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Musings on Mission

Anyone who has been paying attention to the Society is aware that these past two years have been a period of change, challenge, and growth. The American Society of Regional Anesthesia and Pain Medicine’s Board of Directors, meeting program chairs, key committee members, and a handful of loyal and dedicated management partners have lived these challenges first-hand and have skillfully directed ASRA through what, at times, have been turbulent waters. Rightly so, people often focus on the changes that disruption brings. However, reminiscing over the past few years I realize how often, when faced with difficult decisions, the Board of Directors kept coming back to the foundational elements of ASRA’s primary mission – education and research. For your reference, the Society’s mission and vision statements are, respectfully:

“To advance the science and practice of regional anesthesia and pain medicine”

“To be the leader in regional anesthesia and acute and chronic pain medicine through innovations in patient care and education, and support of research”

These declarations are in essence refined and adapted versions of those principles that ASRA was founded upon nearly 40 years ago – a primarily medical professional society dedicated to education and research pertaining to regional anesthesiology and to acute and chronic pain medicine. In the next few months, members will observe dramatic changes to the public face of ASRA – a new website, an expanded social media presence, transformation to a three-day meeting format, and an entirely new management structure. As these changes are assimilated into the fabric that is ASRA, it is our sincerest wish that they be judged as welcome enhancements to our core values of education and research.

What beyond high quality and contemporary educational offerings will be ASRA’s impact over the years? Indeed, the answer to this question weaves together the Society’s dual missions and ultimately determines ASRA’s impact over the next four decades. Reinvestment of revenues realized from our educational offerings – primarily meeting registrations and journal royalties – not only allow the Society to innovate and enrich the educational mission, but also generate the operating margin that largely funds our research mission. Responsible stewardship of ASRA’s finances requires that the Board of Directors strike a balance between doing what is necessary to support the mission and impact the future and do so in a manner that does not unfairly burden our members’ and supporters’ finances. Achieving this balance shapes our future and should dominate a good portion of the Board of Directors’ strategic discussions.

The point of these musings is to share with the ASRA membership that, despite enormous change and challenge over the past few years, the Board and key leaders have guided the Society in a manner true to its mission. The Society has fortunately made modest profits recently, which have allowed us to revamp a grossly outdated and inefficient website so as to optimize membership services and better highlight our educational and research offerings. Yet when faced with the possibility of adding certain costly educational products to the website, the decision was framed within the context of whether or not these additions added commensurate value and member benefit. Another example of mission-driven decision making applies to this newsletter. This is the last ASRA News that you will receive in the mail. Future issues...
Here is it – the last print issue of ASRA News. Based on member feedback (see Dr. Neal’s column in the February 2014 issue http://www.asra.com/Newsletters/feb-14.pdf), ASRA News will be transitioning to an exclusively e-reader format starting with the February 2015 issue. I want to thank the staff of our current publisher, The Martin Group, for the fantastic job they have done in producing such a high quality print newsletter during my term as Editor. This issue is packed full of outstanding original contributions. To accompany his “How I Do It” article on ultrasound-guided rectus sheath block, Dr. Francis Salinas has provided supplemental videos posted on http://www.asra.com/publications-newsletters.php. Just in time for the ultrasound in pain medicine workshops at the 13th Annual Pain Medicine Meeting, we feature an article on the infectious risks of non-sterile ultrasound gel by Dr. Dave Provenzano, Chair of the Scientific/Education Planning Committee. Other timely articles in this issue and related to the Fall Meeting include a pro-con on the use of diagnostic sacral lateral branch blocks for screening patients prior to sacroiliac joint radiofrequency ablation by Drs. Nileshkumar Patel and Kevin Vorenkamp and an update on changes in payment for interventional pain physicians by Drs. Daniel Rothstein and Rick Rosenquist. The latter article is extremely informative, and it reminds me how fortunate we are to have Dr. Rosenquist representing our interests in anesthesiology and pain medicine.

We have all heard the “doom and gloom” statistics about rising health care spending, and maybe even some of them have begun to sink in since the roll-out of the Affordable Care Act.

For many reasons, the federal government is working to curb health care expenditures, but many of the processes currently attributed to “Obamacare” have been in the works for a long time. As an example, the Medicare Modernization Act of 2003 introduced the Inpatient Prospective Payment System; this system encouraged participating hospitals to voluntarily report performance data to avoid payment reductions. The Deficit Reduction Act of 2005 went further by mandating the development of what we now know as pay-for-performance or value-based purchasing (used interchangeably).

In 2012, the Institute of Medicine published “Best Care at Lower Cost: the Path to Continuously Learning Health Care in America.”1 In this report, Recommendation #9 refers to performance transparency: making data related to “quality, prices and cost, and outcomes of care” available to consumers. What does this mean? Value-based purchasing in health care is supposed to reward better value, patient outcomes, and innovations – instead of just volume of services.2 It is funded by participating institutions based on withholding a set percentage (1.25% currently) of their estimated annual Diagnosis-Related Group (DRG) payments from Center for Medicare and Medicaid Services (CMS). The percentage is increasing every year and will be 2% by 2017.

For FY2014, the elements of value-based purchasing have been updated3 to include the Clinical Process of Care Domain, Patient Experience of Care Domain, and a new Outcomes Domain. The amount that each of these domains contributes to the eventual DRG payment return at the end of the year is 45%, 30%, and 25%, respectively. Scores in each domain are calculated based on an institution’s improvement compared to its own historical performance and a comparison against national benchmarks.3

How does this affect pain medicine? The Patient Experience Domain is assessed using the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. HCAHPS consists of 32 questions, publicly reports its results 4 times a year on http://www.hospitalcompare.hhs.gov, and contains 7 questions that directly or indirectly relate to pain.

On the inpatient side, an acute pain service adds value through cost savings for the hospital. More effective pain management can prevent inadvertent admissions or readmissions due to pain. In addition, an effective multimodal analgesic protocol can directly or indirectly prevent hospital-acquired conditions (HACs). HACs are considered by CMS to be “never events” and supposedly preventable;4 hospitals reporting HACs as secondary diagnoses are not entitled to CMS payments for related care. Examples of HACs include: urinary and vascular catheter-related infections, surgical site infections, DVT/PE, pressure ulcers, and inpatient falls leading to injury.

There are clear opportunities for pain medicine specialists to take an active role in adding value and minimizing risks for patients in the acute setting. With the recent approval of the ACGME Board of Directors to make Regional Anesthesiology and Acute Pain Medicine the next accredited fellowship within anesthesiology, we can start to develop a standardized curriculum to train the future leaders of our subspecialty.

REFERENCES
The American Society of Regional Anesthesia and Pain Medicine remembers and honors Jordan Katz, MD, who died this year on June 28th in Rancho Mirage, CA, at age 82. Dr. Katz was one of the five “ASRA Founding Fathers.” Drs. Don Bridenbaugh, Prithvi Raj, and Alon Winnie are the remaining members of that visionary group along with Dr. Harold Carron who died in 1991. During his long association with the ASRA, Dr. Katz filled numerous committee and editorial roles, served on the Board of Directors from 1976-1989, and was ASRA President from 1987-1988. Dr. Katz received the ASRA Distinguished Service Award in 1993 and continued to attend ASRA annual meetings until just recently.

After completing anesthesiology residency training at Columbia Presbyterian in 1960 and three years of service in the Army Medical Command in Japan, Dr. Katz embarked on a distinguished academic medical career that encompassed leadership positions in medical schools and Veterans Administration hospitals including Stanford, University of Miami, University of Wisconsin, and University of California, San Diego. Although many of his academic interests included topics pertinent to regional anesthesia and pain medicine, Dr. Katz also performed basic science research on halothane. Widely published, Dr. Katz was perhaps best known as the co-editor from 1973-1989 of Katz & Kadis - Anesthesia in Uncommon Diseases: Clinical and Pathophysiological Correlation.
Schleich first described the use of bilateral rectus sheath blocks (BRSBs) in 1899, with the aim of providing muscle relaxation and analgesia of the abdominal wall by blocking the terminal branches of the thoracolumbar nerves within the substance of the rectus abdominis muscle (RAM). It was originally performed as a blind, loss-of-resistance technique. BRSBs had previously remained underutilized, largely due to concerns over the accuracy of needle-tip placement, particularly in relation to vascular structures contained within the rectus sheath as well as visceral structures contained within the underlying peritoneal cavity. BRSBs are ideally suited for ultrasound guidance because the RAM, layers of the rectus sheath, and important vascular structures are easily identified with ultrasound technology.

