

Pain Management in Abdominal Wall Reconstruction

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Background: In abdominal wall reconstruction, adequate pain control and minimization of narcotic consumption are essential to improving patient outcomes and satisfaction. Previous studies have examined the role of individual strategies, such as neuraxial analgesia and multimodal analgesia. However, there has not been a study that examined all potential determinants of postoperative narcotic requirements, including intraoperative strategies.

Methods: Consecutive patients who underwent abdominal wall reconstruction were reviewed. Preoperative factors (chronic preoperative narcotic usage, indication for abdominal wall reconstruction, administration of neuraxial analgesia), intraoperative factors (intraoperative narcotics administered, method of mesh fixation), and postoperative factors (multimodal analgesia, complications) were collected. The main outcomes were daily amount of opioids used and length of hospital stay.

Results: Ninety-three patients were included in the study. Patients who had an epidural required lower doses of opioids postoperatively, while those on chronic preoperative opioids, those whose mesh was fixated using transfascial sutures, and those who received large doses of opioids intraoperatively required higher doses of postoperative opioids. Hospital length of stay was longer in patients who received transfascially sutured mesh and those on chronic opioids preoperatively.

Conclusions: This study provides potential strategies to improve pain control and minimize narcotic consumption postoperatively in patients undergoing abdominal wall reconstruction. Intraoperative administration of opioids should be minimized to avoid the development of tolerance. Epidural analgesia reduces postoperative narcotic requirement and may be especially beneficial in patients at highest risk for postoperative pain, including those on chronic opioids, and those in whom transfascial sutures are used for mesh fixation. (*Plast Reconstr Surg Glob Open* 2017;5:e1400; doi: 10.1097/GOX.0000000000001400; Published online 23 June 2017.)

INTRODUCTION

Patients undergoing abdominal wall reconstruction often have significant postoperative pain.¹ Poorly controlled postoperative pain has been shown to lead to longer postoperative care unit stays, longer hospital stays increased readmission rates, and decreased patient satisfaction.²⁻⁴ Another, less well-known, deleterious effect of poorly controlled postoperative pain is peripheral and central sensitization,² giving rise to chronic pain.⁵ Interestingly, poorly

controlled pain has also been shown to impair immune function and decrease blood flow through sympathetic-induced peripheral vasoconstriction, placing the patient at increased risk of surgical-site infection and wound healing complications.⁶⁻¹¹

Traditional pain control methods have relied heavily on intraoperative and postoperative opioids. However, those drugs are known to increase the risks of constipation, confusion, ileus, falls, and even fatal respiratory arrest.^{12,13} They also can lead to the development of opioid dependence, contributing to the current epidemic across the United States, which has spurred the Joint Commission on Accreditation of Healthcare Organizations, the Centers for Disease Control, American Society of Anesthesiologists, and even the Surgeon General to urge for a shift toward nonopioid

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options for pain management.^{9–11,14} Opioids also lead to tolerance, and patients on chronic opioid therapy usually require higher doses of postoperative opioids to achieve pain control.¹⁵ Interestingly, tolerance to opioids can develop very rapidly, within a few hours.¹⁶ So rapid is the development of tolerance to opioids that remifentanyl has been found to lose 75% of its potency after a 3-hour infusion.¹⁷ Intraoperative administration of high doses of narcotics can therefore lead to rapid opioid tolerance postoperatively.

Nonnarcotic methods of pain control have emerged as effective and safe alternatives and have been shown to reduce the need for postoperative narcotics. Those methods include local anesthetics,^{18,19} nonsteroidal anti-inflammatory drugs (NSAIDs, such as ketorolac, ibuprofen, and celecoxib),^{20–24} acetaminophen,^{25–27} gabapentin, and epidural analgesia.^{28,29} Multimodal analgesia has been defined as the simultaneous use of 2 or more classes of these nonopioid alternatives.³⁰ This approach takes advantage of the different mechanisms of action of these pain control modalities. In abdominal surgery, several of those modalities have been proven to be effective.^{31–39}

However, there are additional factors that may affect postoperative pain control and narcotic requirement that have not been discussed as thoroughly in the literature: preoperative chronic opioid usage would be expected to increase postoperative opioid requirements. In addition, we have recently shown that the use of sutureless self-gripping mesh results in lower postoperative pain and narcotic requirement than the use of transfascially sutured mesh.⁴⁰

Our goal in this study was to perform a comprehensive analysis of the predictors of higher opioid usage after abdominal wall reconstruction, including preoperative, intraoperative, and postoperative factors.

