Clinical and Cost Considerations For Managing Postsurgical Pain: Elastomeric Pumps and Continuous Catheters, or a Single-Dose Non-Opioid Local Analgesic

Postoperative pain is a common phenomenon and can have a significant effect on patient outcomes and health care costs. For example, in 2003, Apfelbaum and colleagues conducted a survey of 250 adults who recently had undergone surgical procedures, and reported that 80% of patients experienced acute pain after surgery; 86% reported moderate, severe, or extreme pain. Furthermore, 23% of patients who received pain medications experienced adverse effects (AEs). More recently, Gan and colleagues conducted a survey of a random sample of 300 adults who had undergone surgery within the previous 5 years. Approximately 86% experienced pain after surgery and of these, 75% had moderate or extreme pain during the immediate postsurgical period (Figure 1). After being discharged from the hospital, 74% reported a continuation of these pain levels.

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Undermanaged postsurgical pain has broad implications for clinical care.\textsuperscript{3,5} Indeed, various studies have demonstrated that undermanaged pain after surgery is associated with longer hospital lengths of stay, a higher rate of complications (including cardiovascular, pulmonary, renal, and psychological sequelae), increased risk for developing chronic pain syndromes, and decreased patient satisfaction.\textsuperscript{3,5} Because health care utilization organizations are tracking pain-related end points as measures of quality of care in surgical patients (eg, within the Hospital Consumer Assessment of Healthcare Providers and Systems survey), these suboptimal outcomes may have a direct effect on hospital reimbursements.\textsuperscript{6}

Opioids are the current mainstay of postsurgical pain management but have idiosyncratic or dose-limiting side effects that can be serious.\textsuperscript{7,8} The study by Gan and colleagues showed that 88% of postsurgical patients received analgesic medication after surgery and that opioids were the most commonly administered.\textsuperscript{2} However, 80% of those patients reported AEs. Although the most common AEs were not severe (eg, drowsiness and constipation), serious AEs, such as respiratory depression, also were noted.\textsuperscript{8} In 2012, the Joint Commission issued a Sentinel Event Alert regarding the use of opioids in the inpatient setting. This alert described several populations that were at particularly high risk for experiencing AEs in response to opioids, including the elderly, patients with morbid obesity, and those with sleep apnea.\textsuperscript{9-11}

One strategy to obviate the effect of opioid-related AEs is to employ a multimodal analgesic approach.\textsuperscript{12} Multimodal analgesia, the use of different classes of analgesics that act on different pathways and receptors, has gained increased acceptance and use over the past decade as a potential strategy for managing postsurgical pain while simultaneously reducing the incidence of AEs related to any single analgesic agent.\textsuperscript{13-15} Several studies have reported that a multimodal approach that reduces opioid use may result in improved outcomes, increased patient satisfaction, and lower cost of care.\textsuperscript{6,14,16} These benefits have led both the American Society of Anesthesiologists and the Joint Commission to endorse the use of multimodal analgesia in postsurgical patients.\textsuperscript{4,9}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Percentage of patients reporting various postsurgical pain levels in 2 different studies. Based on references 1 and 2.}
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\textsuperscript{Gan et al.}
\textsuperscript{Apfelbaum et al.}
Elastomeric Pumps and Continuous Catheters

Perioperative and postsurgical regional anesthesia is another strategy that uses local anesthetics or other agents in an effort to augment pain control while simultaneously avoiding the AEs associated with opioids. However, the duration of action of traditional local anesthetics, such as bupivacaine HCl, does not match the time course of postsurgical pain. In order to offer longer-lasting pain relief compared with that offered by traditional local anesthetics infiltrated into tissue that may or may not be associated with a nerve block, elastomeric pumps and catheters for continuous infusions of local anesthetics were introduced in the 1990s and are increasingly used in the inpatient postsurgical setting. The utility of these strategies is promoted by the fact that these analgesic routes can be continued even when the patient is discharged from the hospital. Continuation of these advanced analgesic strategies after hospital discharge more closely mirrors the prolonged time course of postsurgical pain.

