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Thank You for your attention to this brief Presidential message – some may say there is nothing better to hasten your long winter’s nap.... I wish to use this opportunity to highlight three topics – a celebration of the 2012 Fall Pain Meeting, a foreshadowing of great things to come with our journal, Regional Anesthesia and Pain Medicine, and good news regarding ASRA’s accreditation as a continuing medical education (CME) provider.

I am writing this essay at the close of an extremely successful fall pain meeting. For those of you who were fortunate enough to attend this tour de force, you know of what I speak. For those ASRA members who could not attend in person, I hope that you hear enough good things about our 11th Annual ASRA Pain Meeting to entice you to begin planning to attend the 12th Annual Meeting next November 21st through 24th, 2013, in Phoenix, Arizona.

If there was a consistent comment heard outside the lecture halls in Miami Beach this past November, it was wonderment about “the energy.” For lack of a better description, attendees noted a return of the buzz, excitement, and anticipation generated at this meeting that was reminiscent of pain meetings of several years ago. By final count, there were nearly a thousand attendees from 40 different countries. The participants included over 200 residents and fellows who participated in the main meeting offerings plus programs specifically designed for their educational needs. Nearly 150 exhibitors contributed to the success of the meeting, both in terms of product display and generous financial support. Over 250 scientific abstracts and medically challenging cases were discussed by presenters from around the globe.

The John J. Bonica Award was presented to Jianren Mao, MD, PhD, of Massachusetts General Hospital / Harvard Medical School. This prestigious award honored Dr. Mao’s significant contributions to the clinical and basic science of pain mechanisms. Chad Brummett, MD, of the University of Michigan presented nearly complete data from his clinical study of fibromyalgia and phenotype. This work is the result of ASRA’s first Pain Medicine Research Award and predicts a bright future regarding how ASRA, its members, and corporate donors can support meaningful outcome research in pain medicine. Wide-ranging didactic programs and workshops covered the breadth of pain medicine, culminating with an update concerning the recent cases of fungal meningitis stemming from contaminated compounded steroid preparations.

Our community owes a great deal of gratitude to the superb meeting planning efforts led by Dan Warren, MD, Chair of the 2012 Fall Pain Meeting Scientific and Education Planning Committee. Dan’s committee of ASRA volunteers designed a program that spanned the needs of many, yet provided the detail and depth that experienced pain practitioners demand. Behind the scenes, the very capable team from our management partner, Kenes International, lived up to their reputation of meeting planners extraordinaire. If 2012 is any indication, the Fall 2013 planning team has a tough act to follow.

Please join me in welcoming Marc Huntoon, MD, as the eighth Editor-in-Chief of Regional Anesthesia and Pain Medicine. Marc’s five-year term officially began with the January-February 2013 issue of the Journal and you will begin to see his editorial vision almost immediately. Marc and I just completed negotiations on a new publisher contract, which resulted in our current publishing partner, Lippincott Williams & Wilkins (LWW), being awarded a five-year contract through 2018. You as ASRA members consistently tell us that RAPM is the most valuable benefit of ASRA membership. Hopefully by now you have had the opportunity to experience reading the Journal on an iPad using our new app, which is available for free to all Regional Anesthesia and Pain Medicine subscribers at https://itunes.apple.com/us/app/regional-anesthesia-pain-medicine/id553001337?mt=8. During 2013, look for the RAPM editorial board and LWW to solicit your input via a survey regarding the Journal’s future. As medical publishing becomes increasingly electronic, we will seek and highly value your opinion with regard to how you prefer to read the Journal – in paper format, on a tablet, via your laptop or desktop computer, or some combination thereof. Our publishing partners are anxious to work with us to increase the Journal’s electronic presence, but like the Journal’s leadership, are committed to making no major changes without seeking your guidance. When that survey shows up in your inbox, please take a few minutes to let us know what you think.

Lastly, ASRA’s raison d’être is education. Thus it is welcome news that the Accreditation Council for Continuing Medical Education has awarded the Society full CME accreditation through 2014. This accomplishment results directly from the hard work of Julie Simper, our CME Manager with Kenes Education, and Terre Horlocker, MD, and her outstanding team that comprises the ASRA CME Committee. We are all indebted to the collective service of these individuals.
In this issue, Dr. David Webb, our ASRA Resident Section Committee Chair, reports on his experiences during fellowship learning how to perform ultrasound-guided thoracic paravertebral blocks using a parasagittal, in-plane technique. David’s letter is in response to a recent “How I Do It” article published in our August 2012 issue by Dr. Myles Conroy. David reviews the relevant literature and contrasts his approach with Dr. Conroy’s presentation of the transverse approach. There is a great deal of debate regarding the ideal ultrasound-guided paravertebral block technique, and concerns over epidural spread must be considered.

The main point here is that expressing divergent views in the Newsletter is useful for all of us who seek to learn from those with more, or different, experience. Reporting variations in technique, based upon considerable experience in the clinical realm, serves to stimulate thought, encourage comparative investigations, and even influence clinical innovations in regional anesthesia. For this reason, a number of featured articles in ASRA News welcome the discussion of variable approaches to common (and uncommon) clinical problems, including “How I Do It,” “Pro-Con” forums and the “Ask the Expert” column. These types of articles frequently rely on the opinions and experiences of experts and academicians in our field, without requiring the same rigorous peer-review and scientific undergirding necessary for many of the print peer-review journals. Another recent example of encouraging discourse and thought about a technique for acute pain medicine in the last few years is the call for letters describing success (or lack thereof) with transverses abdominis plane blocks, by our previous Editor, Dr. Colin McCartney. We feel it is healthy to air these disagreements, descriptions of alternatives, and profiles of experiences, so that we all may learn from the wisdom of our colleagues.