METHODS

After institutional review board approval, a retrospective chart review of all patients who underwent abdominal wall reconstruction by the senior author (J.E.J.) between September 2013 and February 2016 was performed.

Preoperative patient and hernia characteristics were collected, including the indication for abdominal wall reconstruction (hernia versus reconstruction after tumor resection), whether the patient was on chronic opioids preoperatively, and whether an epidural catheter was placed preoperatively. In patients who received an epidural catheter, this was placed in the preoperative holding area with the patient seated. Each patient's T7/T8 interspace was identified, prepped, and sterilely draped. Utilizing the loss of resistance technique, the epidural space was identified, and an epidural catheter was advanced. Following catheter insertion, a test dose of local anesthetic with epinephrine was instilled to ensure proper placement. The epidural catheter was then secured and connected to an epidural pump. The epidural infusion consisted of a mixture of 0.0625% bupivacaine and 4 mcg/ml fentanyl. The anesthesia-acute pain team followed patients postoperatively to make adjustments to epidural pump settings. Changes to the rate and/or patient controlled epidural

analgesia (PCEA) dose were based on individual pain scores (0–10) verbalized by the patient during rounds.

Intraoperative details included whether mesh was fixed using transfascial sutures, whether components separation (anterior or posterior) was performed, and the amount of intraoperative narcotics administered by the anesthesiologist (in milligrams of oral morphine equivalents).

Postoperative details included complications (surgical-site occurrences at 30 days and hernia recurrence at last follow-up), median daily amount of narcotic analgesics used (in milligrams of oral morphine equivalents), and whether the patient received multimodal analgesia. Multimodal analgesia was administered orally once the patient was able to tolerate a clear liquid diet. This consisted of scheduled acetaminophen 1,000 mg every 6 hours, celecoxib 200 mg 3 times a day, and gabapentin 300 mg 3 times a day. Celecoxib was withheld in patients with known or suspected cardiac or renal disease. Gabapentin was dosed accordingly in patients with renal impairment based on creatinine clearance and was withheld in patients with obstructive sleep apnea, given the risk of exacerbation. Narcotics consisted of hydromorphone or morphine patient-controlled analgesia in the early postoperative period, followed by oral oxycodone or hydrocodone as needed once bowel function return, with intravenous narcotics available for breakthrough pain. Due to the scheduled acetaminophen, no additional acetaminophen-containing narcotics were administered (Table 1).

Statistical analyses included the Mann-Whitney test and multivariate binary logistic regression. To obtain binary values from continuous values, the outcome (amount of daily narcotics used postoperatively) was classified as equal or greater than 100 mg of oral morphine equivalent, since 100 mg of daily oral morphine intake is considered the threshold for high-dose opioids that places the patient at higher risk of complications.^{13,41} The amount of intraoperative narcotics given was classified as greater or smaller than its mean (75 mg). Statistical analyses were performed using Minitab 17, with $P \leq 0.05$ considered statistically significant.

RESULTS

Ninety-three patients underwent abdominal wall reconstruction between September 2013 and February 2016. Mean follow-up was 574 days (range, 250–1,090 days). Thirty patients (32.3%) were using chronic narcotics preoperatively. Eighty-one patients (87.1%) underwent reconstruction for hernia as an isolated procedure, whereas 12 patients (12.9%) underwent reconstruction after tumor extirpation. Components separation was performed in 49 patients (52.7%). Mesh was used in 85 patients. This included transfascially sutured mesh in the underlay or retrorectus positions in 63 patients (67.6%) and self-adhering sutureless mesh in 22 patients (23.7%). No mesh was used in 8 patients (8.6%). Epidural catheterization was performed in 37 patients (39.8%). Multimodal analgesia was administered in 51 patients (54.8%; Table 2).