However, the use of an indwelling catheter for continuous delivery of local anesthetics has several defined disadvantages (Table). Indwelling catheter use carries a risk for catheter-related complications, such as dislodgment, migration, infection, or bleeding. Additionally, continuous delivery using a pump and catheter incurs financial costs associated with the equipment and the resources needed to safely manage these systems both inside and outside the hospital setting.

Concerns Raised by the FDA and ISMP

Both the Institute for Safe Medication Practices (ISMP) and the FDA have raised concerns about the safety of elastomeric pumps in clinical practice. In May 2009, the ISMP published a report noting an association between the ON-Q® system and cartilage destruction, especially in cases in which local anesthetic is infused into a joint rather than the surrounding tissue. Similarly, the FDA recommended that elastomeric infusion devices not be used for continuous intra-articular infusion in patients after orthopedic surgery due to the risk for chondrolysis.

Table. Drawbacks, Limitations, and Safety Issues Associated With Use of Elastomeric Pumps and Indwelling Catheters for Postoperative Analgesia

<table>
<thead>
<tr>
<th>Elastomeric pumps</th>
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<tbody>
<tr>
<td>Variable infusion rates and concentrations</td>
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<tr>
<td>Administration of additional medications instead of analgesic alone</td>
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<tr>
<td>Extended use and refilling may result in infection</td>
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<tr>
<td>Premature emptying of the bulb</td>
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<td>Not suitable for outpatient use for individuals with suboptimal health literacy or who live alone</td>
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<td>Costs associated with the equipment and the resources needed to safely manage these systems</td>
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<table>
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<th>Indwelling catheters</th>
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<tr>
<td>Catheter dislodgment</td>
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<td>Catheter migration</td>
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<td>Infection and/or bleeding</td>
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<tr>
<td>Potential for cartilage destruction, especially in cases in which local anesthetic is infused into a joint rather than the surrounding tissue</td>
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Based on references 21 and 24-32.
In July 2009, the ISMP followed up with a report calling for safer practices with the use of ON-Q elastomeric pumps. In this report, the ISMP noted several other issues regarding the use of these pumps, including variable infusion rates and concentrations, administration of medication including the vasoconstrictor epinephrine instead of analgesic alone, and extended use and refilling that may result in infection.

The ISMP warned that elastomeric pump devices are filled outside of the pharmacy, typically in the operating room (OR), which raises concerns regarding accurate filling, labeling, and documentation of the administered medication.

**Clinical Experience**

In a review of experience at a major regional level 1 trauma center, Birrer and colleagues experienced firsthand many of the issues outlined in the ISMP alert. The investigators reported that the hospital’s pharmacy and therapeutics committee did not review the use of the ON-Q system because the pumps used a medication already on the formulary (bupivacaine). Therefore, there was a lack of training or education in use of the device, leading to a lack of involvement from the pharmacy team and increased human error by the OR staff. As a result, there were several serious incidents. In one incident, a physician inserted 2 pumps with 4 lumens into a patient with traumatic brain injury and rib fractures. In another incident, the pump’s infusion rate was unpredictable, leading to the clearing of the pump’s bulb in 36 hours, despite the fact that it was expected to last 72 hours.

In a small pilot study evaluating the use of the Homepump Eclipse for the management of acute and chronic pain, investigators reported several safety incidents when using the pumps, including premature emptying of the bulb and variations in drug delivery times. They also highlighted the importance of patient selection when choosing an elastomeric pump, noting that patients with suboptimal health literacy or those who live alone are not good candidates for this strategy.

Capdevila and colleagues studied the use of continuous...
Peripheral nerve block to manage pain in 1,416 patients after orthopedic surgery. They reported that this strategy was associated with a significant risk for AEs, most of which were related to the catheter and its associated devices (eg, kinked catheter, inadvertent withdrawal of the catheter, and undesired stoppage of the pump). Bacterial colonization of the catheters also was a common occurrence.

