PAIN MEDICINE

Positive Impacts of Ultrasound-Guided Regional Anesthesia on Enhanced Recovery Pathways

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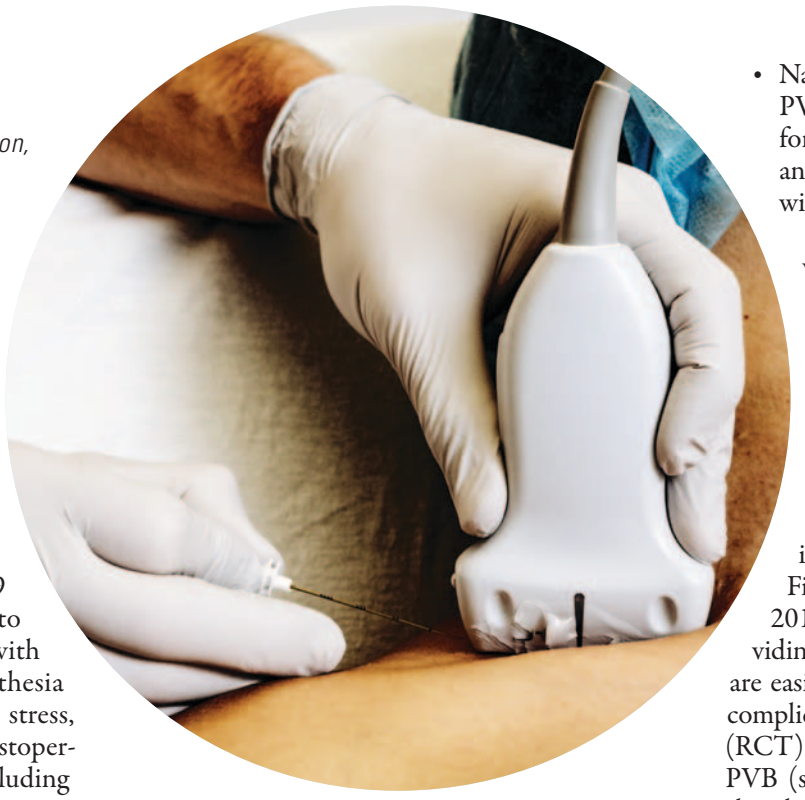

Introduction

Enhanced recovery pathways (ERPs) have been shown to reduce costs and improve outcomes in nearly all surgical specialties, including shortening length of stay (LOS) by 30% to 50%, with similar reductions in complications and decreased readmissions.[1] Compared with traditional care, ERPs have resulted in a cost savings of $6,900 to $7,129 per patient.[2] This evidence-based approach to standardizing care of the surgical patient with best practices often includes regional anesthesia techniques, which reduce surgically induced stress, inflammation, and complications; improve postoperative pain control; and accelerate recovery, including early ambulation.[3]

Guidelines for postoperative pain management from the American Pain Society, the American Society of Regional Anesthesia and Pain Medicine, and the American Society of Anesthesiologists, issued in 2016, strongly recommend the use of multimodal analgesia, including regional anesthesia.[4] Many comparative studies, systematic reviews, and meta-analyses have demonstrated that ultrasound-guided regional anesthesia (UGRA) results in longer block durations, faster onset times, improved block success, and a reduced need for opioids.[5-8]

Reduced Opioid Use and LOS After Mastectomy

Postoperative pain control is the major determinant in hospital LOS and narcotic use in patients undergoing mastectomy. Regional anesthesia techniques provide superior acute pain control and decreased chronic pain, thereby playing an essential role in ERPs.[9] Moreover, paravertebral nerve block (PVB) reduces narcotic requirements and shortens LOS after mastectomy, with or without immediate reconstruction.[10,11] There is also preliminary evidence that use of PVB might reduce the risk for breast cancer recurrence,[12] but further research is necessary to evaluate this possibility.

In a comparison of 145 patients undergoing mastectomy with PVB and 100 patients undergoing this surgery with general anesthesia, the following outcomes were reported[13]:

- Surgery was successfully completed with PVB in 85% of cases with no general anesthesia.
- 98% of general anesthesia patients required opioids versus 25% of those in the PVB group.
- 96% of patients having PVB were discharged the same day versus 76% of the patients undergoing general anesthesia.
- Significant reductions in postoperative nausea and vomiting were observed in the PVB group, with a minimal overall rate of complications (2.6%).
- PVB markedly improved the quality of recovery after breast cancer surgery and provided patients the option of ambulatory discharge.