Univariate analysis showed that the only factor that reduced median postoperative daily opioid usage was the placement of an epidural catheter preoperatively (61.9 mg versus 95.5 mg; $P = 0.015$; Table 3). The use of

Table 1. Multimodal Oral Analgesia Regimen

Drug	Dose (mg)	Frequency	Mechanism of Action	Precautions
Acetaminophen	1,000	Every 6 h	Unclear	Avoid other acetaminophen-containing drugs. Do not use in hepatic dysfunction.
Gabapentin	300	3 times daily (twice daily if 65 years or older)	Inhibits signal transmission through dorsal root ganglia	Needs renal dosing
Celecoxib	200	3 times daily	Inhibits COX-2 and decreases prostaglandin synthesis	Contraindicated in cardiac disease
Ibuprofen	400	Every 6 hours	Inhibits COX and decreases prostaglandin synthesis	Do not use with other NSAIDs. May lead to gastrointestinal bleeding. May inhibit platelet function.
Naproxen	440	Every 12 hours	Inhibits COX and decreases prostaglandin synthesis	Do not use with other NSAIDs. May lead to gastrointestinal bleeding. May inhibit platelet function.

Table 2. Baseline Patient Characteristics

Variables	n (%)
All patients	93 (100)
Indication for surgery	
Hernia	81 (87.1)
Tumor	12 (12.9)
Preoperative narcotics	
Yes	30 (32.3)
No	63 (67.7)
Components separation	
Yes	49 (52.7)
No	44 (47.3)
Mesh	
None	8 (8.6)
Transfascially sutured	63 (67.7)
Self-adhering (sutureless)	22 (23.7)
Multimodal analgesia	
Yes	51 (54.8)
No	42 (45.2)
Epidural	
Yes	37 (39.8)
No	56 (60.2)

multimodal analgesics postoperatively approached statistical significance (70.0 mg versus 93.3 mg; $P = 0.06$). Factors that increased median daily opioid requirement included chronic usage of narcotics preoperatively (114.4 mg versus 65.4 mg; $P = 0.05$) and the placement of transfascially sutured mesh (98.0 versus 57.3 mg; $P = 0.01$).

Excluding patients who had oncologic extirpative defects, the only significant factor was the placement of an epidural catheter (90.8 mg versus 143.2 mg; $P = 0.05$).

Multivariate logistic regression showed that factors associated with higher postoperative opioid usage were preoperative chronic use of narcotics [odds ratio (OR), 3.88; $P = 0.016$], high intraoperative narcotic usage (OR, 2.83; $P = 0.043$), and the use of transfascially sutured mesh (OR, 4.55; $P = 0.014$; Table 4). The use of epidural analgesia was associated with lower postoperative opioid usage (OR, 0.28; $P = 0.018$).

Average postoperative length of stay in the hospital was 5.9 days. The only 2 predictors of increased length of stay were the use of transfascially sutured mesh (OR, 4; $P = 0.007$) and the chronic use of narcotics preoperatively (OR, 2.7; $P = 0.045$). Epidural placement did not affect hospital length of stay (6.3 days with epidural, 5.6 days without epidural; $P = 0.5$).

Table 3. Univariate Analysis of the Predictors of Postoperative Narcotic Consumption

Variables	Patients	Median Daily Postoperative Narcotic Consumption (mg of Oral Morphine Equivalents)	P
All patients	93		
Epidural			
Yes	37	61.9	
No	56	95.5	0.015*
Multimodal analgesia			
Yes	51	70.0	
No	42	93.3	0.06
Preoperative narcotic use			
Yes	29	114.4	
No	64	65.4	0.05*
Mesh fixation			
Sutured	63	98.0	
Sutureless or no mesh	30	57.3	0.01*
Indication for surgery			
Hernia	80	85.0	
Tumor	13	52.0	0.87
Components separation			
Yes	49	81.8	
No	44	73.4	0.7
Surgical Site Occurrences			
Yes	23	94.1	
No	70	69.4	0.3
Intraoperative narcotics (mg of oral morphine equivalents)			
≥ 75 mg	41	109.8	
< 75 mg	52	64.7	0.001*

*Statistically significant values (<0.05).