Grant and colleagues also reviewed their experience with 32 elastomeric pumps. After excluding data from 1 pump due to a leak, the investigators reported a pattern of over infusion in 7 of the pumps in the first hour after refilling. Furthermore, they reported that pump infusion flow-rate accuracy was variable over time.

In a study of 430 pumps, Remerand and colleagues found a variety of issues with both the pumps and the catheters (Figure 2). For example, 20.5% of pumps did not deflate correctly, and 2 catheters were obstructed. Spontaneous deflation occurred in 40 cases at 6 to 43 hours after connection. These dysfunctions were associated with a decrease in analgesic efficacy during the first postsurgical night, leading to many catheters being removed by the anesthesiologist after 11 to 72 hours.

**EXPAREL—A Long-Acting Single-Dose Formulation of Bupivacaine**

The bupivacaine in EXPAREL is encapsulated within multivesicular liposomes (DepoFoam®) that slowly break down and release the bupivacaine into the lymphatics and systemic circulation after injection, reducing systemic exposure and toxicity. In several studies, administration of EXPAREL led to prolonged concentrations of bupivacaine through 72 hours with plasma levels detectable up to 96 hours, which more closely matches the time course of postsurgical pain.

EXPAREL has demonstrated safety and efficacy in 2 pivotal Phase III trials of patients undergoing bunionectomy or hemorrhoidectomy. In both cases, EXPAREL was delivered via wound infiltration at the conclusion of the surgical procedure. Results showed that patient satisfaction and pain scores were significantly better for EXPAREL than for placebo at the primary end point (72 hours for hemorrhoidectomy, 24 hours for bunionectomy), and the opioid requirements were reduced when compared with placebo.

In another study, pooled safety data were generated from an analysis of 10 randomized, double-blind studies including 823 patients who received EXPAREL at the surgical site. The most common AEs in the EXPAREL arms were nausea, constipation, and vomiting. Serious AEs were reported in 2.7% of patients receiving EXPAREL, and in 5.4% and 1.1% of patients who received bupivacaine HCl and placebo, respectively. Additionally, 6.4% of patients experienced a cardiac AE consisting of either tachycardia or bradycardia; however, the cardiac events were mild or moderate in severity, and none required therapeutic intervention.

Studies of EXPAREL suggest that it does not adversely affect wound healing. For example, in a review of all 10 Phase II and III studies of the efficacy and tolerability of EXPAREL when administered into the surgical site, investigators found that EXPAREL did not adversely affect wound or bone healing for up to 2 years in some patients. There were also no reported instances of chondrolysis, although the number needed to detect this is quite large. Additionally, the investigators reported that infections occurred in 5% of patients administered bupivacaine HCl, 3% of patients administered EXPAREL, and 2% of patients administered placebo. These are all critical factors to consider when choosing the optimal postsurgical analgesic regimen.

Based on these and other studies, the FDA approved the use of EXPAREL in October 2011 for single-dose infiltration into the surgical site to produce postsurgical analgesia. EXPAREL is supplied in a ready-to-use aqueous suspension. The volume can be expanded with up to 280 mL preservative-free normal sterile saline as necessary to accommodate administration into a larger surgical site, allowing for a single maximum dose containing 20 mL of EXPAREL without the need for a catheter or pump.