Starting in 2011, mastectomy patients at Stamford Hospital, in Connecticut, received PVB administered under ultrasound guidance in the preoperative holding unit. The catheters were inserted and bolused with local anesthetic preoperatively, using midazolam for sedation. All patients had excellent outcomes. In 2013, we advanced our program and developed a multimodal opioid-sparing approach to perioperative analgesia designed to help patients achieve pain-free recovery after major breast surgery. The protocol included ultrasound-guided paravertebral catheters (PVC) and oral gabapentin, a nonopioid adjuvant medication used in multimodal analgesia protocols[14,15] that has demonstrated opioid-sparing effects in patients undergoing breast cancer surgery.[16,17]

A retrospective chart review of 139 patients undergoing mastectomy with or without immediate tissue expander (TE) placement, between 2009 and 2014, at Stamford Hospital revealed the following outcomes for those who received PVC alone or PVC with perioperative gabapentin (PVC+G), compared with conventional pain management (CPM) with on-demand narcotics:

- LOS was significantly reduced with PVC+G (1.6 days) compared with CPM (2.3 days) and PVC (2.1 days) for all mastectomies, bilateral mastectomies, and mastectomies with TE reconstruction.
- Narcotic usage was significantly decreased with PVC+G (39 mg) compared with CPM (72 mg) for all mastectomies and bilateral mastectomies, and trended toward a decrease in mastectomies with TE reconstruction (58 mg).

Overall, LOS and narcotic usage decreased with increased use of multimodal perioperative analgesia.

PECS I/II Blocks: Effective Analgesia After Breast Surgery

In 2012, we added ultrasound-guided pectoral (PECS) I/II blocks to our ERP for mastectomy patients, with the blocks placed after induction of general anesthesia, before incision. First described by Blanco in 2011 (PECS I)[18] and 2012 (PECS II),[19] these novel techniques for providing postsurgical pain relief after breast surgery are easier to perform than PVB, with fewer potential complications.[20] A recent randomized controlled trial (RCT) comparing the effects of the PECS block versus PVB (single shot) after radical mastectomy reported that the PECS block offered the following benefits[21]:

- longer duration of action;
- reduced morphine consumption;
- superior axilla coverage (PECS II); and
- improved postoperative analgesia compared with thoracic PVB, with no adverse effects.

In another recent RCT of 120 patients undergoing unilateral, modified radical mastectomy, those who received an ultrasound-guided PECS I/II block plus general anesthesia had the following outcomes, compared with a control group of patients who underwent general anesthesia alone[22]:

- lower pain scores and less morphine use in the first 12 hours;
- lower intraoperative fentanyl consumptions;
- decreased nausea, vomiting, and sedation; and
- shorter LOS in the PACU and hospital.

The investigators concluded that combined PECS I/II blocks offer superior analgesia for radical breast surgery, using "simple, easy-to-learn techniques, having easily identifiable landmarks based on good anatomical and ultrasound knowledge, making them an excellent alternative to [thoracic PVB]."[22]

Ultrasound-Guided Abdominal Blocks in ERPs

Over the last decade, the widespread availability of point-of-care ultrasound has been primarily responsible for a dramatic rise in adoption of abdominal wall blocks, including safe and effective techniques, such as the transversus abdominis plane (TAP) block, and novel techniques, such as the quadratus lumborum (QL) block. Not only are abdominal wall blocks technically simple to perform with ultrasound guidance, but they have been shown to reduce pain and opioid consumption in many clinical settings, while also expediting postsurgical ambulation.[23]

Moreover, these regional anesthesia techniques have valuable clinical and economic benefits when incorporated into ERPs. For example, a recent study by University of Virginia Health System revealed direct cost savings of $777,061 in the first 6 months after implementing an ERP for colorectal surgery that included regional anesthesia.[24] Not only was opioid use reduced by nearly 80%, but patient satisfaction more than doubled, prompting the investigators to conclude that "small investments in the perioperative environment can lead to large returns."

Favorable Outcomes and Effective Pain Control

In 2010, the Department of Anesthesiology at Stamford Hospital introduced ultrasound-guided TAP blocks as part of its narcotic-sparing ERP for pain management, initially for colorectal surgery and later for most major and minor abdominal surgeries, with excellent patient outcomes. Subsequently, ultrasound-guided QL blocks were introduced for appropriate patients, also with favorable outcomes, including effective pain control and minimal complication rates.

However, abdominal wall blocks have some limitations. With the exception of the QL block, they do not provide analgesia lateral to the anterior–axillary line and provide limited additional benefit for surgeries with substantial visceral pain. Moreover, the extent of sensory block can be somewhat variable because it depends on the spread of local anesthetic and the anatomic course of the targeted nerves, as opposed to targeting specific nerve structures. These factors, combined with individual variations in patient response, suggest that these blocks are best used as part of a multimodal analgesia protocol.