INDICATIONS
Ultrasound-guided BRSBs provide somatic analgesia over the midline anterior abdominal wall from the xyphoid process superiorly to the symphysis pubis inferiorly. It is therefore indicated for vertical midline (or paramedian) surgical incisions. Historically, BRSBs were primarily used as an analgesic adjunct for umbilical hernia repair or laparoscopic gynecologic procedures; however, with the ever-increasing adoption of ultrasound imaging and experience with ultrasound-guided peripheral nerve blockade, more recent indications include analgesia for vertical midline laparotomy incisions for either lower or upper abdominal surgery. The duration of BRSBs may be extended by placement of catheters within the rectus sheath to allow either continuous and/or intermittent bolus administration of local anesthetics. Thus, ultrasound-guided BRSBs hold considerable potential as an integral part of a perioperative multimodal analgesic regimen.

CLINICALLY RELEVANT ANATOMY
Anatomical Course of the Thoracolumbar Nerves
The sensorimotor innervation of the anterior abdominal wall is supplied by the ventral rami of the thoracolumbar spinal (T7-L1) segmental nerves. The thoracolumbar nerves course along the anterolateral wall within the transversus abdominis plane (TAP), and continue anteromedial within the TAP, eventually encroaching upon the lateral aspect of the rectus sheath. The nerves then enter the lateral aspect of RAM and contribute to the formation of a nerve plexus that runs cranio-caudally within the muscle in close relation to the lateral branch of the deep epigastric artery. The thoracolumbar nerves typically pierce the posterior border (89%) and less commonly the lateral border (11%) of the RAM, with the nerves piercing the posterior border within 1.6 to 2.6 cm from the lateral edge of the RAM. The nerves provide both muscular and cutaneous branches to innervate the muscle fibers and overlying skin. Notably, the branches of the thoracolumbar nerves do not cross midline.

“The target site for local anesthetic deposition is deep to the RAM, but superficial to the posterior aspect of the rectus sheath.”
Anatomy of the Rectus Sheath

The rectus sheath is formed from the aponeuroses of the fascial sheaths of all three lateral abdominal wall muscles. The external oblique (EOM), internal oblique (IOM), and transversus abdominis (TAM) muscles each form a bilaminar aponeurosis at its medial border (Figure 1) converging to form the lateral border of the RAM, termed the *linea semilunaris*. The anterior and posterior lamina of the EOM and the anterior lamina of the IOM fuse together and continue further medially over the ventral surface of the RAM to form the anterior portion of the rectus sheath (Figure 2a and Figure 3). Similarly, the posterior lamina of the IOM and anterior and posterior lamina of the TAM fuse together and continue medially dorsal to the RAM to form the posterior portion of the rectus sheath (Figure 2a and Figure 3). At the medial border of the RAM, the anterior and posterior portions

**Figure 2a:** Illustration demonstrating the cross-sectional anatomy of the rectus sheath above the arcuate line: RA=rectus abdominis muscle.

**Figure 2b:** Illustration demonstrating the cross-sectional anatomy of the rectus sheath below the arcuate line: RA=rectus abdominis muscle.
of the rectus sheath come together, with the fibers coursing further medially toward the medial border of the contralateral RAM forming the midline *linea alba*.

The anterior portion of the rectus sheath extends along the entire vertical length of the RAM. In contrast, the posterior portion of the rectus sheath extends only along the upper two-thirds of the RAM. In the lower one-third, the posterior portion of the rectus sheath stops approximately midway between the umbilicus and symphysis pubis. At this anatomical transition point, the aponeuroses that had formed the posterior portion of the rectus sheath now also course over the ventral surface of the RAM (Figure 2b). This transition point is known as the *arcuate line*. The transversalis fascia is a thin layer of connective tissue located just deep to posterior portion of the rectus sheath (Figures 2a, 2b, 3). Located just deep to the transversalis fascia is the parietal peritoneum. Inferior to the arcuate line, the transversalis fascia is located immediately deep to the posterior border of the RAM.

**ULTRASOUND ANATOMY AND TECHNIQUE**

**Short-Axis In-Plane Approach**

The transducer (high frequency linear array or low frequency curved array, depending on body habitus) is positioned just lateral to the umbilicus in an axial (transverse) plane (Figure 4). Identify the layers of the anterior abdominal wall from superficial to deep (Figures 2a, 2b, and 3):

- A layer of subcutaneous tissue and adipose that will vary in depth depending on body habitus.
- Deep to the subcutaneous tissues will be the anterior portion of the of the rectus sheath (a horizontal bright hyperechoic linear structure extending from lateral to medial).
- Deep to the anterior rectus sheath is the RAM (relatively hypoechoic in relation to the rectus sheath).
- Deep to the RAM will be the posterior portion of the rectus sheath (a horizontal bright hyperechoic structure extending from lateral to medial).
- The deep superior (above the umbilicus) and inferior (below the umbilicus) epigastric arteries may be seen as small, pulsatile, anechoic structures located in the deepest aspect of the RAM. Color flow Doppler may confirm the presence of blood flow within the arteries.
- Deep to the posterior portion of the rectus sheath will be the transversalis fascia (a hyperechoic linear structure).
- Deep to the rectus sheath and transversalis fascia is the peritoneal cavity, which is identified by the presence of peristaltic movements of the bowel loops.

The target site for local anesthetic deposition is deep to the RAM, but superficial to the posterior aspect of the rectus sheath. The terminal thoracolumbar nerves are too small to be visualized as discrete structures; thus, BRSBs are a “compartment block.” Transducer position and initial needle insertion site (lateral to the transducer) should be adjusted in a cephalad-to-caudad manner based on the anticipated location of the vertical midline incision. Placing the transducer in the middle of the anticipated vertical extent of the midline incision should optimize distribution of local anesthetic spread.

- Typically, a 21-gauge, 100 mm (or 20-gauge, 150 mm) needle is inserted 3-8 cm lateral to the lateral edge of the transducer and guided “in-plane” (Figure 4).
- The needle is advanced in-plane from lateral to medial and superficial to deep.
  - The needle should penetrate through the lateral aspect of the linea semilunaris and enter the lateral aspect of the RAM.
  - The needle is further advanced until it is positioned deep to the potential space between the deepest (posterior) border of the RAM, but superficial to the posterior aspect of the rectus sheath. This target site will be referred to as the “posterior rectus sheath compartment.”
  - At this point, a small (1-3 ml) volume of local anesthetic (or sterile saline) is injected to confirm correct placement within the posterior rectus sheath compartment, indicated by the appearance of an anechoic fluid collection (Figure 5a).
  - Subsequently, 15-20 ml of local anesthetic is incrementally injected while observing for the expanding anechoic fluid collection. As the local anesthetic is injected, it will often result in clear separation of the deep border of the RAM from the posterior rectus sheath (Figure 5b). Improved local anesthetic spread may be facilitated by advancement of the needle further medially as the anechoic fluid collection visibly expands the posterior rectus sheath compartment in a lateral-to-medial fashion.
  - After local anesthetic injection, the transducer can be translated in a cephalad-to-caudad fashion to visualize cephalad-to-caudad spread within the posterior rectus sheath compartment.
  - The same procedure is repeated on the contralateral side.

Continuous Catheter Technique (Video Clip 2: http://asra.com/publications-newsletters.php)

- If a continuous catheter technique is desired, the same steps above are followed except that a 17-gauge 90-150 mm Tuohy tip needle is used and, after fluid

**Figure 5a and b:** Ultrasound-guided rectus sheath block using a short-axis in-plane technique: (a) initial needle insertion with a small volume of local anesthetic (LA) injected; (b) continued advancement of the needle with hydrodissection of the posterior rectus sheath compartment; RA=rectus abdominis muscle.
Sacroiliac regional pain (SIRP) most likely contributes to axial non-radicular pain and the incidence of SIRP increases with age. The term sacroiliac regional pain (SIRP) is preferred to sacroiliac joint pain (SIJP) primarily because the joint is not the only source of pain, as pain fibers innervate the joint as well as the soft tissue. Thus, any treatment solely aimed at addressing joint pain (SIJP) will negate the contribution of the soft tissues and will lead to incomplete relief of pain. Second, it is clear that the joint receives its innervation from the anterior as well as the posterior aspects; thus, if the pain is found to be emanating from the joint itself (with sacroiliac joint injection), it is likely to be carried by the anterior and the posterior pain fibers. Simply addressing the posterior aspect of the joint pain (through lateral branch denervation) will ignore the contribution from the anterior aspects of the joint, thereby resulting in incomplete relief. Conversely, as the lateral branches contribute to both the joint and the ligaments, blockade of these branches will be the best prognostic test prior to proceeding to neurotomy of the lateral branches.