**A Review of the Recent Literature**

Several studies in 2013 and 2014 reported more recent experience with EXPAREL since its approval for clinical use. For example, Hollander and colleagues compared the efficacy of EXPAREL (diluted with 40 mL normal saline and injected subfascially before closure of the fascia) versus subfascial continuous local anesthesia (SFCLA; subfascial tunneled catheters and a ropivacaine pump) and patient-controlled analgesia (PCA; morphine) in 195 patients undergoing laparoscopic single-site donor nephrectomy. Patients managed with PCA required more supplemental narcotics than those on EXPAREL (63.3 vs 29.4 mg; P<0.01) or SFCLA (vs 32.9 mg; P<0.01), but narcotic use was similar between patients treated with EXPAREL and those receiving SFCLA. Pain control (as demonstrated by maximal pain score according to the visual analog scale [VAS]) was comparable between patients receiving EXPAREL and SFCLA (6.3 vs 6.2). Operating time was longer for SFCLA compared with EXPAREL (219.8 vs 199.3 minutes; P<0.01) and PCA (vs 202 minutes; P<0.01). Based on these data, the investigators concluded that EXPAREL was as effective as SFCLA for perioperative analgesia and also was associated with decreased costs and operative time, likely due to its comparative ease of administration.

Emerson and colleagues compared continuous femoral nerve block (FNB) to wound infiltration with EXPAREL as part of a multimodal pain program in 72 patients undergoing total knee replacement. On average, patients receiving EXPAREL required significantly lower amounts of opioid medication during their inpatient stay than those treated with an FNB (hydrocodone equivalent doses: 82.2 vs 176.6 mg; P<0.001), and
requested fewer narcotic doses (7.5 vs 14.3; Figure 3). There was a trend ($P=0.09$) toward lower inpatient VAS pain scores with EXPAREL compared with FNB (1.8 vs 2.3; $P=0.09$). In the EXPAREL group, investigators found no incidence of quadriceps weakness, a common drawback to administering traditional local anesthetics via continuous FNB. The investigators concluded that wound infiltration with EXPAREL yielded equivalent postsurgical analgesia compared with a continuous FNB and with significantly less narcotic medication. As a result, they suggested that use of EXPAREL would replace the traditional opioid-reliant model of postsurgical analgesia.

In another study, Richard and colleagues compared EXPAREL to the ON-Q system in controlling pain at the extraction and stapler insertion sites in patients undergoing laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass (RYGB). Patients in the EXPAREL group used significantly less narcotics (hydrocodone/acetaminophen) in the immediate postsurgical period than patients in the ON-Q group (<10 vs 30 mg; $P=0.001$).

Additionally, in a single-institution, single-surgeon, retrospective study of 108 patients undergoing robotic-assisted laparoscopic urologic surgeries, Walker and colleagues compared the efficacy of 0.5% ropivacaine delivered via an ON-Q pump (through 2 catheters placed under the fascia at the wound sites at the end of the surgery) versus wound infiltration with EXPAREL (injected subcutaneously into the incision sites and circumferentially along the trocars above and below the fascia down to the peritoneum). The investigators

**Figure 3.** Patients receiving EXPAREL required significantly lower amounts of opioid medication during their inpatient stay than those treated with an FNB (hydrocodone equivalent doses: 82.2 vs 176.6 mg; $P<0.001$).

**Figure 4.** Comparison of the efficacy of wound infiltration with EXPAREL versus 0.5% ropivacaine delivered via the ON-Q system following robotic-assisted laparoscopic urologic surgery.

Based on reference 46.
reported that the mean morphine equivalent dose was less in the EXPAREL group than in the ON-Q group (23.8 vs 65.9; \(P<0.0001\)). Furthermore, the mean time to first opioid use was delayed in favor of EXPAREL (186.0 vs 63.9 minutes; \(P=0.0043\); Figure 4). Of particular note, 5 patients in the EXPAREL group and 1 in the ON-Q group did not require any supplemental opioids. Based on these data, the investigators concluded that the use of EXPAREL was an effective strategy for postsurgical analgesia in patients undergoing minimally invasive surgery and was associated with a significant reduction in narcotic use.86

**Conclusion**

Postoperative pain is common and is associated with worse patient outcomes and higher health care costs. Although the use of local anesthetics as part of a multimodal analgesic approach can reduce opioid use and its associated AEs, the use of elastomeric pumps and continuous catheters needed to provide incisional pain control to a more diverse population of total abdominal hysterectomy patients.

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**Case Study 1**

A 66-year-old woman presented for open total abdominal hysterectomy, bilateral salpingo-oophorectomy, periaortic lymphadectomy, and omentectomy for ovarian cancer.