The extent of analgesia achieved with abdominal nerve blocks varies with the specific technique, and this should be matched to the surgical site. For example, the ultrasound-guided subcostal TAP block reliably provides analgesia to the supraumbilical abdominal wall (T6-T9), whereas the lateral ultrasound-guided TAP block is best suited for incisions in the T10-T12 area.

TAP Blocks Enhance Recovery and Reduce LOS, Costs, and Opioid Use

A recent extensive literature review revealed that TAP blocks play a valuable role in enhancing recovery after open or laparoscopic colorectal surgery[25]:

- TAP blocks significantly reduce opioid use, compared with conventional treatment including wound infiltration and patient-controlled analgesia (PCA).
- TAP infusions via catheter are as effective as thoracic epidurals.
- TAP blocks are an easily performed, cost-effective, and narcotic-sparing adjunct to colorectal surgery with minimal procedural complications or morbidity.
- The benefits of TAP blocks align with several goals of ERPs.

In a recent study comparing TAP catheter blocks with epidurals followed by PCA in patients undergoing laparoscopic colon resection, morphine consumption at 12 hours postoperatively was 51% lower in those who received TAP blocks—with PCA rescue, if required for pain management.[26] These patients also had significantly lower pain scores, faster recovery of bowel function, and a shorter LOS (3.4 vs 5.7 days for the epidural group).

A recent meta-analysis encompassing all TAP block techniques and surgery types found decreased morphine consumption in adult patients undergoing open/laparoscopic surgery or cesarean delivery.[27]

Ultrasound-Guided QL Block for Cesarean Delivery and Other Abdominal Surgeries

First described in 2007 by Blanco,[28] ultrasound-guided QL blocks are an

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effective technique for abdominal surgery, including cesarean delivery. Emerging evidence also suggests that these techniques may provide effective analgesia for hip and femur surgeries. Multiple approaches to QL blockade have been described, but the best one has yet to be identified. Spread of local anesthetic varies according to which approach is employed, with differing degrees of analgesia from T7 to L1.[29]

Recent RCTs have examined the effects of combining QL blocks with other anesthetic agents, with the following findings:

- In patients undergoing general anesthesia for laparoscopic ovarian surgery, those who received QL blocks had a significantly longer duration of analgesia (>24 hours) than those who received TAP blocks.[30]
- In patients undergoing spinal anesthesia for cesarean delivery, use of posterior QL blocks was more effective than TAP blocks for reducing morphine consumption for up to 48 hours postoperatively.[31]

Further investigation is needed to compare QL blocks with other abdominal wall blocks and determine the best approach, which should be tailored to fit the specific surgery, when possible. This novel application of UGRA appears to provide superior analgesia than TAP blocks for surgeries with a large component of visceral pain.

Conclusion

ERPs that include UGRA represent a paradigm shift in surgical care with important clinical and economic benefits. By reducing postoperative pain, opioid consumption, and LOS, while also contributing to expedited ambulation and recovery, UGRA is an ideal fit with the key goals of the ERP movement, which is founded on using evidence-based best practices to optimize patient outcomes.

ERPs have valuable economic benefits. Along with reported cost savings of up to $7,129 per patient for those treated with these opioid-sparing protocols,[2] use of UGRA increases patient satisfaction, which may lead to improved scores on the Hospital Consumer Assessment of Healthcare Providers and Systems survey. One of the measures used to calculate incentive payments under the value-based care program, this survey includes several questions that directly or indirectly relate to pain management.

Moreover, reducing opioid use with regional anesthesia techniques represents an important opportunity for anesthesiologists to take the lead in combating the US opioid epidemic. Nationally, more than 70 million patients per year are prescribed opioids for postsurgical pain,[32] with more than 10% of those prescribed opioids within 7 days of surgery continuing to use them a year later, escalating their risk for drug-related harm.[33] Overdose deaths involving prescription opioids have quadrupled since 1999 in the United States, and more than 1,000 patients are treated every day in emergency departments for misuse of these drugs,[34] highlighting the urgent need for wider implementation of opioid-sparing ERPs.

By using the most advanced techniques, including UGRA, and the latest scientific knowledge, anesthesiologists can enhance recovery both during the immediate postsurgical period and over the long term, helping to improve—and protect—the lives of surgical patients with quality care at a lower cost.

Dr Bowling developed and led the Regional Anesthesia Program at the Stamford Hospital, in Stamford, Connecticut, and in 2012 founded the Stamford School of Regional Anesthesia.

Dr Bowling reported that she is a consultant to Fujifilm SonoSite and has received educational grants from Pacira Pharmaceuticals.

References for this article are available online at AnesthesiologyNews.com.