Sacroiliac joint injection is therefore not the preferred prognostic block. The crux of the argument can be addressed by taking a deep dive into the published literature. Dreyfuss and colleagues in their elegant studies have demonstrated that blocking the lateral branches decreases the sensation to both the joint and the posterior ligamentous tissue; logic would dictate that denervation of the ligaments and the joint are going to decrease the sensation arising from these tissues. Conversely, Dreyfuss et al have demonstrated that blockade of the joint with local anesthetic decreases the sensation of pain arising from the joint but not from the ligamentous tissue. We can conclude that the only viable prognostic and diagnostic test is the lateral branch block prior to considering denervation.

At present, there are no studies comparing the outcomes of radiofrequency lateral branch neurotomy with prognostic SIJP injection versus lateral branch blocks, and such a study performed in a randomized fashion with consistent application of the neurotomy technique would help address the issue definitively. The ideal study would have excluded patients with other sources of pain including the facet joints. Cohen and colleagues in their randomized prospective trial performed L4, L5 medial branch (which innervate the L5-S1 facet joint) and lateral S1, S2, S3 neurotomy (which innervate both the joint and the ligaments); thus, the study did not truly just address sacroiliac joint pain. It is for this reason that future studies intending to address the question of sacroiliac regional pain only focus on the L5 dorsal ramus and the lateral S1-S3 branch blocks versus sacroiliac joint injection prior to proceeding to radiofrequency neurotomy. Clearly, the results of Patel et al can be improved upon significantly by including multi-site, multi-depth compared to anesthetic blocks in patients who only have SIRP with no pain from other sources (e.g., axial pain). In their lateral branch neurotomy study, Patel and colleagues also failed to exclude other sources of pain, including the hip joint, the knee joint, and cervical spine in their elderly subject; this affected the sixth month outcome as some of the patients did have additional surgeries which affected functional outcome measures, and some patients dropped out at six months. Further, the only randomized comparison in their study that counts is the three month outcome where all patients were followed, and the results at 3 months conclusively demonstrate effectiveness of lateral branch neurotomy when patients were selected with local anesthetic L5, S1, S2, S3 lateral branch blocks prior to proceeding to denervation.

References:
Many patients have benefited from sacroiliac joint radiofrequency ablation procedures (SIJ-RFA). Multiple reasons exist for the improved success compared to prior approaches. These include improved technique and technological advances aimed at maximizing the likelihood of neuronal destruction. Although patient selection remains critical to successful outcome, there is not currently an “optimal” diagnostic test to determine who is most likely to benefit from SIJ-RFA. Reasons for failed improvement following SIJ-RFA include technical factors as well as proper patient testing. In establishing a diagnostic algorithm for SIJ-RFA, patient evaluation must include the following key characteristics:

1. A test that reliably blocks the SIJ structures
2. A test that does not block structures that will not be targeted with SIJ-RFA
3. A test that can be performed safely and with reliable results

Although intra-articular (IA) injection of local anesthetic may be regarded as the “gold standard” for diagnosing sacroiliac joint pain, this procedure anesthetizes both the anterior and posterior portions of the joint, and a single block may be associated with a false positive rate of 17% or higher. Conversely, SIJ-RFA targets only the dorsal innervation of the joint. Additionally, IA blocks do not anesthetize the pain generated from interosseous or dorsal sacroiliac ligaments.

Therefore, it has been suggested that diagnostic procedures targeting only the posterior innervation may provide better selection parameters for patients to be considered candidates for SIJ-RFA. Unfortunately, proposed sacral lateral branch blocks (LBB), as currently performed, do not reliably achieve this.

The innervation of the sacroiliac joint has been well described although somewhat conflicting in the reported literature. Over a decade ago, Yin et al described a technique of deep interosseous ligament injection as a possible diagnostic test to block nociception from extra-articular sources of SIJ pain. Contemporaneously, Cohen and Abdi published a pilot study on sacral LBB as a treatment for SIJ pain, blocking the dorsal rami of L4 and L5 in addition to the lateral branch nerves at S1-S3. A single injection of 0.5 ml was injected at each level and 13/18 patients reported >50% improvement in their pain scores. These patients then underwent sensory-guided RFA at each level with the majority reporting >50% pain improvement persisting at 9 months post-procedure.

Dreyfuss et al subsequently demonstrated in both clinical and cadaveric models that single-site LBB were only 40% effective in blocking painful stimuli arising from the dorsal sacral ligament and the SIJ capsule. The authors concluded that “single site, single depth sacral lateral branch injections do not adequately anesthetize the inferior dorsal SIJ ligament or IA portions of the SIJ.” Dreyfuss et al later described an alternative blockade, consisting of multi-site and multi-depth injections of local anesthetic at S1, S2 and S3, in addition to L5 dorsal ramus blockade. They reported 70% effectiveness from interosseous and dorsal sacral ligament blocks without effectively blocking the sacroiliac joint. Although this technique appears superior to the single-injection technique, there are currently no studies reporting SIJ-RFA response when this technique is utilized for diagnostic purposes.

A careful review of the literature on SIJ-RFA may allow for better patient selection criteria. Cohen and colleagues looked at various factors and their association with a positive response to SIJ-RFA in a series of 77 patients. The analysis failed to identify any single clinical variable that reliably predicted treatment results. There was no relationship between the number of diagnostic IA blocks, the percentage of pain relief with the blocks, or the utility of confirmatory sacral LBB and the outcomes of RFA. Cohen et al previously demonstrated no statistically-significant correlation between the degree of pain relief following lumbar medial branch blocks and RFA success; however, the finding that LBB did not provide additional screening benefit is important. In fact, the authors concluded that the “preliminary data do not support the routine use of more stringent selection criteria, such as multiple SI joint local anesthetic blocks, near-complete pain relief from diagnostic blocks, or prognostic LBB.”

Published studies on SIJ-RFA support this notion that the results of SIJ-RFA are not correlated with the selection criteria used (Table 1). The most common selection criteria involved with these studies is >50% relief with singe IA block. The only
Recent studies on the impact of obstructive sleep apnea (OSA) on perioperative outcomes have led to an increased awareness of this disorder as an important perioperative risk factor. With the already high numbers of OSA patients expected to rise due to the ongoing obesity epidemic, as well as rising surgical volume, this often undiagnosed disorder will undoubtedly represent an increasing and challenging factor in need of careful consideration in the perioperative period.

The prevalence of OSA has been estimated at approximately 25% of all surgical patients, of which 80% percent may not be diagnosed at the time of their intervention. While many tools have been proposed to screen for the presence of OSA in surgical patients, many questionnaires currently in use (e.g., STOP-Bang, Berlin) are limited in their ability to predict adverse outcomes, especially mortality. Given the concern over increased risk for perioperative complications based in part on the notion of an increased sensitivity to opioids and risk for respiratory depression, clinicians are seeking interventions to reduce the likelihood of adverse events. Unfortunately to date, few commonly employed interventions, despite their high cost (i.e., perioperative observation, routine use of continuous positive airway pressure [CPAP]) have been proven to be effective.

Further, the relationship between OSA and negative postoperative outcomes may not be quite as straightforward as has been often suggested. Thus considerable discrepancies can be found in the literature concerning this topic. In this context, while some authors suggest higher complications especially among orthopedic patients with OSA, others point to a paradoxical protective effect on mortality. Mokhlesi et al. noted that while there may be a small increase in cardiopulmonary complications and earlier emergent intubation risk, this finding did not translate into higher mortality rates. This may be explained by the presence of specialized, albeit not standardized, care and heightened awareness these patients already seem to receive. Similar lack of impact has been reported for 30 day mortality in a single-center prospective cohort study. Nevertheless OSA patients seem to be at an increased risk for specific complications. This has been demonstrated in spine surgery patients with a near 7-fold risk for postoperative mechanical ventilation, as well as in patients after knee arthroplasty for delirium or inpatient falls.

Currently, a paucity of studies exists examining who amongst OSA patients is at highest risk for postoperative complications, thus making allocation of resources difficult. The idea that concomitant, often occult, disease processes such as the high prevalence of pulmonary arterial hypertension may play an important role has been proposed and is being investigated. A multivariate regression analysis of population-based data previously analyzed by our group indeed shows that the combination of OSA with various comorbidities increases perioperative complication risk.