**Jacob Hutchins, MD**

The patient had a history of an abnormal right ovary with elevated CA-125. She had no other past medical history and this was her first surgery. She declined to have an indwelling catheter to manage postsurgical pain because neither she nor her husband felt comfortable removing it at home. The decision was made to provide postsurgical analgesia with bilateral classic transversus abdominal plane (TAP) infiltration with EXPAREL. Before surgery, in the preoperative block area, the patient received bilateral ultrasound-guided TAP infiltration. She received 30 mL total volume per side (10 mL EXPAREL and 20 mL normal saline). She was then taken to the OR where she was induced with 100 mg propofol, 100 mcg fentanyl, 100 mg lidocaine, and 50 mg rocuronium. She received a total of 400 mcg of fentanyl intraoperatively and 1 mg hydromorphone for a procedure that lasted 264 minutes. Final pathology showed stage IIC adenocarcinoma of the right fallopian tube.

The patient’s postoperative pain was well controlled, with her maximal pain score in the postanesthesia care unit (PACU) at 3 out of 10 on the NRS. While in the PACU, she received 50 mcg fentanyl and 1 mg hydromorphone IV. During her first 24 hours postoperatively, her maximal pain score was 3 out of 10 and she received 0.1 mg IV hydromorphone, 5 mg oxycodone, 30 mg IV ketorolac, and 325 mg oral acetaminophen. During the first postoperative 24 to 48 hours, her maximal pain score was 4 out of 10 and she used only 15 mg ketorolac IV and 1,200 mg ibuprofen. She denied nausea or vomiting during the entire postoperative period. She was discharged home with oral opioids and enoxaparin injections 40.15 hours after surgery. When contacted on postoperative day (POD) 2, she reported continued good pain control without the need for additional opioids and was satisfied with the method of pain management.

**Commentary**

Continuous TAP instillation with a pump and catheter provides incisional pain coverage and can be continued once discharged, but may be contraindicated or not desired in certain patients. By using TAP infiltration with EXPAREL instead of a continuous catheter and pump, a similar duration of analgesia can be provided and all postoperative anticoagulation needs can be met. Additionally, those with limited mental ability or assistance can still receive up to 72 hours of incisional pain relief. This technique also eliminates the potential for accidental catheter removal. With the change to EXPAREL, we have been able to provide postoperative incisional pain control to a more diverse population of total abdominal hysterectomy patients.
Case Study 2

A 44-year-old man undergoing a skin graft following multiple surgeries.

Susan E. Downey, MD, FACS

The patient was previously healthy and had developed chest pain. His medical history was notable for hypertension but he was not on medication. Stress test confirmed an ascending aortic aneurysm. He underwent elective ascending aortic replacement with a femoral artery cut down and repair. Later that same day he began to complain of severe calf pain and was found to have a compartment syndrome in his left calf. He was taken back emergently to the OR and underwent fasciotomies of the calf. A week later, he developed shortness of breath and was found to have a pericardial effusion. This required another return to the OR and subxiphoid drainage. Two weeks later, a plastic surgery consultation was obtained for a skin graft for the fasciotomy wounds on his calf.

The nursing staff and the rest of his medical team were concerned about his postoperative pain management because he had been on narcotics in the ICU for several weeks. Due to his many complications and surgical procedures in such a short period of time, the patient was having pain control issues. The Palliative Care Department had been consulted and was following him with the diagnosis of “intractable pain.” He was maintained on a hydromorphone PCA 0.9 mg per hour continuous drip with 0.3 mg every 10 minutes as needed and a 3-mg per hour lockout. The patient was taken to the OR and a split-thickness skin graft was harvested from his upper thigh using a dermatome.

The dermatome was set at 18/100,000 of an inch. EXPAREL 20 mL with 40 mL saline (total volume 60 mL) was injected into the donor site. The donor site was dressed with xeroform and a bulky dressing. The skin graft was secured to the recipient site with staples and Adaptic gauze. No local anesthetic was injected into the recipient site.