However, variations in practice patterns or knowledge are not always useful, and may actually retard the growth of knowledge in various facets of the specialty. Another article in this issue, written by Dr. Admir Hadzic, is actually a call for consistency. A follow-up to his enlightening lecture at the 2012 ASRA Spring Annual Meeting in San Diego, this column emphasizes the importance of having a consistent nomenclature related to peripheral nerve anatomy, and its relationship to ultrasound-guided peripheral block. Specifically, how do we know where we are placing the injectate, and how do we avoid placing it in a location which may be harmful? A number of studies published recently in our peer-review journals have focused on this question, particularly with regard to the distal sciatic nerve and its surrounding investments. As Dr. Hadzic emphasizes, consistency in terminology is imperative so that practitioners can interpret the literature and act accordingly, and investigators can speak to each other with confidence that each is describing similar phenomena in a similar way. Terms such as “intraneural,” “subepineurial,” and “perineural” must be consistently applied from study to study and article to article. To that end, his commentary should be useful to all of us who endeavor to place blocks with maximal efficacy and minimal risk.

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I am very excited to invite you to the 38th Annual Regional Anesthesiology and Acute Pain Medicine Meeting, which will be held May 2-5, 2013, at the Westin Boston Waterfront Hotel (http://www.kenes.com/asraspring/). Since agreeing to serve as Chair of the 2013 Spring Annual Meeting a few years ago, I have been playing close attention to member feedback in person at conferences, via email, and through ASRA News and E-News. Past attendees have asked for more expert tips and tricks for block performance, practice management strategies, protocols for joint replacement, and evidence-based guidelines. I have also heard members say that they are tired of the “same old, same old.” With regional anesthesia workshops, private and academic, popping up everywhere, the ASRA Spring Annual Meeting needs to stay relevant. The 2013 Spring Annual Meeting program is the direct result of your comments and suggestions and features the most positive aspects of ASRA—access to experts, innovative teaching, and timely relevant topics.

In 2013, we are introducing two new workshops that emphasize practice development. The first is the simulation-based Crisis Management for the Regional Anesthesiologist workshop designed to expose attendees to, and prepare them for, the common and uncommon issues related to regional anesthesia practice. The second is a completely hands-on ultrasound-guided continuous peripheral nerve block (perineural catheter) workshop that will train attendees on all aspects of ultrasound-guided catheter insertion from start to finish.

For the “Ask the Experts” interactive demonstrations (formerly “Demonstration-Focused Workshops”), we have increased the number of faculty to enhance participant access to the experts who have been assigned to each session based on his or her clinical expertise and research on the subject matter.

The hottest topic in regional anesthesia and acute pain medicine for the past decade has been ultrasound guidance. In the upcoming 2013 Spring Annual Meeting, we dedicate a full day session to discussing the evidence basis of ultrasound in regional anesthesia. This the second such ASRA evidence-based session on this topic and will be an update of the findings published in 2010 to include many new important studies.

In addition, the ASRA practice advisory update on preventing infectious complications of regional anesthesia will take place on the first day of the meeting. Meningitis from neuraxial injections took center stage in the popular press this past year as a result of issues related to sterility in drug preparation. ASRA is committed to ensuring patient safety and maximizing patient benefits when it comes to interventional procedures, and this practice advisory update is an important aspect of fulfilling ASRA’s mission.

We are also featuring an ASRA-ESRA session dedicated to the topic of patient care protocols for joint replacement that will provide attendees with a variety of strategies from around the world that may be applicable to their own practices. Specific subtopics to be discussed include analgesia, anticoagulation, and rehabilitation.

We have dedicated one general session to practice management which will cover documentation and billing, informed consent, marketing, ambulatory perineural infusion, and other key issues. Other new lecture and session topics include pay for performance, LAST for non-anesthesiologists, new strategies for labor analgesia, acute pain management for special populations, and much much more!

The Spring Annual Meeting is “one-stop shopping” for anyone interested in regional anesthesia and acute pain medicine, and the educational opportunities take many different forms in order to meet the needs of a diverse audience. There are expert lectures with question and answer sessions, problem-based learning discussions with smaller groups, poster discussions and display sessions that showcase the latest science and clinical challenges, “Ask the Experts” interactive demonstrations with live models, and hands-on workshops. All sessions and workshops will be led by ASRA faculty and special guests including Dr. Steven Howard, co-author of Crisis Management in Anesthesiology, who will be leading our new simulation-based workshop; Dr. Brendan Carvalho, an internationally-recognized expert in Obstetric Anesthesiology and peripartum analgesia, and our colleagues from the European Society of Regional Anesthesia, Drs. Xavier Capdevila, Sybille Kozek-Langenecker and Pekka Tarkkila. We
will also have a full-day Nursing Program dedicated to regional anesthesia and pain nursing led by Sheila Hoehn from the Mayo Clinic and a special educational program for our residents and fellows (see accompanying article by Dr. David Webb).

Why should you attend the 2013 Spring Annual Meeting? Come to attend the practice advisory and evidence-based medicine updates. Participate in hands-on workshops and get answers from the experts on questions that are pertinent to your practice. Submit an abstract to present your cutting-edge research and challenging cases. Meet new people who share similar interests and may be interested in collaborating. Or, catch up with your friends and colleagues and tour the birthplace of the American Revolution and home of the Ether Dome.


Resident and Fellow Events at the 2013 Spring Annual Meeting

The 38th Annual Regional Anesthesiology and Acute Pain Medicine Meeting will be held May 2-5, 2013, in Boston, Massachusetts, at the Westin Boston Waterfront Hotel. On behalf of the ASRA Board of Directors, this year’s Spring 2013 Scientific and Education Planning Committee Chair, Dr. Ed Mariano, and the ASRA Resident Section Committee, we welcome and encourage all residents and fellows to attend the highly-regarded resident/fellow education program.