Table 1: The impact of obstructive sleep apnea (OSA) combined with different comorbidities versus OSA alone on perioperative complications in total hip and knee arthroplasty patients.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Effect</th>
<th>Adjusted Odds Ratio (Corrected 95% C.I.)</th>
<th>Corrected P-Value</th>
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<td>OSA + Obesity</td>
<td>1.27 (1.17,1.37)</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>OSA + Diabetes</td>
<td>1.12 (1.03, 1.22)</td>
<td>0.0019</td>
<td></td>
</tr>
<tr>
<td>OSA + Complicated Diabetes</td>
<td>1.49 (1.19,1.86)</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>OSA + Hypertension</td>
<td>1.08 (0.98,1.17)</td>
<td>0.1831</td>
<td></td>
</tr>
<tr>
<td>OSA + Complicated Hypertension</td>
<td>2.46 (2.15,2.81)</td>
<td>&lt;0.0001</td>
<td></td>
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<tr>
<td>OSA + Pulmonary Hypertension</td>
<td>2.33 (1.83,2.97)</td>
<td>&lt;0.0001</td>
<td></td>
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* Composite outcome (incidence of pulmonary embolism, deep vein thrombosis, cerebral complications, pulmonary complications, pneumonia, sepsis, other infectious complications, acute renal failure, gastrointestinal complications, acute myocardial infarction, other cardiac complications and mortality)
The prevalence of obesity, increased pulmonary and systemic complications in patients with OSA one has to consider possible perioperative outcomes. When discussing the role of regional anesthesia may indeed positively affect perioperative outcomes, such as CPAP and extended observation, are unproven to date, the use of regional anesthesia may represent an effective way by which outcomes may be positively affected. While mechanisms by which such benefits may be conferred need to be further elucidated, it remains a fact that regional anesthesia is widely underutilized with currently 74% of total hip and knee arthroplasties performed under general anesthesia alone.

Osborne shows that regional anesthesia is widely underutilized with currently 74% of total hip and knee arthroplasties performed under general anesthesia alone. This is widely underutilized with currently 74% of total hip and knee arthroplasties performed under general anesthesia alone. For the use of peripheral nerve blocks, no difference in pulmonary or cardiac complications was noted, although a decreased need for mechanical ventilation or critical care services was found. OSA may represent a significant risk factor for perioperative complications; however, tools to identify those at risk remain largely elusive. Although many suggested interventions to improve outcomes, such as CPAP and extended observation, are unproven to date, the use of regional anesthesia may represent an effective way by which outcomes may be positively affected. While mechanisms by which such benefits may be conferred need to be further elucidated, it remains a fact that regional anesthesia is widely underutilized with currently 74% of total hip and knee arthroplasties performed under general anesthesia alone. Given the long track record of safety of regional anesthetic techniques, we believe that their utilization as a corner stone of perioperative care services was found.

Despite the magnitude of the problem and the existence of guidelines provided by the ASA, evidence for effective perioperative intervention remains rare. For example, while experts do believe perioperative CPAP therapy to be beneficial, evidence of benefit in the perioperative setting remains inconclusive as data are extrapolated from long term care studies. It is not surprising that a recent analysis of national data from over 500 hospitals suggests that only 17% of OSA patients currently receive CPAP therapy in the hospital. Besides the lack of conclusive evidence of effectiveness, this finding may be explained by high cost, lack of resources and low perioperative adherence to CPAP therapy by patients.

Recent research, however, has provided some evidence that the use of regional anesthesia may indeed positively affect perioperative outcomes. When discussing the role of regional anesthesia in patients with OSA one has to consider possible reasons for complications in this distinctive patient group. These include impaired pulmonary mechanics due to a high prevalence of obesity, increased pulmonary inflammatory mediator levels, higher risk for aspiration by impaired pharyngeal sphincter function and increased sensitivity to opioids and other medications. The use of regional anesthetic and analgesic techniques has been postulated to have theoretical advantages such as 1) reduction in the need for systemic opioids and anesthetics; 2) reduction in the need for airway instrumentation and mechanical ventilation; and 3) reduction in the extent of systemic inflammatory response. In this context regional anesthesia may be used to avoid intubation and mechanical ventilation in a patient group that has a prevalence of pulmonary hypertension of up to 70% and may further underscore its importance in orthopedic surgery where pulmonary circulatory changes are frequently seen due to surgical methods.

In a retrospective cohort study of 30,000 OSA patients, our workgroup compared the use of neuraxial vs. general anesthesia in patients with a similar comorbidity burden for total joint arthroplasties. Neuroaxial anesthesia, when compared to general anesthesia, showed protective effects for pulmonary and cardiac complications (OR 0.825 and 0.904, respectively) with a noted reduction for mechanical ventilation (OR 0.636) and critical care service utilization (OR 0.433). Interestingly, similar effects could be observed for combined neuraxial and general anesthesia vs. general anesthesia alone. For the use of peripheral nerve blocks, no difference in pulmonary or cardiac complications was noted, although a decreased need for mechanical ventilation or critical care services was found.

There is no doubt, however, that given the extent of the problem, much more effort and resources need to be expended to study approaches to improve outcomes in an accountable manner when caring for patients with OSA.

REFERENCES
Interventional pain physicians have endured significant cuts in their payment rates in 2014. The Centers for Medicare and Medicaid Services (CMS) implemented steep reductions in payments for the most commonly performed interventional pain procedures, interlaminar epidural injections. According to the American Society of Interventional Pain Physicians (ASIPP), these cuts may result in an increasing number of private practice pain physicians going out of business or transferring their practices to a hospital setting.1

The final CMS physician fee schedule for 2014 states that physician payment for a cervical epidural injection performed in an office setting is $110.69, which is significantly lower than the $251.77 paid in 2013, representing a decrease of 56%. If the same procedure is performed in a facility setting (i.e., ambulatory surgical center or hospital outpatient department), physician reimbursement is $74.15, a 33% drop from prior year. Physician payment for a lumbar epidural injection performed in an office is down to $108.90 from $211.96, a drop of 48%. If performed in a facility, the physician would be reimbursed $72.72, which is 19% less than in 2013.2

This change in physician professional fee payments is in contrast to what Medicare pays the facility, which is substantially larger than physician reimbursement and is actually increasing. Payments to ambulatory surgical centers for cervical or lumbar epidural procedures increased by 17% to $370.07 in 2014, while hospitals are receiving $669.90 for these procedures, an increase of 18% from the prior year.

The process of how Medicare pays for services is worth reviewing. For physicians’ services, Medicare pays a predetermined amount based on a fee schedule of payment rates for over 7,000 types of services. Generally, payment rates are higher when services are provided in a non-facility setting, such as a physician owned office, and lower when services are provided in a facility, such as a hospital or ambulatory surgical center. Presumably, physicians incur lower costs when providing services in a facility and thus receive smaller payments. In addition, when services are provided in a facility, Medicare pays a separate (often higher) fee directly to the facility.

The value of physicians’ services is determined by relative value units (RVUs), a weighted index of the “costliness” of each service. RVUs are derived from three components – physician work, practice expense, and the cost of related professional liability insurance. There is also an adjustment for geographic location to account for differences in practice costs across the country.4 The final payment rate for a specific service is calculated by summing the three component RVUs into a “total RVU” and multiplying by a dollar amount called the conversion factor (CF), which in the 2014 fee schedule is $35.82. For example, a cervical epidural injection performed in an office setting carries a total RVU of 3.09 (1.18 for physician work, 1.81 for practice expense, and 0.10 for malpractice insurance). Multiplying the total RVU by the conversion factor gives the final payment rate of $110.69, as stated in the 2014 fee schedule.

Updates to physician work and office expense RVUs are based on recommendations from the Relative Value Scale Update Committee (RUC), a committee comprised of members from the American Medical Association and other national medical specialty societies.5 The committee’s recommendations for the 2014 fee schedule were based on a survey of pain physicians which concluded that physician work time for epidural injections should be reduced.6 Based on the results of this survey, the committee recommended that the RVUs for physician work be reduced by 12% (1.68 from 1.91) for cervical epidurals and remain unchanged for lumbar epidurals (1.54). Nevertheless, CMS implemented significantly steeper cuts in their final 2014 physician payment rule – RVUs of 1.18 for cervical epidurals and 1.17 for lumbar epidural, representing decreases of 38% and 24%, respectively.6

These cuts may result in an increasing number of private practice pain physicians going out of business or transferring their practices to a hospital setting.”
Several strategies have been developed to prolong single injection nerve blocks. Multi-drug mixtures for injection around a peripheral nerve have been studied and shown to prolong nerve block duration; for example, adding dexamethasone, clonidine, and buprenorphine to bupivacaine has been demonstrated to prolong single injection blocks for an average of 30 hours and longer in select cases. A formulation of liposomal bupivacaine has been recently FDA-approved (2011) and is indicated for wound infiltration although it is anticipated that this drug will receive approval for a peripheral nerve block indication soon. The drug theoretically confers substantially longer block duration over all current bupivacaine formulations including the aforementioned mixture of additional agents. Despite this theoretical advantage, for many procedures these prolonged single injection blocks may still in fact be inferior to continuous peripheral nerve block (CPNB) catheters.