Immediately after the skin graft procedure, the PCA was stopped and the patient was switched to hydromorphone IV push 0.5 mg every 3 hours as needed for pain. Oxycodone/acetaminophen was administered for breakthrough pain. He was discharged home 2 days after the skin graft procedure on oral oxycodone/acetaminophen alone.

Commentary

When harvesting skin grafts, the donor site can be as painful as a second-degree burn. It can take days or even weeks for the pain to subside, and an injection of marcaine or lidocaine only lasts a few hours. A pain pump cannot be used because the harvesting of the skin graft does not leave a cavity for a catheter. The patient was informed that EXPAREL would be used in the donor site before surgery to minimize his postoperative pain. After surgery, the patient was found to be resting comfortably and reported no pain in the donor site.

Case Studies 3 and 4


John Pilcher, MD, FACS, FASMBS

The 53-Year-Old Woman: Using an ON-Q Pump and Catheter

The patient suffered from many years of weight gain despite regular diet and exercise. Her medical problems included hypertension, hyperlipidemia, asthma, chronic low back pain, and knee pain. She had previously undergone laparoscopic cholecystectomy and total abdominal hysterectomy. She also had a history of atrial fibrillation and spontaneous deep vein thrombosis 4 years before her initial encounter with the bariatric surgical team. She took ibuprofen regularly for moderate knee and back pain, but was not taking any narcotic pain medication before surgery. Her height was 163 cm and her weight was 113 kg, with a body mass index (BMI) of 43 kg/m². Medications before surgery included lisinopril, metoprolol, spironolactone, atorvastatin, and cetirizine.

The bariatric surgical team recommended RYGB to treat the patient’s progressive metabolic obesity disease. The surgery was performed laparoscopically, without any unusual events. The gastrojejunal anastomosis was accomplished using a size 25 circular stapler, which was introduced into the abdomen by removing the left flank trocar and dilating the site to accommodate the device. At the end of the procedure, the fascia and muscle at the site that had been dilated were closed using a single vicryl suture. The other trocars (all nonbladed) were simply removed and no fascial closure was deemed necessary. No drains were deemed necessary.
Bupivacaine 0.5% plus epinephrine was infiltrated preemptively at each trocar site after the abdomen was prepped and draped, and an additional 20 mL was infiltrated at the end of the procedure into the left flank fascia where the suture closure was accomplished. An ON-Q catheter was threaded into the preperitoneal plane on the left flank, lateral to the site of the suture closure. The 48-hour elastomeric ON-Q pump was charged with a 120-mL volume of bupivacaine 0.25%, which infused gradually through the catheter during the 2-day hospital stay.

The patient received the standard postoperative pain and nausea regimen, which included 2 mg PCA morphine in 10-minute intervals with 30/4-hour lockout; 15 to 30 mL of hydrocodone/acetaminophen elixir (7.5/500 mg per 15 mL) orally every 4 hours as needed for pain; 4 doses of 30 mg IV ketorolac every 8 hours beginning at 4 hours postsurgery; 4 doses of 4 mg IV ondansetron every 6 hours (standing), then 8 mg IV every 6 hours as needed for nausea; and 10 mg of IV metoclopramide every 6 hours as needed for nausea, if ondansetron was not effective.

The 48-hour elastomeric ON-Q pump was charged. The patient received the standard postoperative pain and nausea regimen, which included 2 mg PCA morphine in 10-minute intervals with 30/4-hour lockout; 15 to 30 mL of hydrocodone/acetaminophen elixir (7.5/500 mg per 15 mL) orally every 4 hours as needed for pain; 4 doses of 30 mg IV ketorolac every 8 hours beginning at 4 hours postsurgery; 4 doses of 4 mg IV ondansetron every 6 hours (standing), then 8 mg IV every 6 hours as needed for nausea; and 10 mg of IV metoclopramide every 6 hours as needed for nausea, if ondansetron was not effective.