The Resident/Fellow Education Program begins the next day with a continental breakfast and incorporates the morning Refresher Course Lectures. Expert speakers will cover topics including pain mechanisms, preventing the transition of acute to chronic pain, the role of nerve stimulation, and neurologic complications. Immediately following the morning session, you will be able to participate in interactive workshops with live models which are only open to residents and fellows. These workshops will be directed by leaders in the field of regional anesthesia and acute pain medicine and translate basic science to clinical application. Following a break will be the resident and fellow forum, consisting of a panel of ASRA faculty who will be there to answer your questions about obtaining a regional anesthesia and acute pain medicine fellowship, what fellowship alumni are doing today, and any other questions you may have. Current hot topics in medicine will be also be addressed, including effects of fatigue on performance, professionalism and wellness, and global health opportunities for residents and fellows.

In addition to the Resident/Fellow Education Program, Dr. Mariano and the Scientific and Education Planning Committee have also planned an excellent general conference program, which you are highly encouraged to attend. The Resident/Fellow Education Program has been condensed this year so you can participate in the other program offerings and even enjoy the city of Boston, better known as “Bean Town.” Remember to save the date, and we look forward to seeing you there!
Shoulder pain is very common in the general population. It has been estimated that one in five individuals will suffer shoulder pain during his/her lifetime. It is responsible for 16% of all musculoskeletal complaints in the primary care setting and is only second to low back pain as the most common musculoskeletal ailment in general practice.

In most patients, chronic shoulder disorder can initially be managed conservatively with multimodal therapy consisting of activity modification, physical therapy, medications, and corticosteroid injections. This two-part series will describe ultrasound-guided injections for the long head of biceps tendon (LHB), acromioclavicular joint (ACJ), subacromial subdeltoid bursa, and glenohumeral joint with LHB and ACJ injections covered in this article. A comprehensive review has recently been published on this subject for reference.

**LONG HEAD OF BICEPS TENDON**

**ANATOMY**

The proximal part of LHB tendon is intra-articular (extrasynovial) and arises from the supraglenoid tubercle and the superior labrum. The tendon exits the joint within the bicipital groove, where an extension of the synovial lining of the GHJ invests the LHB tendon down to approximately 3-4 cm beyond the distal end of the groove. The LHB tendon is covered by the transverse humeral ligament and accompanied by the ascending branch of the anterior circumflex artery. The rotator cuff interval (RCI) is a triangular space that occupies the area between the subscapularis (SSC) and supraspinatus (SS) tendons and the base of the coracoid process. It is a space where the GHJ synovial lining extends around the biceps tendon and where the arthroscope enters the GHJ to avoid damaging the cuff tendons. Thus, this is an entry site by which an interventional pain physician can access the GHJ (Figs. 1A,B). The RCI is roofed by the rotator interval capsule, which is principally made up of the coracohumeral ligament (CHL). The RCI contains the tendon of the LHB tendon and the superior glenohumeral ligament (SGHL).

**Figure 1**

*Figure 1*  
*A) Anterosuperior view showing the rotator cuff interval, which is a triangular space between the tendons of subscapularis (anterior) and supraspinatus (posterior) muscles, and the base of the coracoid process. The roof is the coracohumeral ligament (ghosted) and the contents are the long head of biceps tendon (blue) and superior glenohumeral ligament (green).*  
*B) Cut out of the rotator cuff interval to show the content. The superior glenohumeral ligament (SGHL), a focal thickening of the glenohumeral joint capsule, runs anterior to the tendon of the long head of biceps (LHB) initially (position a). The SGHL maintains a close relationship with the LHB and subsequently inserts into a small depression above the lesser tuberosity (position b), contributing to the biceps reflection pulley (position c) to prevent the dislocation of the LHB. Reprinted with permission from http://usra.ca.*
SONOANATOMY

The patient is positioned sitting with back support and the hand supinated (“Give me your money gesture”). Place a high frequency (6-13 MHz) linear ultrasound probe over the bicipital groove (surface landmark halfway between the clavicle and anterior axillary fold). The LHB is seen as either a hyperechoic or a hypoechoic structure (anisotropy) between the greater and lesser tuberosity covered by transverse humeral ligament (Figs. 2A,B). A Doppler scan is then performed to reveal the ascending branch of the anterior circumflex artery (Fig. 2C). Doppler may also reveal increased vascularity of the tendon due to inflammation.

PROCEDURE

My preference is to use a 25 gauge 1.5 inch needle. The injectate is 2-4 mL of 0.25% bupivacaine including 20-40 mg methylprednisolone acetate and the approach is either in-plane or out-of-plane (Video 1: http://www.asra.com/publications-newsletters.php). The target is the synovial sheath. Thus a successful injection should reveal the injectate surrounding the tendon. If the tendon swells up during injection, injection should stop as it signifies intratendinous injection, and the needle should be repositioned.

LITERATURE REVIEW

Primary tendinitis (in the absence of other shoulder pathology) is rare. Biceps tendon disease can be divided into tendinitis and tenosynovitis. The latter refers to an inflamed tendon sheath with the tendon in a relatively normal shape and is more responsive to non-operative management including steroid injection. However, tendinitis is more recalcitrant to conservative therapy.