From a clinical standpoint, catheters provide two important advantages over single injection blocks: duration and titratability. While liposomal bupivacaine may provide the first effect, it certainly does not allow for titratability. This is an important consideration for any nerve block of prolonged duration in which both motor and sensory components are affected.

Lower extremity joint replacement surgeries are the most obvious examples of when prolonged motor blockade is detrimental. While pain from these procedures can be significant for several days postoperatively, it is beneficial from an economic and clinical standpoint that physical therapy commences shortly after surgery is completed. Femoral, sciatic, and lumbar plexus catheters have been demonstrated to reduce pain scores, opioid consumption, length of stay, and facilitate physical therapy. Patients vary in their response to nerve blockade depending on the location of local anesthetic injection relative to the nerve and inter-individual variability in terms of sensitivity to local anesthetic. Thus while a standardized CPNB order set is typical, titration up or down in cases of severe pain or excessive motor blockade is very common. Without titration, any single injection nerve block has the potential to either undertreat pain or disable the patient in the crucial early postoperative period during which time physical therapy may otherwise confer significant benefit.

Procedures for orthopedic trauma repair also benefit from a long lasting but titratable nerve block. These procedures are often very painful for several days postoperatively. While physical therapy expectations tend to be lower in such cases, maintenance of motor function and some sensory ability remains essential. Compartment syndrome, associated with paresis, pain, and paresthesia, is a known complication of orthopedic trauma procedures which must be detected early. Any of these symptoms alone are not sensitive for the detection of neural entrapment. A dense nerve block that cannot be titrated may create a situation in which some or all of these signs are either ignored or absent which may place this patient population at risk for this debilitating condition. On the other hand, compartment syndrome has been detected despite the use of CPNB in several case reports, and perineural infusions can be titrated downwards or held should any of these symptoms manifest. It is the authors’ opinion that CPNB should continue to be considered the preferred technique over any prolonged single injection nerve block in this surgical population.

In contrast, the use of liposomal bupivacaine for single injection regional anesthesia procedures may prove superior to CPNB for specific block locations that are primarily or entirely sensory-specific: transversus abdominis plane (TAP) and paravertebral blocks. For TAP catheters, the optimal local anesthetic infusion regimen remains unknown. Paravertebral catheters have been shown to be very effective for managing pain and reducing complications in thoracic surgeries, breast surgeries, and abdominal surgeries for 3-5 days. They are similarly useful for managing rib fracture pain. They have been shown to reduce time to extubation, hospital length of stay, and ICU time in minimally-invasive cardiac surgery patients.

“From a clinical standpoint, catheters provide two important advantages over single injection blocks: duration and titratability.”
Ultrasound Gel: Do Not Forget the Importance of Appropriate Infection Control Practices

Ultrasound imaging is a useful diagnostic tool in a variety of medical settings. To assist in the transmission of acoustic energy, ultrasound transmission gel is used as a coupling medium for ultrasound-guided interventional regional anesthesia, pain, and musculoskeletal procedures, diagnostic scans, and transesophageal echocardiogram (TEE) examinations. Recently, concerns both nationally and internationally have been raised regarding the ability of ultrasound gel to serve as a vector for the spread of bacteria and as the causative agent for significant healthcare associated infections. Unfortunately, best infection control practices are still not consistently followed. A recent survey of cardiothoracic anesthesiology fellowship directors demonstrated that 56% of respondents did not follow the Food and Drug Administration’s (FDA) recommendation of using sterile ultrasound gel for TEE examinations. In a safety communication, the FDA recommended the use of sterile ultrasound gel, not only for sterile body site procedures and invasive procedures, but also for noninvasive procedures with mucosal contact where any possible added bioburden would be undesirable or mucosal trauma is likely. Furthermore, the FDA specifies that only ultrasound gel obtained from unopened containers/packets labeled “sterile” should be considered sterile. Based on this definition, multi-use bottles of ultrasound transmission gel would be considered nonsterile.

Multiple case reports have been published identifying ultrasound gel as a source of nosocomial infection (Table 1). In these case reports, both manufacturer and user processes have been identified as sources of contamination for various bacterial organisms, including *Klebsiella pneumoniae,* *Burkholderia cepacia,* *Achromobacter xylosoxidans,* and *Staphylococcus aureus.* Intrinsically contaminated ultrasound gel at the time of manufacturing has been responsible for multiple cases of nosocomial infection. Hutchinson et al. identified serious *Burkholderia cepacia* infections at tertiary care centers that resulted from contaminated ultrasound gel that originated directly from the manufacturer. Respiratory infections from *Pseudomonas aeruginosa* occurred in patients that had undergone cardiovascular surgery during which intraoperative TEE was utilized. After an infection control investigation with the assistance of molecular typing, ultrasound gel multi-use bottles were identified as the source of *Pseudomonas aeruginosa.* Furthermore, sealed unopened bottles also contained the same isolate of *Pseudomonas aeruginosa,* suggesting that contamination occurred at the time of manufacturing.

Besides contamination at the time of manufacturing, contamination of ultrasound gel in the spread of infection may also occur from inappropriate use of products. An outbreak of *Achromobacter xylosoxidans* associated with ultrasound gel used for transrectal ultrasound-guided prostate biopsies occurred from contaminated ultrasound gel through which biopsy needles passed. The ultrasound gel originated from a large supply bag that was used to refill ultrasound gel containers. In addition, nosocomial outbreaks of *Klebsiella pneumoniae* in six adult women and two neonates, and *Burkholderia cepacia* in a pediatric institution, have occurred secondary to inappropriate user processes for handling ultrasound gel.

Efforts to reduce gel-borne contamination have occurred through both the publishing of clinical recommendations by international and national communities and the modification of the manufacturing process. In response to this health concern, multiple medical associations and government agencies have published warnings and proposed preliminary clinical recommendations to minimize infection when using sterile and nonsterile medical gels. In 2004, following several cases of bacteremia and septicemia that occurred from the utilization of contaminated ultrasound gel, Health Canada published practice recommendations for the use of both sterile and nonsterile gels. These recommendations have been endorsed by many professional associations, including the Canadian Society of Diagnostic Medical Sonographers, the Society of Diagnostic Medical Sonography, and the American Institute of Ultrasound in Medicine. In April 2013, the Australian Sonographers Association published a background paper on the safe use and storage of ultrasound gel to prevent nosocomial infections, including cross infections. The stimulus for this background paper originated from safety alerts and recalls released in 2012 by the Australian Department of Health Therapeutic Goods Administration due to the confirmed presence of bacterial contamination in ultrasound gel. Recently in the United States, recommendations based on expert opinion have been proposed to minimize clinical risk. These recommendations build on the Health Canada recommendations that suggest the use of single-use sterile gels for invasive procedures, for neonates, for all procedures involving sterile equipment or non-intact skin, and for procedures on intact
**Table 1: Summary of previous case reports in which ultrasound gel was a source of nosocomial infection.** (Reproduced with permission from *Regional Anesthesia and Pain Medicine*).