The postoperative stay was unremarkable, and the patient was discharged home on POD 2. During her hospital stay she received 26 mg morphine via PCA, 120 mL hydrocodone/acetaminophen elixir; ketorolac as scheduled; ondansetron as scheduled followed by 2 additional doses of ondansetron as needed; 20 mg of metoclopramide (2 doses as needed as backup for ondansetron); and bupivacaine via ON-Q catheter, with catheter removal just before discharge.

At time of discharge, the patient received a standard prescription for additional hydrocodone/acetaminophen elixir. At her first follow-up visit, the patient reported that she took the as-needed prescription “very regularly” for the first few days at home, obtained the permitted refill (each fill = 1 pint), then used “about one-fourth” of the second pint. Approximately 1 week post-discharge the patient experienced very severe constipation, requiring 2 enemas and self-disimpaction.

In long-term follow-up, the patient had experienced substantial weight loss and health improvement. There was no long-term pain, nausea, or constipation sequelae.

**Commentary**

Although these are 2 different patients, they underwent similar procedures. However, when EXPAREL was administered, less narcotics were used, resulting in fewer postsurgical side effects.
A Pharmacist’s Clinical Perspective

Andrew Rogalski, PharmD, BCPS

Our institution began using EXPAREL in 2012, and it is now used in general, orthopedic, and gynecologic procedures by multiple practitioners. We have seen a number of advantages throughout the institution since making it a part of our multimodal pain control strategy.

In discussions with providers, caregivers, and patients there has been a nearly universal description of reduction in requirements for rescue narcotics in the postoperative period, with consistent results into POD 3. Our nurses have even reported narcotic-free PACU discharges for several same-day procedures.

Operationally, we had been using considerable numbers of elastomeric infusers and CADD infusers for regional anesthesia and nerve blocks. Many of our surgeons have abandoned these modalities and adopted EXPAREL for its superior simplicity with excellent results.

When accounting for costs, we found that the acquisition costs for the infusion devices and standard anesthetics were initially slightly less than EXPAREL, but when the cost of the catheters, tubing, and preparation time were tabulated, the costs were essentially equivalent. For example, preparation of infusers required a minimum of 12 hours of pharmacy technician resources each week, which have now virtually been eliminated.

We have elected to provide EXPAREL at room temperature in a centrally located automated dispensing cabinet (Pyxis) within the OR core. Because of frequency of use, we have encountered no issues with the limited beyond-use dating when removed from refrigeration. Speculative concerns for look-alike issues with propofol have not been observed in our practice; however, as a precaution, our circulating nurses retrieve the EXPAREL and our anesthesiologists have no role in its administration. Our organization has seen many successes with the adoption of EXPAREL as part of our multimodal approach to pain management. When drug, device, and operational costs are considered in totality, we have found it to be at least cost-neutral to other regional anesthetic modalities.

Important Safety Information

EXPAREL is contraindicated in obstetrical paracervical block anesthesia. EXPAREL has not been studied for use in patients younger than 18 years of age.

Non–bupivacaine-based local anesthetics, including lidocaine, may cause an immediate release of bupivacaine from EXPAREL if administered together locally. The administration of EXPAREL may follow the administration of lidocaine after delay of 20 minutes or more. Other formulations of bupivacaine should not be administered within 96 hours following administration of EXPAREL.

Monitoring of cardiovascular and neurological status, as well as vital signs should be performed during and after injection of EXPAREL as with other local anesthetic products.

Because amide-type local anesthetics, such as bupivacaine, are metabolized by the liver, EXPAREL should be used cautiously in patients with hepatic disease. Patients with severe hepatic disease, because of their inability to metabolize local anesthetics normally, are at a greater risk of developing toxic plasma concentrations.

In clinical trials, the most common adverse reactions (incidence ≥10%) following EXPAREL administration were nausea, constipation, and vomiting.

Please see full Prescribing Information for EXPAREL.