To achieve maximum benefit, steroid should be injected into the tendon sheath only and intratendinous injection should be avoided. This injection is technically difficult to achieve with palpation only, and ultrasound guidance is a reasonable method for accurate injection. There is only one study comparing the ultrasound-guided and palpation method using CT scan as the validating tool. All ultrasound-guided injections reached the tendon sheath but one-third of injections by palpation did not reach the tendon sheath. Correct placement of injectate results in better outcome. In a prospective randomized trial, ultrasound-guided injection resulted in greater improvement in pain score and Constant-Murley score (measuring pain, ADL, range and strength) over the palpation method. The mean follow up time was 33 weeks (range 24 to 56 weeks). The visual analog scale score decreased from 7.1 ± 2.3 before injection to 4.2 ± 3.1 at follow-up with blind method and from 6.9 ± 2.6 to 2.1 ± 1.9 in the ultrasound-guided group (p <0.05). The Constant-Murley score improved from 31.4 ± 11.6 before injection to 73.5 ± 19.2 at follow-up and from 32.5 ± 14.7 to 85.5 ± 10.3 (p <0.01) in the palpation group and ultrasound–guided injection groups respectively. A total of 9 patients in the palpation group and 5 patients in the ultrasound guided injection groups were refractory to the steroid injections. Follow-up arthroscopy in patients refractory to treatment demonstrated severely frayed LHB tendons in 44% of the patients in blind injection group compared to 100% of the patients in the ultrasound-guided injection.
Based on these findings the authors concluded that patients with intratendinous pathology were more recalcitrant to conservative treatment including corticosteroid injections.

**ACROMIOCLAVICULAR JOINT**
The ACJ injection is commonly used as a diagnostic test to localize the source of pain in ACJ injury. The main therapeutic indication for ACJ injection is arthritis (post-traumatic and osteoarthritis). Although the radiological evidence of osteoarthritis in ACJ is in the range of 50–60%, the prevalence of clinically symptomatic ACJ osteoarthritis is lower. In contrast, arthritis following trauma to ACJ is more common due to the frequency of injury to this vulnerable joint.

**ANATOMY**
The ACJ is a diarthrodial joint located between the concave medial end of the acromion and the convex lateral end of the clavicle, with dual neural innervation from both the suprascapular nerve and the lateral pectoral nerve (Fig. 3). It has limited range of motion, primarily rotation and translation in the anterior-posterior and the superior-inferior planes. The articular surfaces are made up of hyaline cartilage and are separated by a wedge-shaped fibrocartilaginous disk either partly or completely. By early adulthood, the disk is usually little more than a fibrocartilage remnant. The ACJ is stabilized both by static and dynamic stabilizers. Static stabilizers include the acromioclavicular ligaments (superior, inferior, anterior, and posterior), the coracoclavicular ligaments (trapezoid and conoid), and the coracoacromial ligament. Dynamic stabilizers include the deltoid and trapezius muscles.

**SONOANATOMY**
The patient is positioned sitting or supine with arm neutral because the deep joint space is the widest in this arm position. A high frequency linear array probe (6-13 MHz) is used for this procedure. The initial scan is obtained with the probe over the joint in the coronal plane (medial part of probe in line with clavicle initially). The probe is then moved anterior-posterior to obtain the best view of the ACJ (hyperchoic ends of acromion, distal clavicle, fibrocartilaginous disk, superior joint capsule; Video 2, http://www.asra.com/publications-newsletters.php).

**PROCEDURE**
Because the target is superficial, a 25 gauge 1.5 inch needle will be sufficient. The volume of injectate is 1-2 mL of 0.25% bupivacaine with 10-20 mg methylprednisolone acetate), and the approach of needle can be in-plane or out-of-plane (Fig. 4). A few clinical pearls are mentioned here. The ACJ is very shallow and the needle should not be inserted for more than 1 cm deep into the joint. Overzealous injection will deposit medication into the subacromial bursa. One alternative approach for needle insertion is to turn the probe 900 degrees to the standard imaging (from long axis to short axis) and direct the needle in plane from the anterior position (Video 3, http://www.asra.com/publications-newsletters.php). When imaging the ACJ, moving the probe anteriorly may reveal a well-defined cortical...
discontinuity on the superior aspect of the acromion. This is the "os acromiale," which is an accessory bone of the acromion that is derived from the non-fused epiphysis of the anterior part of the acromion. The prevalence is approximately 8% and is bilateral in one third of the cases.12

LITERATURE REVIEW

The accuracy of landmark-based or blind injection for ACJ is limited (40% to 66% in cadaveric studies and 39% to 50% in clinical studies). Accuracy does not differ significantly based on level of experience (specialist, resident, or student).5 In contrast, accuracy of ultrasound-guided injection ranges between 95% to 100%.13,14

The therapeutic role of ACJ steroid injection is unclear as a literature search only reveals a few case series.15-19 All confirm short term benefit, but response rates are variable. In a certain percentage of patients, the effect can be very long-lasting in terms of years. In a retrospective case series, 27 patients with isolated ACJ arthritis received steroid injections with landmark-based technique.17 Significant pain relief and functional improvement were achieved in 25 of 27 patients, with a mean duration of improvement of 20 days (range, 2 hrs to 3 months). In another study, 18 patients with isolated unilateral ACJ arthropathy were prospectively studied 2 weeks after ACJ injections were performed under fluoroscopic guidance.18 All patients had pain relief at 2 weeks, with a mean pain score decrease from 7 of 10 to 3.6 of 10 (range, 2-10 and 0-8, respectively). The average duration of pain relief was 14.3 weeks (range, 8-24 weeks). Bain et al15 performed ACJ steroid injection in 44 patients with confirmation of needle placement with fluoroscopy, and the patients were followed up for an average duration of 42 months. Approximately 14% resulted in more than 3 months of pain relief. Hossain et al16 studied ACJ steroid injections in 25 shoulders from 20 patients prospectively for 5 years. They used the Constant score, which is a composite score of pain and function (total score of 100 points with 15 points in pain assessment), and found that patients continued to improve after 6 months. The average Constant score was significantly better at 5 years than that of preinjection level, with more than 20 point improvement in 72% of the shoulders in the final assessment. The most recent study by van Riet et al19 revealed that only 28% had a clear positive result; but, in most cases, this result was sustained at long-term follow-up (average duration 42 months). There were no complications from the injection.