<table>
<thead>
<tr>
<th>Author</th>
<th>Gel Used</th>
<th>Antimicrobial Agent</th>
<th>Identified Microorganism</th>
<th>Source of Contamination</th>
<th>Associated Procedure</th>
<th>Type of Nosocomial Infection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chittick, P. et al. (13)</td>
<td>Other-Sonic; Pharmaceutical Innovations, Inc., Newark, NJ</td>
<td>Not indicated</td>
<td>Pseudomonas aeruginosa</td>
<td>In-use and unopened gel bottles</td>
<td>Transesophageal echocardiography</td>
<td>Respiratory tract infection</td>
</tr>
<tr>
<td>Olshtain-Pops, K. et al. (11)</td>
<td>250mL unidentified gel bottle</td>
<td>Not indicated</td>
<td>Achromobacter xylosoxidans</td>
<td>250mL in-use gel bottles</td>
<td>Transrectal prostate biopsy</td>
<td>Bacteriuria and septicemia</td>
</tr>
<tr>
<td>Marigliano, A. et al. (9)</td>
<td>Not indicated</td>
<td>Methylchloroisothiazolinone and methylisothiazolinone</td>
<td>Burkholderia cepacia</td>
<td>Not indicated</td>
<td>Echocardiographic procedures</td>
<td>Not indicated</td>
</tr>
<tr>
<td>Jacobson, M. et al. (8)</td>
<td>250mL gel bottles from 4 un-identified manufacturers</td>
<td>Propyl and methyl parabens</td>
<td>Burkholderia cepacia, Klebsiella oxytoca, Stenotrophomonas maltophilia, Ralstonia pickettii, Pantoea agglomerans, Enterobacter ictaluri, Burkholderia stabilis</td>
<td>250mL in-use gel bottles</td>
<td>Diagnostic ultrasonography</td>
<td>Respiratory tract infection, bacteriuria, skin wound</td>
</tr>
<tr>
<td>Hutchinson, J. et al. (7)</td>
<td>250mL un-identified gel bottles, 5L opened stock bottles</td>
<td>Methyl paraben</td>
<td>Burkholderia cepacia, Enterobacter cloacae</td>
<td>Intrinsically contaminated gel during the manufacturing process</td>
<td>Transrectal prostate biopsy</td>
<td>Urinary tract infection and septicemia</td>
</tr>
<tr>
<td>Weist, K. et al. (12)</td>
<td>500mL un-identified gel bottle</td>
<td>Not indicated</td>
<td>Methicillin-susceptible Staphylococcus aureus</td>
<td>Dispensing spatula and 500mL in-use gel bottle</td>
<td>Neonate hip-joint sonography</td>
<td>Pyoderma</td>
</tr>
<tr>
<td>Gaillot, O. et al. (6)</td>
<td>250mL Sonecho gel bottles; Echos Contacts, Eragny, France</td>
<td>Not indicated</td>
<td>Klebsiella pneumoniae producing extended-spectrum -lactamase</td>
<td>Wide-mouthed bulk container</td>
<td>Emergency Room ultrasound scan</td>
<td>Urinary tract infection and skin lesion</td>
</tr>
<tr>
<td>Keizur, J. et al. (10)</td>
<td>Not indicated</td>
<td>Not indicated</td>
<td>Pseudomonas cepacia (i.e. Burkholderia cepacia)</td>
<td>Portable dispensing bottles and opened bulk dispensers</td>
<td>Transrectal prostate biopsy</td>
<td>Urinary tract infection</td>
</tr>
</tbody>
</table>

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*American Society of Regional Anesthesia and Pain Medicine* 2014

*Continued on page 24*
Regional Anesthesia and Obstructive Sleep Apnea continued...


PRO

Sacral lateral branch blocks are THE diagnostic test of choice continued...


Theoretically a single injection paravertebral block with liposomal bupivacaine that can last three days may provide consistent pain relief over the duration typically provided by CPNB while avoiding the challenges of catheter placement and management. Catheters can be associated with problems postoperatively such as leaking, dislodgement, and accumulating blood levels of local anesthetic. Nursing staff must understand how to program and adjust infusion pumps as well as troubleshoot catheter-related issues.

Although we assume that liposomal bupivacaine can indeed provide a prolonged nerve block of sufficient duration to replace 3-5 days of perineural infusion, supportive evidence is lacking. To date, the only liposomal bupivacaine dose-response study related to peripheral nerve blocks was conducted on a small cohort receiving femoral nerve blocks and demonstrates inconsistent block duration. Since the benefits of paravertebral catheters are well-established, comparative liposomal bupivacaine single injection nerve block studies will need to demonstrate equivalent analgesia for the same time frame.

With respect to cost-effectiveness, liposomal bupivacaine will remain on patent for several years. During its patent life, the drug is considered fairly expensive with the average wholesale price of $140 for a 10 mL vial and $285 for a 20 mL vial. However, since there may be system benefits associated with avoiding the management challenges associated with CPNB, formal cost analyses are needed.

In conclusion, non-selective nerve blocks of prolonged duration that impair motor function in addition to sensation need to be titratable except in specific cases. CPNB catheters allow for this while liposomal local anesthetic formulations may not. Once the FDA approves liposomal bupivacaine’s nerve block indication, we encourage clinical researchers to conduct much-needed comparative-effectiveness research studies with these two regional analgesic modalities.

References
Sacral lateral branch blocks are NOT the diagnostic test of choice continued...

Table 1: Chronological list of recent clinical studies evaluating radiofrequency procedures in the treatment of sacroiliac joint pain. For studies prior to 2008, please see Cohen et al, Table 5.24

<table>
<thead>
<tr>
<th>Author(s), Journal, Year</th>
<th>Study type (# of patients/treatments)</th>
<th>Patient Selection Criteria</th>
<th>RFA Technique (Number of lesions)</th>
<th>Results-Pain</th>
<th>Results-Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kapural et al. Pain Practice 2008.16</td>
<td>Retrospective (26/36)</td>
<td>Dual diagnostic SIJ IA blocks (&gt;50% relief)</td>
<td>RFA 90C x 90 sec at L5DR (1)</td>
<td>Mean VAS pain scores decreased from 7.1 to 4.2. % pts with % of relief: 50%&gt;50% relief 15%&gt;75% relief 12%-100% relief GPE: 18/27 pts (67%) rated pain as improved or much improved</td>
<td>Improvements in function (PDI) from 32.7 to 20.3 (38% improvement)</td>
<td>First published case series with CRF. Results at 3-4 mo. Opioid use decreased from median 30 to 20 mg morphine equivalents.</td>
</tr>
<tr>
<td>Cohen et al. Anesthesiology 2008.17</td>
<td>Randomized, placebo controlled, blinded (28)</td>
<td>Single SIJ IA block (&gt;75% relief x 6 hours)</td>
<td>L4 and L5 DR: 22G, 10cm w 5mm at RF at 80 C x 90sec; CRF 60C x 150 sec at S1 (3), S2 (3), S3 (2) and +/- S4 (1) Crossover arm received RFA 80C x 90 sec at all levels</td>
<td>&gt;50% pain relief: 79%-1 mo 64%-3 mo 57%-6 mo 14%-12 mo</td>
<td>ODI scores were reduced: 44%-1 mo 50%-3 mo 39%-6 mo</td>
<td>Crossover group ODI scores were reduced: 28%-1 mo 59%-3 mo 49%-6 mo</td>
</tr>
<tr>
<td>Cohen et al. RAPM 2009.14</td>
<td>Retrospective (77/80)</td>
<td>Single SIJ IA block (&gt;50% relief)-all patients. -35/77 received second IA block -24/77 received L4-S3 blocks (single injection technique with 0.5ml/level and &gt;50% relief)</td>
<td>RFA of L4DR (71/77), L5DR (all) 80C x 90 sec with 22G, 10cm, 5mm a.t. Sacral lesions: Traditional (57/77): 22g, 10cm, 5mm a.t. 80C x 90 sec S1-3 (2/level) Cooled (20/77): 17G, 7.5cm, 4mm a.t. 60C x 150sec S1-3 (2/level)</td>
<td>52% of patients reported &gt;50% improvement at 6 mo. In this group, mean NRS decreased from 6.0-2.7 (55%)</td>
<td>Mean ODI improved in “success” group from 41.8 to 23.0 (45%)</td>
<td>No single clinical variable reliable predicted treatment results. Negative predictors were increased age and duration of pain, and opioid use. Only positive predictor of a successful outcome was use of cooled RF technology.</td>
</tr>
<tr>
<td>Speldewinde. Pain Med 2011.18</td>
<td>Prospective (20)</td>
<td>“Improvement” with IA block</td>
<td>80C x 90 sec at L5(1), 80C x 90 sec (Cohort 1) or 60sec (Cohort 2) at S1 (3), S2 (3), S3 (3)</td>
<td>At 3 mo: NRS reduced from 7.1 to 4.5 % relief at 6-36mo (%pts): 100%-47 75-99%: 7 50-74%:27 1-50%:13 0%:7 16/20 reported ave 82% relief for ave duration of 15 mo.</td>
<td>Improvements in function at 3 mo: FRI (26%) GHQ (29%) 4-ADLs (13%)</td>
<td>80% Success rate. Improvements in “psychological state” at 3 mo. DASS scores decreased for: -depression (39%) -anxiety (40%) -stress (35%)</td>
</tr>
</tbody>
</table>

SIJ= Sacroiliac joint, IA=Intra-articular, LBB=Lateral branch blocks, L5 DR=L5 Dorsal ramus, L4 DR=L4 Dorsal ramus; CRF=Cooled radiofrequency lesion, RFA=Thermal radiofrequency lesion (standard), a.t.=active tip; C=Celsius, sec=Seconds, mo=month(s), yr=year(s), pts=patients, ave=average; NRS=Numerical rating scale for pain, VAS=Visual analog scale for pain, GHQ: General health questionnaire, FRI=Functional rating index, 4-ADLs=Four activities of daily living, ODI= Oswestry disability index, SF-36 (bodily pain), SF-36PF (physical function), AQoL=Assessment quality of life, DASS=Depression anxiety stress scale
Table 1: continued...

