellows to learn the basics of inpatient pain management, is it worth 25-35% of their educational experience? Does inpatient care outweigh the importance of other aspects of pain medicine education? Neither the ACGME pain fellowship guidelines state nor do I believe this focus or time commitment is warranted. A more practical approach is that the mainstay of inpatient pain services should be ceded to the perioperative or acute pain services or another hospital-based service. The pain fellows should rotate through this service on a limited basis (2 weeks to 1 month) and then focus the remainder of their inpatient time taking care of inpatient palliative care patients. The CPP can be trained following the ACGME guidelines by incorporating strong rotations in multiple medical specialties. In Physical Medicine and Rehabilitation (PMR), trainees should spend significant time with musculoskeletal PMR physicians to learn and develop improved musculoskeletal exam skills. Gaining a musculoskeletal perspective on electromyography/nerve conduction studies as well as peripheral joint therapy can add significant value. In Neurology, trainees should learn the subtleties of the neurological exam, headache exam and treatment, and spine film interpretation. In Psychology/Psychiatry, trainees learn the diagnosis and treatment of addiction disorders and the management and treatment of co-morbid psychological disturbance in pain patients. Additional rotations in neurosurgery, neuroradiology, and physical therapy are also essential to the development of the CPP. The goal of this diverse training is not to raise the CPP to the level of expert in each of these fields, but rather to allow them to appropriately diagnose and refer or treat complex patients. Although most program directors and pain physicians can agree that these are appropriate goals, they are rarely achieved anywhere but on paper. The question is why.

Prior to 2007, the ACGME did not require these multidisciplinary rotations; therefore pain fellows spent time in either the inpatient pain service or the pain clinic with an elective here or there. Programs and institutions developed a reliance on the pain fellows for service on their inpatient pain services, as discussed above, but also for the outpatient pain clinics. After 2007, it was/is challenging for programs that became dependent on their fellow workforce to reallocate them to multiple extensive rotations outside of these traditional services; this has in part resulted in a call for two year fellowship. Many fellowships voluntarily disbanded due to the difficulty in successfully integrating the new educational mandates.

In the challenging fiscal times in which we currently practice, we need to reprioritize the educational goals of pain medicine fellowships knowing that time (directly associated to funds) is not unlimited. This is particularly true in smaller programs and/or programs dependent on Graduate Medical Education (GME) funding. It is very unlikely that GME funding will be increased to cover the expense of added fellowship years, shifting the cost of an extra year to the programs. For applicants with student loan burdens and concerns over physician payment reform, one additional year of fellowship training with associated financial adversity may result in fewer applications. Given these practical limitations, we should sacrifice traditional service rotation time commitments in order to make room for other essential educational rotations. If this is done, then I believe the one-year fellowship can be preserved, and we can produce the best, well-rounded pain physicians.
Most peripheral nerve blocks at our centre use an ultrasound-guided approach, and we were keen to develop a “real-time” ultrasound-guided approach to spinal anesthesia. While ultrasound has been described for pre-puncture scanning,1-3 few existing case reports utilizing various real-time techniques have been published.4,5 We experimented with a “modified” paramedian in-plane approach. By adding ultrasound and understanding certain unique features of lumbar vertebral sono-anatomy,6 this approach becomes less of a guessing game and success can frequently be achieved on the first pass of the needle.

The real-time ultrasound-guided spinal technique is advanced. From an imaging standpoint and a conceptual one, it is relatively-easy to teach and understand. The actual technical skills required are complex, however, and beginners may find this procedure difficult.

The technique should be approached like any other spinal anesthetic with the usual considerations, contraindications, and sterile preparation. The patient is placed in the sitting or lateral position. The ultrasound machine should be set up for a medium to deep scan with a 2-5 MHz curvilinear probe. The probe should be covered with a sterile cover and held in the non-dominant hand. The initial scan (paramedian view) should be made in the parasagittal plane just lateral to the midline of the spine starting at the level of the sacrum. The ultrasound should be moved cephalad in this plane until the lumbar laminae and spaces between can be visualized. Once the target level has been chosen, the mid-point between the two lamina should be positioned in the middle of the screen then the probe should be rotated approximately 30 to 60 degrees so that the cephalad pole of the probe moves towards the midline with the goal of maintaining a view of lamina of the caudad vertebral body (e.g., L4) and, at the same time, bringing the spinous process of the cephalad vertebral body (e.g., L3) into view (Fig. 1).

The upper part of the image is the spinous process as it translates into the lamina of the cephalad vertebra; the lower part of the image is the lamina of the caudad vertebral body (Fig. 2). The image as a whole is an oblique view of the bony components that overlie the paramedian window between two vertebrae. Think of a triangle formed by the acoustic shadow cast by the upper spinous process/lamina over the lower lamina in this oblique view (Fig. 2). If the window is wide enough (this is more common in younger patients), the ligaments and intravertebral components can be visualized.

If the window is narrow, the operator may only be able to identify the bony landmarks as describe as above. Before introducing the needle, the operator must move the probe towards midline in precisely the axis that the probe has achieved its best view to bring the target structures closer to the needle entry point otherwise the needle insertion may be too lateral.

Infiltrate skin with local anesthetic beside the lateral edge of the probe then insert the needle or introducer. A 22 gauge needle is probably the best size of needle for this technique; thinner (e.g., 25 gauge) needles bend away from the intended trajectory without any change in the feel of the needle’s advancement. However, a longer introducer may be used in conjunction with a smaller-gauge spinal needle to establish the intended trajectory and decrease the likelihood of needle wandering. This is a deep block, and needle visualization can be challenging, but continuous movement with the needle and observation of tissue movement can help with visualization. The needle should be visualized at all times and should be directed toward the base of the triangle (Fig. 2). If the image does not allow for a full view of the spinal canal, then the needle point will disappear as soon as it enters the base of the triangle shadow. At this point, the resistance to needle advancement...
should change as it enters ligament. The needle should continue to be advanced until it enters the intrathecal space, typically within 1 cm of entering the space bounded by the triangle shadow. The probe should be placed down and the local anesthetic delivered with a two-handed technique unless one wishes to visualize the injection with colour Doppler, in which case an assistant should aid in scanning.

References