References
How We Do It: Ultrasound-guided Thoracic Paravertebral Block

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To the Editor:

We read with interest the excellent article by Dr. Myles Conroy published in the August 2012 ASRA News titled, “How I Do It: Ultrasound-guided Thoracic Paravertebral Blockade.” The author provided a comprehensive discussion of thoracic paravertebral block (TPVB), which included an informative and descriptive overview of surface anatomy and sonoanatomy, relationship to the thoracic spine, and a detailed discussion including ultrasound-guided visual images of two techniques, the transverse and parasagittal approaches.1 In this letter, we present how we perform an ultrasound-guided thoracic paravertebral block to further expand on Dr. Conroy’s article with the intention to initiate and cultivate collegial dialogue.

When performing an ultrasound-guided transverse in-plane approach, the author states that the needle insertion point should be at least 2 cm lateral to the tip of the transverse process to allow an insertion angle adequate for needle visualization. Utilizing ultrasound guidance, the needle is inserted in-plane and directed medially between the transverse process and pleura. The tip of the needle then traverses the superior costo-transverse ligament and enters the paravertebral space where local anesthetic is deposited. In support of this approach, the author referenced an article by Dr. Manoj Karmakar related to TPVB, which states, “A number of ultrasound-guided approaches to the paravertebral space have been advocated, and no particular approach has been proven superior.”2 After performing an extensive evaluation of the current literature and an institutional retrospective review of our data utilizing ultrasound guided thoracic paravertebral blocks, we believe there is evidence to support a superior technique. We advocate the use of an ultrasound-guided parasagittal in-plane approach as opposed to the transverse in-plane technique when performing TPVB.

The University of Pittsburgh Medical Center (UPMC) Acute Interventional Perioperative Pain Service (AIPPS) performed 30,937 blocks in 2010-11, including 8,637 TPVB. In our institution, TPVBs are performed for postoperative pain control following abdominal, thoracic, and urological surgical procedures. TPVBs are performed using either a blind classic or an ultrasound-guided approach. In this regard, we are presently evaluating if the use of ultrasound guidance provides more effective analgesia than the blind approach. If post-operative analgesia is required for more than 24 hrs, a continuous TPVB is indicated. Ropivacaine 0.5% is our local anesthetic of choice (5 ml per level in the case of single PVBs or 5 ml through the introducer needle followed by 10 ml via the PVB catheter in the case of a continuous block). Using contrast dye, we have previously demonstrated that the administration of 10 ml of local anesthetic in the paravertebral space may distribute 1-2 segments above and between 3-5 segments below the level of the injection (Fig.1).3

Contrary to Dr, Conroy, we advocate the use of the parasagittal in-plane approach when performing TPVB. We have found this approach to be highly efficacious, readily reproducible with minimal complications, and unlikely to produce systemic side effects since epidural spread is reduced. Dr. Conroy notes that, in his experience, the parasagittal in-plane approach is more difficult to perform than the transverse in-plane approach. He attributes this to the necessarily steep angle required for insertion of the needle, which results in poor visualization of the needle tip as it is guided into the paravertebral space posterior to the pleura. At our institution, the parasagittal in-plane approach has been our sole technique over the past 8 years, and we do not find the approach to be particularly difficult. We believe that with experience and proper technique, adequate needle visualization can be achieved.

Figure 1
X-Ray of the thoracic paravertebral space at the level of T5, demonstrating multi-level distribution of 10 ml of injected contrast dye
EVIDENCE
In previously-published reports and in Dr. Conroy’s article, it is well-established that the transverse approach can result in epidural blockade, secondary to the documented spread of the local anesthetic solution into the epidural space.4,5 The clinical presentation associated with epidural blockade may include numerous adverse systemic symptoms, which manifest clinically as significant hypotension, lower extremity weakness, and bradycardia. The incidence of epidural spread while performing ultrasound-guided TPVB with a “latero-medial” direction of the needle has been reported up to 30%,4 and, in one series, as high as 70%.5 This is in sharp contrast to the reported incidence of hypotension (4%) and epidural or intrathecal spread (1%) with the blind, nerve stimulator-guided perpendicular technique.6 The increased incidence of systemic symptoms observed with the transverse approach is most likely related to epidural spread, which we believe is due to the “latero-medial” introduction and guidance of the needle utilized in this approach. When the needle is advanced latero-medially to the paravertebral space, it also becomes aligned directly with the neural foramen, which is an anatomic point of entry into the epidural space. With this orientation, the needle tip and/or the catheter can inadvertently enter the epidural space. An alternative mechanism, resulting in epidural spread, can occur if the jet of local anesthetic diffuses, or if the multiport catheter passes through the neural foramen, thus entering the epidural space. This can occur even if the needle is properly placed in the paravertebral space.

With the parasagittal technique, the neural foramen is approached perpendicularly, making epidural spread unlikely. Using a blind technique, Naja et al. reported a 4% incidence of epidural spread.7 Chelly et al. have advocated in favor of the parasagittal approach to reduce the risk of epidural spread when performing ultrasound-guided TPVB. Since the needle is advanced under direct visualization, and the spread of the local anesthetic can be monitored, this approach may reduce complications and provide increased safety when performing TPVB.8,9