<table>
<thead>
<tr>
<th>Author(s), Journal, Year</th>
<th>Study type (# of patients/treatments)</th>
<th>Patient Selection Criteria</th>
<th>RFA Technique (Number of lesions)</th>
<th>Results - Pain</th>
<th>Results - Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel, Gross, Brown &amp; Gekht. Pain Med 2012.19</td>
<td>Randomized, placebo controlled, blinded (51)</td>
<td>Dual blocks with &gt;75% relief; Blocks of L5DR, S1-S3 LB (single-site, single depth, 0.5ml/level)</td>
<td>CRF (60C x 150 sec) at L5DR, S1 (3), S2 (3), S3 (2)</td>
<td>Improved pain NRS for pain (% decrease in mean): 44-1 mo 39-3 mo 41-6 mo 44-9mo</td>
<td>Improved function ODI (% improvement): 32-1 mo 30-3 mo 35-6 mo 50-9mo</td>
<td>RCT: Lateral Branch Neurotomy vs Sham; Only controlled study using lbf as screening test</td>
</tr>
<tr>
<td>Cheng et al. Clin J Pain 2013.20</td>
<td>Retrospective (88: 30 RFA, 58 CRF)</td>
<td>Dual diagnostic SIJ IA blocks (&gt;50% relief)</td>
<td>Traditional: 22g, 10cm, 5mm a.t. 80C x 90 sec L4(1), L5 (1), S1-3 (1-2 each level)</td>
<td>% patients receiving &gt;50% relief: 3 mo: 50-60 6mo:40 9mo:30</td>
<td>Not reported</td>
<td>No significant difference in duration of relief or % of patients receiving &gt;50% relief between the patients receiving RFA versus CRF.</td>
</tr>
<tr>
<td>Stelzer et al. Pain Med 2013.21</td>
<td>Retrospective (126)</td>
<td>Single diagnostic SIJ IA block (&gt;50% relief)</td>
<td>Cooled RF 60C x 150 sec at L5 (1), S1 (2-3), S2 (2-3), S3 (2)</td>
<td>VAS (&gt;50% reduction): 86%-4-6 months 71%-6-12 months 48%-&gt;12 months</td>
<td>AQoL (% reporting improved or much improved): 96:4-6 mo 93:6-12 mo 85:12 mo</td>
<td>% opioid users who stopped / decreased use: 100:4-6 mo 62:6-12 mo 67:12 mo</td>
</tr>
<tr>
<td>Ho, Hadi, Pasuthansqrtchat &amp; Tan. J Pain Research 2013.22</td>
<td>Retrospective (20/23)</td>
<td>Single diagnostic SIJ IA block (&gt;50% relief)</td>
<td>CRF 60C x 150 sec at L5DR (1), S1 (2-3), S2 (2-3), S3 (2)</td>
<td>Mean NRS pain (% Decreased): Baseline 7.4 1mo: 4.3 (42) 3mo: 2.3 (66) 6mo: 2.9 (61) 1 yr: 3.0 (59) 2 yr: 3.1 (58)</td>
<td>Not reported</td>
<td>Reported results at 2 years.</td>
</tr>
<tr>
<td>Schmidt, Pino &amp; Vorenkamp. Anesthesia &amp; Analgesia 2014.23</td>
<td>Retrospective (60/77)</td>
<td>&gt;50% relief with single SIJ IA injection</td>
<td>RFA, multilesion probe (80-85C x 3-5 lesion areas) + L5DR +/- L4 DR (80C x 90 sec)</td>
<td>&gt;50% pain relief: 71%-6 weeks 55%-6months 16%-12 months</td>
<td>Not reported</td>
<td>Only published study using multilesion probe.</td>
</tr>
</tbody>
</table>
Sacral lateral branch blocks are NOT the diagnostic test of choice

controlled study evaluating response to SIJ-RFA following LBB was performed by Patel et al. using the single depth, single injection technique. Despite the more stringent selection criteria, the 6-month results did not demonstrate greater improvements in pain compared with the other reports. Using more stringent selection criteria do not appear to result in better outcomes following SIJ-RFA but may be potentially excluding a portion of patients who may have otherwise benefited from this therapy.

In summary, technical advances have resulted in greater success with ablative strategies targeting the sacroiliac joint. Currently, the vast majority of the studies have selected patients based on clinically-significant pain relief (often defined as >50% reduction) with single IA injections. Those studies that have employed more stringent selection criteria (dual blocks and/or minimum 75% improvement) have NOT shown superior efficacy and may in fact be eliminating patients who may have benefited from the procedure. Similarly, sacral lateral branch blocks have limited sensitivity, and the results of SIJ-RFA based on this selection criterion are promising but not superior to the other studies. Therefore, based on the current literature, IA blocks remain the diagnostic test of choice in selecting patients for SIJ-RFA.

References:

expansion of the posterior rectus sheath compartment, a 19-gauge wire-reinforced catheter is inserted 4-6 cm beyond the needle tip.

- The location of the catheter tip may be confirmed by direct visualization of the catheter or via visualization of local anesthetic spread within the posterior rectus sheath compartment by injecting local anesthetic through the catheter.
- The needle is withdrawn and the catheter is secured to the skin and covered with a sterile clear transparent dressing.

**CLINICAL PEARLS AND TIPS**

Although the anterior and posterior rectus sheaths are relatively easy to identify as hyperechoic linear structures that encase the RAM, novices may initially find the technique somewhat more difficult due to the “dynamic nature” of the block. The anterior abdominal wall may move with respiratory excursions and even small movements may displace the needle out of the imaging plane. Since this is a compartment block (similar to a TAP block), it is reasonable (and preferred by the author) to perform the block in the operating room after induction of general anesthesia but prior to surgical incision or emergence.

- **Local Anesthetic Selection**
  - 15-20 ml ropivacaine 0.25% with 1:400,000 epinephrine or bupivacaine 0.25% with 1:400,000 epinephrine per side. For pediatric patients, the suggested dosing is 0.5 ml/kg (either bupivacaine 0.25% or ropivacaine 0.25% with epinephrine 1:400,000) per side.14
  - This author suggests adding epinephrine to decrease local anesthetic peak plasma concentration (Cmax), as spread of local anesthetic will encompass a relatively large surface area for vascular absorption into the systemic circulation. Based on initial pharmacokinetic studies, the time to peak plasma concentration (Tmax) is approximately 45 minutes.14-16 Thus, the patient should be observed for potential signs or symptoms of local anesthetic systemic toxicity for a minimum of 45 minutes after completion of BRSBs.
  - The expected duration of RSBs is approximately 6-10 hours. Thus, there should be an analgesic plan for when the analgesic effects of the BRSBs dissipate.
  - For a continuous catheter technique, a small continuous infusion (2-3 ml/hr) is recommended simply to keep to catheter tip patent. Intermittent bolus injection of 10-20 ml ropivacaine 0.25% per side every 6-10 hours is recommend to maintain postoperative analgesia.11, 12
- **Current Role of Ultrasound-Guided RSBs in Perioperative Multimodal Analgesia**
  - BRSBs may be performed prior to surgical incision to facilitate analgesia immediately after surgery. If they are performed prior to the surgical incision, they will decrease intraoperative analgesic (opioid) requirements.
  - Alternatively, BRSBs may also be performed in the immediate postoperative setting as a “rescue block technique” (in the event of either unexpected severe postoperative pain after an abdominal surgical procedure or unanticipated failed epidural analgesic technique).
  - BRSBs do not provide complete anesthesia-analgesia for major abdominal surgical procedures, as they do not provide visceral analgesia. Thus, BRSBs should be used as part of a multimodal analgesic approach that includes NSAIDs or COX-2 inhibitors, acetaminophen, gabapentin, and as-needed systemic opioids.
  - One of the primary indications for BRSBs with or without catheters in our institution is to provide postoperative abdominal wall analgesia when thoracic epidural analgesia (TEA) is contraindicated. One potential advantage is the notable lack of sympathetically (and hypotension) that is commonly associated with TEA.