Table 4. Multivariate Logistic Regression of the Predictors of Increased Postoperative Narcotic Requirement

	Odds Ratio of Postoperative Opioids > 100 mg Oral Morphine Equivalents Daily	P
Intraoperative opioids > 75 mg of oral morphine equivalents	2.83 (1.03–7.81)	0.043*
Sutured mesh	4.55 (1.24–16.66)	0.014*
Epidural	0.28 (0.09–0.85)	0.018*
Multimodal analgesia	0.61 (0.16–2.29)	0.46
Preoperative opioids	3.88 (1.24–12.2)	0.016*

*Statistically significant values (<0.05).

Twenty patients developed surgical-site occurrences at 30 days (21.5%). This included delayed wound healing in 8 (8.6%), cellulitis in 6 (6.5%), abscess in 5 (5.4%), and hematoma in 1 (1.1%). There were no differences in complication rates between patients receiving an epidural and those not receiving an epidural.

At last follow-up, hernia recurrence occurred in 2 patients (2.2%), and bulge occurred in 1 patient (1.1%). One patient (1.1%) developed a pulmonary embolus. No patients developed epidural catheter-related complications.

DISCUSSION

Adequate pain control with minimization of narcotic usage has become the standard of care in abdominal wall reconstruction. Previous authors have demonstrated the importance of this approach. Novitsky et al. studied their Enhanced Recovery After Surgery pathway in patients undergoing abdominal wall reconstruction.^{25,42} They found that the pain control portion of their pathway, which included intraoperative transversus abdominis plane (TAP) block with liposomal bupivacaine, multimodal analgesia preoperatively and postoperatively (acetaminophen, ibuprofen, gabapentin), and minimization of narcotic usage, was effective. Their study did not evaluate the use of epidural analgesia.

In our study, we have examined multiple factors that may affect postoperative pain and narcotic usage. This includes epidural catheter placement and the use of multimodal analgesia. We also examined preoperative narcotic usage and intraoperative narcotic administration as variables because patients on chronic opioids are likely to develop tolerance. In fact, tolerance can develop very rapidly, even as a response to intraoperative opioids,¹⁷ highlighting the need to consider modification to intraoperative strategies to minimize this from occurring and to underscore the importance of close communication and collaboration with anesthesia. Another variable that we examined was whether mesh fixation was performed with transfascial sutures: we have previously shown that the use of sutureless, self-gripping mesh resulted in lower narcotic requirement than the use of transfascially sutured mesh.⁴⁰ We also examined whether components separation was performed, as this would indicate a larger amount of dissection that may increase pain, and whether there was a surgical-site occurrence because patients with such a complication may have increased pain as a result of the complication.

In both our univariate and multivariate analyses, we found that epidural catheterization decreased postoperative narcotic utilization. Placement of the epidural catheter was performed preoperatively, which has been shown to result in improved pain control compared with postoperative placement.⁴³ Few patients early in this series received an epidural catheter. As we observed improved patient comfort with the use of neuraxial analgesia, we employed epidural catheters more frequently. Currently, the vast majority of patients undergoing complex abdominal wall reconstruction receive neuraxial analgesia.

Epidurals aimed at providing abdominal analgesia for abdominal wall reconstruction are usually placed in the

lower thoracic interspaces (T7–T9). Blocking signaling through these nerve roots, and adjacent roots affected by the subsequent spread of the local anesthetic and opioid in the epidural space, provides analgesia in an appropriate T5–T12 dermatomal distribution for abdominal wall reconstruction (Table 5). Placement at this location also allows titration of the epidural dose to cover the operative site without affecting muscle strength and bladder tone, allowing the patient to ambulate and void spontaneously.