PARASAGITTAL ULTRASOUND-GUIDED TECHNIQUE
The patient is placed in a sitting position. The relevant skin landmarks, including thoracic spinous processes, are identified and marked. A point 2-2.5 cm lateral to the tip of the spinous processes is measured and marked. After proper preparation and disinfection of the area, a 2-5 MHz low frequency curvilinear array transducer (a 10 MHz high frequency linear array transducer may be used for higher thoracic levels) is placed parallel to the spinous process. The transverse process (TP), the costo-transverse ligament (CTL) and the pleura (P) are identified. “Tilting” of the probe may allow for better visualization of the costo-transverse ligament and pleura. Skin and the planned trajectory of the block needle are infiltrated with 1% lidocaine (5 ml) under ultrasound-guidance. An 18-gauge Tuohy tip needle connected to extension tubing is inserted at the cephalic end of the transducer (Fig. 2). Using an in-plane technique, the needle is directed towards the CTL. The passage of the needle through the CTL is associated with a tactile “pop” (Fig. 3A). After aspiration is negative for blood, 5-7 ml of ropivacaine 0.5% is injected slowly into the space. If the needle is appropriately located within the PVB space, the administration of local anesthetic will result in a multi-level (2 or more) distribution, with uniform anterior displacement of the pleura (Fig. 3B). If the deposition of local anesthetic is not administered in the TPVB space, the spread is limited to a single level (Fig. 4A, 4B). If a continuous infusion of local anesthetics is desired, a 20-gauge multi-port catheter is introduced through the Tuohy needle and placed 4-5 cm beyond the tip of the needle. For the past 3 years, we have administered lidocaine 0.25% for bilateral continuous TPVBs, and bupivacaine 0.0625% for single continuous TPVB. The infusion rate is initiated at 7 ml/hr per catheter, with a max of 10 ml/hr if desired. A nurse-administered bolus of 3 ml every hour per catheter as needed for breakthrough pain completes the orders.
CONCLUSION
Based upon our experience, we believe the parasagittal in-plane approach minimizes the risk of epidural spread and its associated deleterious systemic effects because needle orientation is perpendicular to the axis of the neural foramen. Therefore, we recommend this as the standard approach when performing ultrasound-guided TPVB.

References

Figure 3
A) Ultrasound scan of the thoracic paravertebral space at the level of T8/T9. Note the needle tip positioned within the paravertebral space.
B) deposition of local anesthetic, resulting in uniform, multi-level depression of the pleura; TP=transverse process; LA=local anesthetic; CTL=costo-transverse ligament; P=pleura.

Figure 4
A) Ultrasound scan of the thoracic level T8/T9.
B) deposition of local anesthetic, resulting in a single level depression of the pleura, demonstrating an injection outside the paravertebral space; TP=transverse process; LA=local anesthetic; CTL=costo-transverse ligament; P=pleura.
The Challenging Role of Pain Medicine in the Treatment of Polytrauma Patients

Perhaps not enough Americans are aware of the significance of these words spoken by our 16th President during his second inauguration only months before his assassination. They are roundly regarded as the birth words for the eventual legislation establishing the federal system of caring for fallen and injured service members and their households. It is the task of this Department of Veterans Affairs to care not only for the commonly encountered maladies of the typical human condition within the population of prior servicemen and women, but to also speak to and treat professionally the unique injuries of combat: polytrauma.

Polytrauma is currently defined by the Department of Veterans Affairs as, “two or more injuries to physical regions or organ systems, one of which may be life threatening, resulting in physical, cognitive, psychological, or psychosocial impairments and functional disability.”¹ Our injured returning United States service members from Operation Iraqi Freedom (OIF)/Operation Enduring Freedom (OEF) face a set of challenges that have never been previously encountered. The survivability of injuries sustained in combat actions is increasing, and the types of injuries sustained are shifting. Advancements in battlefield technology, triage systems, evacuation protocols, and treatment algorithms have resulted in an increasing number of significantly disabled Americans returning from overseas to face their next battle. Data from the Department of Defense indicate that the lethality of war wounds has decreased from 24% in the Vietnam and Persian Gulf Wars to 10% in the recent OIF/OEF conflicts.² Expected residual disabilities from combat injuries are often the focus of medical treatment in the polytrauma patient. Multisite trauma and amputations, visual and auditory impairments, shrapnel wounds, burns, and functional limitations of ambulation are all possible sites of chronic pain and disability. Treatment of these painful conditions is no less varied and challenging than in a typical civilian patient population. Dilemmas of diagnosis and appropriateness of treatment strategies still exist. The limited outcomes of interventional procedures and medication management are no less robust in the polytrauma patient than they are in civilian episodes of traumatic injuries. However, these are not the only burdens the polytrauma patient must bear. Significant psychological symptomatology may prove to be the most problematic.

A constellation of symptoms appearing in polytrauma OIF/OEF veterans has recently been titled the “Polytrauma Clinical Triad.”³ It refers to: chronic pain, post traumatic stress disorder (PTSD), and persistent postconcussive symptoms (PPCS) which are also known as traumatic brain injury (TBI). This represents perhaps the most challenging and unfortunately the most frequently encountered clinical situation in the combat injured OIF/OEF Veteran. In the above-referenced study by Lew et al., it was determined chronic pain, PTSD, and TBI are present in 81.5%, 68.2%, and 66.8% of the returning OIF/OEF population, respectively.

Failure to psychologically adapt, which is at the heart of PTSD, and its ensuing qualities of avoidance, emotional numbing, anxiety, and frequently encountered catastrophizing wreak havoc on carefully laid-out plans of the specialty pain physician.⁴ Overriding physiological and behavioral dysfunction has consistently been shown to accompany treatment failure and is a significant contributor to worsening clinical outcome.

“With malice toward none, with charity for all, with firmness in the right as God gives us to see the right, let us strive on to finish the work we are in; to bind up the nation’s wounds; to care for him who shall have borne the battle, and for his widow and his orphan.” - Abraham Lincoln

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TBI is another unseen ailment of the battlefield. Due to the increase in survivability of battlefield conditions, we now have significantly more combat Veterans suffering from TBI. Previously-published data indicate that 28% of all individuals medically evacuated to the Walter Reed Army Medical Center for combat injuries during OEF/OIF had TBI. During the Vietnam war, this number was less than half that value. TBI is often the most challenging clinical situation resulting in issues of emotional and behavioral lability, and deficits of sensation, concentration and vocalization. When these clinical conditions are taken in their entirety, the challenge of caring for polytrauma patients is as complicated as they are unique; they therefore require a unique approach.