**REFERENCES**

These payment reductions were announced on November 27, 2013 and went into effect on January 1, 2014. The American Society of Anesthesiologists (ASA), the American Society of Regional Anesthesia and Pain Medicine (ASRA), and six other pain medicine specialty societies advocated for delay of these cuts. In a formal communication to CMS, the pain specialty societies requested that the agency stop implementation of these cuts, arguing that no comment period was given to interested parties prior to release of the final rule.  

Subsequently, a number of pain societies undertook multiple efforts to reverse these cuts. These efforts have included lobbying members of Congress, direct communication with CMS and its carrier medical directors, asking for a refinement panel, and ongoing grassroots efforts. It was argued that the magnitude of these reductions would have devastating consequences on Medicare beneficiaries’ access to pain medicine. Some possible consequences are increased opioid use as well as reduced usage of interlaminar epidurals in favor of more expensive transforaminal injections. Ultimately, this may result in the transforaminal codes being open to resurvey and the potential for a significant drop in their value as well.

Overall Medicare expenses may actually increase as more office-based physicians are forced to move into the more expensive hospital setting, and this wide variability in reimbursement based on setting has also been criticized. The Medicare Payment Advisory Commission (MedPAC), an independent Congressional agency that advises Congress on issues affecting Medicare, has been recommending elimination of variable payment rates provided in different settings. According to MedPAC, differences in payment across settings may increase overall Medicare spending by incentivizing providers to deliver care in higher paid settings. A survey from the American Hospital Association found that from 2000 to 2011, the number of physicians employed by hospitals surged by 55%. This trend is prevalent in many medical specialties, particularly cardiology where the proportion of cardiologists employed by hospitals tripled between 2007 and 2012.

The thousands of comments received by CMS objecting to the payment reductions to interlaminar epidural procedures have shown signs of success. On July 3, 2014, CMS published their draft recommendations for 2015, which state that valuation for these procedures will be re-examined and reimbursement will revert back to 2013 values. Image guidance will be bundled with the injection and included in the overall valuation of these procedures, as they are for transforaminal and paraverterbral procedures. In order to appropriately determine the bundled values, CMS is requesting more information. As such, these procedures will be included on the potentially misvalued code list distributed by CMS so that more information can be obtained, and a proper valuation can finally be determined. In the meantime, pain physicians will continue to navigate through the uncertainty of a changing health care environment and will anxiously await release of the final fee schedule, which is due out later this year.

References:
2. CY 2014 Physician Fee Schedule Final Rule. Centers for Medicare and Medicaid Services; CMS.gov
9. CY 2015 Physician Fee Schedule Proposed Rule. Centers for Medicare and Medicaid Services; CMS.gov

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2014
mucous membranes. The additional recommendations proposed by Oleszkowicz et al.\textsuperscript{1} are shown in Table 2. In addition, a “call” was made for the development of standardized professional society guidelines on the appropriate use of ultrasound transmission gel that could be adopted by healthcare practitioners and facilities.

Numerous factors can contribute to the risk of contaminating ultrasound gel and thus increase the spread of infection. For example, when using nonsterile ultrasound gel, multiple inappropriate practices may increase the risk of infection, including: 1) failing to wipe the outside of the bottle with a disinfectant between patients; 2) not following the expiration date of a bulk refilling container; 3) placing the tip or dispensing nozzle of the ultrasound gel bottle in direct contact with a patient, environment, or instrumentation; 4) reusing the ultrasound gel bottle after scanning individuals with known contact precautions; 5) refilling an ultrasound gel bottle by inserting the tip of the refillable bottle into the bulk container to aspirate contents; and 6) utilizing inappropriate gel warming methods. In addition, it has been recommended that if refillable containers are used, they should not be topped off and should be washed in hot soapy water or hospital-grade disinfectant prior to refilling the container.\textsuperscript{3} The healthcare community often assumes that when non-invasive diagnostic ultrasound scans are performed on patients with intact skin, ultrasound gel is a noncritical item and sterility is not essential.\textsuperscript{1,15} However, clinically-relevant infections have occurred even in these situations. Weist et al.\textsuperscript{12} reported Methicillin-resistant \textit{Staphylococcus aureus} associated with contaminated dispensing spatula and gel bottles.

Not only can the ultrasound gel itself serve as a potential vector for the spread of nosocomial infection, but so can the ultrasound probe, gel bottle, and dispensing equipment.\textsuperscript{16}

Besides the clinical recommendations made by multiple societies, ultrasound gel manufacturers have also attempted to limit gel-borne contamination through the addition of stabilizing bacteriostatic preservatives such as parabens.\textsuperscript{7} First introduced in the 1930s, parabens (alkyl esters of \textit{p}-hydroxybenzoic acid) are a type of preservative used in cosmetic, pharmaceutical, and industrial products considered to have significant bacteriostatic (stopping bacterial growth) rather than bactericidal (destroying bacteria) effects. Although parabens are thought to have a broad spectrum of inhibiting activity against yeast, fungi, and bacteria, multiple reports have demonstrated resistance to these agents and have ultimately questioned their bacteriostatic effects.\textsuperscript{2,17-22} In 1995, Muradali et al.\textsuperscript{20} demonstrated that ultrasound gel containing parabens did not effectively limit the growth of \textit{Staphylococcus aureus}. A recent study suggests that ultrasound gel containing parabens is only marginally effective at inhibiting the growth of specific bacterial species on a growth promoting substrate.\textsuperscript{21} In this study, the ultrasound gel containing parabens was more effective at inhibiting the growth of gram-positive bacteria (specifically \textit{Staphylococcus aureus} and Methicillin-resistant \textit{Staphylococcus aureus}) than gram-negative bacteria (specifically \textit{Escherichia coli}, \textit{Klebsiella pneumoniae}, and \textit{Pseudomonas aeruginosa}). The bacteriostatic effects of ultrasound gel containing parabens did not inhibit the growth of \textit{Pseudomonas aeruginosa} and only limited the growth of \textit{Escherichia coli} and \textit{Klebsiella pneumoniae} for 24 out of the 72 hours examined. Gram-negative bacteria have been shown to have the ability to degrade, hydrolyze, and develop resistance to parabens.\textsuperscript{7,22,23}

In conclusion, continued work is needed in both the development and enhancement of evidence-based infection control guidelines for the use of sterile and nonsterile ultrasound gel. Furthermore, advancement is required for manufacturer-based strategies to limit contamination at the time of manufacturing and assist with impending bacterial contamination of in-use ultrasound gel. Although a good start, guidelines to date have been based largely on professional recommendations, with limited evidence to prove their effectiveness in reducing contamination rates.\textsuperscript{21} Furthermore, recent research suggests richer educational strategies are warranted on methods to instruct healthcare professionals on the potential of ultrasound gel to serve as a vector for nosocomial infection and methods to limit this risk.\textsuperscript{21} When performing diagnostic and interventional ultrasound-guided procedures, practitioners need to recognize the ability of ultrasound gel to serve as a potential vector. Currently, the use of sterile single-use packets is the recommended practice for limiting nosocomial infection when performing invasive regional, musculoskeletal, and chronic pain procedures and

### Table 2: Additional guidelines proposed by Oleszkowicz et al.\textsuperscript{1}

<table>
<thead>
<tr>
<th>Follow the Centers for Disease Control and Prevention’s guidelines for disinfection and sterilization in healthcare facilities for reprocessing ultrasound transducers.</th>
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<tbody>
<tr>
<td>Single-dose sterile ultrasound transmission gel should be used during the following:</td>
</tr>
<tr>
<td>1. Performing a biopsy or puncture</td>
</tr>
<tr>
<td>2. Procedures involving mucous membranes</td>
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<tr>
<td>3. Scanning nonintact skin</td>
</tr>
<tr>
<td>4. Scanning near a surgical wound</td>
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<tr>
<td>5. Scanning neonates and critically ill pediatric patients</td>
</tr>
<tr>
<td>Nonsterile ultrasound gel may be used for low risk, noninvasive procedures on intact skin and for low risk patients.</td>
</tr>
<tr>
<td>Seal multidose nonsterile ultrasound containers appropriately when not in use.</td>
</tr>
<tr>
<td>Do not reuse ultrasound gel containers and replace when empty.</td>
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<tr>
<td>When warming ultrasound gel, dry heat is the preferred method.</td>
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