The system of care as designed by the Department of Veteran Affairs includes a series of five main hospital centers defined as Polytrauma Rehabilitation Centers (PRC). They are located in Palo Alto, CA; Richmond, VA; Tampa, FL; Minneapolis, MN; and San Antonio, TX. Additional satellite resources include 22 second-tier Polytrauma Network Sites (PNS), and 87 third-tier Polytrauma Support Clinic Teams (PSC) interspersed at community based outpatient clinics (CBOCs) throughout the United States.

Treating the conditions of a polytrauma patient requires a significant dedication of resources. Full time contribution is required from not only rehabilitation physicians and nursing staff but physical, occupational, and recreational therapists, speech pathologists, social workers, psychologists, and case managers. All of these are present at even the lowest tier of PSC care. The more robust PRC and PNS levels include integration with further specialists such as pain medicine, neurology, neurosurgery, orthopedics, plastic surgery, and further rehabilitative services.

At present, however, the most effective treatment strategies available for the polytrauma patients are the current clinical practice guidelines addressing only the commonly encountered comorbidities of PTSD, TBI and chronic pain. While much work has been done towards determining the specific important nuances of the polytrauma patient, widely accepted specific treatment algorithms that address the patient as a whole have yet to appear.

Concerning polytrauma pain treatment, current guidelines only go so far as to emphasize the need for a comprehensive pain management plan with inclusion of specialists to guide optimization of pharmacological management and evidence-based non-pharmacological interventions. The same can be said of all patients suffering from chronic pain. However, advancing these goals in this very complicated group is an enormous undertaking. It is fortunate that we have in place a system and personnel willing to address the issues left wanting in this truly deserving patient population. It is of course everyone’s hope that further specifics be elucidated and that the most appropriate treatments be devised in the course of our ongoing duty of caring...for those who have borne the battle.

References
1 VHA Polytrauma Rehabilitation Centers Directive 2005-042, June 8, 2005
7 Report of (VA) Consensus Conference: Practice Recommendations for Treatment of Veterans with Comorbid TBI, Pain, and PTSD, summary paragraph, 11
Connective Tissues of the Peripheral Nerves:
A Collective Introspective

There was a time when performing nerve blocks was as simple as eliciting a motor response to nerve stimulation at 0.2-0.4 mA and injecting local anesthetic. There was not much deliberation over intraneural, perineural, subepineurial, perineural lagoons, “doughnut signs,” and other lingo currently in fashion. Admittedly, in the era before ultrasound, knowledge of exact needle-nerve relationships required for successful peripheral nerve blocks was far less complete than it is today; yet well-established practice patterns sufficed for successful practice. The “ignorant” simplicity was the order of the day!

Ultrasound monitoring for needle placement and local anesthetic deposition has since revolutionized the practice and teaching of peripheral nerve blocks, making techniques easier to reproduce. However, the ability to (sometimes imperfectly) visualize needle and anatomical structures may have led to hyper-confidence and discounting of additional localization and safety monitoring (nerve stimulation) techniques, trending away from the prudency of simplicity.1-4

There are two ways to approach this topic. One is to describe the gross anatomical and histological facts in much detail; another is to attempt to demystify the confusion between intraneural and perineural through a more clinical pragmatic approach. The former carries a risk for repetition because much has been published on this topic even recently.5-7 The latter poses a risk of adding yet another opinion to an already overflowing pool of controversies. For these reasons, we have opted for a balance and hope to offer clinically suitable recommendations.

ANATOMY ESSENTIALS
Each fascicle comprises bundles of nerve fibers (axons) and...
their associated Schwann cells held together by a tough squamous epithelial sheath called the perineurium, which acts as a semipermeable barrier to local anesthetics (Fig. 1). Within the perineurium, axons are supported by a delicate connective tissue matrix called the endoneurium; both are fed by capillaries arising from larger epineurial vessels. Fascicles represent 25-75% of the cross-sectional area of a nerve. This proportion varies in different nerves and at different levels of the same nerve. Even when the fascicles alone are analyzed, 40-50% of their surface comprises non-neural tissue, such as endoneurial fluid and connective tissue.

CONNECTIVE TISSUES
The connective tissue of peripheral nerves has different names according to location. Epineurium is located on the outside of peripheral nerves whereas nerve fascicles are embedded in endoneurium and bounded by the perineurium (Fig. 1). The perineurium consists of concentric layers of flattened cells separated by layers of collagen (Figs. 2A and 2B); the number of perineurial cell layers depends on the size of the nerve fascicle and its proximity to its origin (spinal cord). For instance, as many as 8-16 concentric layers may be present around large nerve fascicles (Fig. 2A); whereas small distal fascicles may be surrounded by a single layer of perineurial cells. In larger peripheral nerves, the concentric cell layers alternate with layers of collagen fibers arranged longitudinally similarly to those of the epineurium.8

As the peripheral nerve divides and the number of fascicles is reduced, the connective tissue becomes progressively...
thinner. The epineurium around monofascicular nerves is lacking, intermittent, or merged with the perineurium. Before the individual nerve fibers terminate, their connective tissue sheaths become attenuated and indistinguishable from general connective tissue with the outermost connective tissue merging with local adipose tissue. The quantity of epineurial tissue varies among nerves and their locations (Figs. 3A and 3B); for example, cross-sectional thickness in the ulnar nerve at the elbow is 22% but is 88% in the sciatic nerve in the gluteal area. In general, the epineurium represents between 30-75% of the cross-sectional area of a nerve.

**Figure 4**
Microscopic image of a peripheral nerve with a perineural catheter placed underneath a fascial sheath; 1 and 2 – examples of large and small fascicles; 3 - blood vessel within epineurium; 4 - epineurium within the tissue sheath; 5 - perineural injection of blue dye into epineurium, white arrows – perineurium, black arrows epineural sheath, large white arrow – tissue sheath covering nerve and its epineural tissue within which the catheter (injection) is placed. Available from http://www.NYSORA.com. Copyright permission obtained (accessed 26 October 2012).

**Figure 5**

**CLINICAL CORRELATES**
To accomplish a nerve block, local anesthetic must breach the perineurium to gain access to the fascicles. Block failures occur when local anesthetic is deposited at a sufficient distance from the nerve so that local anesthetic is diluted by interstitial fluid, redistributed or absorbed, before it diffuses across the perineurium. On the other hand, injection of local anesthetic across (into) the perineurium carries a risk for mechanical (needle) and hydrostatic (injection) nerve injury. Thus, the mechanistic view of the goal for nerve blockade is to inject local anesthetic sufficiently close to the nerve while avoiding mechanical-injection injury and neurotoxicity of inrafascicularly-injected local anesthetics (e.g., high concentration).

When a needle is inserted into a peripheral nerve, it can end up in one of two locations: within the epineurium, a loose connective tissue matrix, abundant in (protective) adipose tissue that surrounds the fascicles (Fig. 4) or inside the poorly compliant perineurium containing fascicles or fascicular bundles. Clearly, the latter should be avoided by visually preventing needle-nerve contact (ultrasound), avoidance of nerve stimulation with low current intensity (0.2-0.3 mA, 0.1 msec) and aborting injection when resistance to injection (>15 psi) is present. These precautions cannot be overemphasized as animal studies have demonstrated that injection of even very small amounts of local anesthetic within the fascicle can lead to widespread axonal degeneration and permanent neural damage or centroneuraxial spread. The perineurium, a tough multilayer epithelial sheath, is not easily distensible; intrafascicular pressure rises on injection and can remain detrimentally higher than capillary perfusion pressure, leading to neural ischemia. In contrast, injections into the compliant intraepineural or perineural loose connective are associated with low opening injection pressure, due to its more accommodating stromal architecture (Figs. 1 and 3).
and their locations. For instance, the popliteal sciatic block is anatomically a block of a peripheral nerve but its blockade is accomplished functionally by the principles used in a plexus block – injection into a common connective tissue sheath that contains multiple nerves (common peroneal and tibial, in this case) (Figs. 1 and 3). In the case of popliteal sciatic block, this external tissue layer, often called common epineural or paraneurial sheath, is uniquely distinctive and combines epineurium with paraneurium and fascia of the surrounding muscles to create a “tunnel” containing sciatic nerve (Fig. 5).15-17 Our current understanding is that insertion of the needle into this layer should not be considered an intraneural injection as it has been unfortunately labeled in a number of studies and often enforced during the peer-review process.18-20 However, the epineural sheath of nearly all other nerves (e.g., femoral) is distinctly different, and its crossing with a needle is far more hazardous.

Nerve blocks are best thought of as injections of local anesthetic within a tissue space or sheaths containing nerve(s). With all peripheral nerves, this is typically underneath or between muscle fasciae (e.g., femoral nerve block beneath fascia iliaca); whereas with plexus blocks, the injection can be made in a common connective tissue (e.g., neurovascular) sheath (e.g., axillary or supraclavicular brachial plexus block) or between muscle fasciae (e.g., interscalene block). The take home message is that injection should never be intentionally made into the epineurium as this is neither necessary for successful block or entirely safe, although most such injections in fact, do not appear to inevitably result in nerve injury.21-25 The notable exception is the sciatic nerve, where the external connective tissue layer (whatever the terminology) must be entered for a successful block, and the safety of this recommendation has been well documented.16,19

Crucial to understanding this logic is to keep in mind that connective tissues that contain nerves and plexi at different locations vary substantially. At certain places they are primarily made up of muscle fasciae (e.g., femoral); at others they are epineurium or its combination with the neighboring tissues (e.g., popliteal block); and elsewhere they may be a combination of the two and/or the vascular sheath. It is not surprising that the terms “plexus sheath,” “common epineural sheath,” “subepineural space,” “paramysium,” “paraneurium,” and so forth are used interchangeably; thus adding to the confusion. Some have, perhaps rightly, argued that such terminology should be redefined to avoid confusion.5,26

**SUMMARY**

We believe that the terms “tissue sheath” and “tissue fasciae” (all-encompassing: plexus sheath, subepineural space, intermuscular fascia, paramysium, intermuscular tunnel, paraneurium, etc.) are very useful in describing the location of local anesthetic injection. An injection into the common epineurium of the sciatic nerve containing tibial and common peroneal nerves with their own epineurium should not labeled an intraneural injection, as this structure is distinctly different from epineurium of other peripheral nerves.22 Instead, the term “intraneural” should be reserved for injections that inadvertently occur within the epineurium of all other peripheral nerves, accompanied by nerve swelling and other well established signs of intraneural injections – whether they occur intrafascicularly or (hopefully) not. Dr. Alon Winnie was wise to simplify nerve (brachial plexus) block techniques using easily understandable methods and terminology: “a single injection of local anesthetic into the brachial plexus sheath.”27 Despite the ongoing over-intellectualization of the concept, the efficacy of brachial plexus blocks has not improved substantially, even with ultrasound guidance and multiple injections. The purpose of current research should be to push the boundaries and challenge the conventional, but there are times when an old saying: “Don’t fix what ain’t broke” could contribute to the popularization, simplicity and safety of regional anesthesia.

**References**

Connective Tissues of the Peripheral Nerves: A Collective Introspective continued...


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