Our epidural infusion generally consisted of bupivacaine and fentanyl at a continuous infusion of 4–6 ml/h, and a PCEA dose of 4–8 ml with a lockout period of 15 minutes after PCEA dose delivery. The combination of a local anesthetic and an opioid was used to take advantage of the synergistic effect of these 2 classes of drugs in blocking painful stimuli at the level of the spinal cord.^{44–46} All patients were able to ambulate starting on the evening of surgery with the epidural catheter in place, and none developed catheter-related complications. Despite widespread concern that patients with epidurals are at a higher fall risk than patients without epidurals, there is no significant difference in fall risks between the 2 groups.⁴⁷ Existing published evidence favors the use of epidural analgesia in major abdominal surgery: several authors have demonstrated decreased postoperative pain and narcotic usage with epidurals.^{28,29,48} Epidurals have even been found to decrease postoperative morbidity and cost after abdominal wall reconstruction,⁴⁹ resulting in less nausea and vomiting^{50,51} and lead to faster return of gastrointestinal function⁵² compared with systemic opioids. Patients with epidurals also have higher satisfaction, less pain with activity and improved pulmonary function,^{50–56} and shorter length of stay following abdominal surgery.^{57–59} In patients undergoing arthroplasties, epidural analgesia has been shown to decrease venous thromboembolism.⁶⁰ In addition, epidural analgesia has been shown to lower the levels of stress hormones and to increase the number of circulating lymphocytes and helper T-cells.⁴³

Epidurals are commonly believed to have high incidence of hypotension and adverse complications. Studies have shown that acute hypotension occurs in 10% of patients receiving an epidural, compared with 2% of patients receiving systemic opioids. The risk of serious adverse events, such as epidural abscess, persistent neurological damage, or catheter fracture in-situ is approximately 0.1%.^{51,61} Urinary retention has also been reported to occur in 10% of patients with epidurals. However, a vast majority of patients are able to urinate spontaneously without a Foley catheter 24–48 hours postoperatively.^{51,56}

Specific anticoagulation guidelines from the American Society of Regional Anesthesia and Pain Medicine should be followed to determine patient eligibility for epidural placement and timing of catheter and removal.

Table 5. Epidural Insertion Levels for Various Surgical Indications

Indication	Target Dermatomes	Epidural Insertion Level
Thoracic surgery	T3–T8	T5–T7
Abdominal surgery	T4–T12	T7–T9
Pelvic surgery	T6 to sacral	T9–T12

Table 6. Minimal Waiting Period for Anticoagulation Before and After Neuraxial Catheterization^{62,63}

Drug	When to Stop	When to Restart (h)
ASA and ASA combinations	6 d	24
NSAIDs	5 half-lives	24
Diclofenac	1 d	24
Ketorolac	1 d	24
Ibuprofen	1 d	24
Etodolac	2 d	24
Indomethacin	2 d	24
Naproxen	4 d	24
Meloxicam	4 d	24
Nabumetone	6 d	24
Oxaprozin	10 d	24
Piroxicam	10 d	24
Phosphodiesterase inhibitors		
Cilostazol	2 d	24
Dipyridamole	2 d	24
Anticoagulants		
Coumadin	5 d, normal INR	
Acenocoumarol	3 d, normal INR	
IV heparin	4 h	2
SubQ heparin	8–10 h	2
LMWH (prophylactic)	12 h	12–24
LMWH (therapeutic)	24 h	12–24
Fibrinolytic agents		
Fondaparinux	4 d	24
P2Y12 inhibitors		
Clopidogrel	7 d	12–24
Prasugrel	7–10 d	12–24
Ticagrelor	5 d	12–24
New anticoagulants		
Dabigatran	4–5 d (6 if impaired renal function)	24
Rivaroxaban	3 d	24
Apixaban	3–5 d	24
Glycoprotein IIb/IIIa inhibitors		
Abciximab	2–5 d	8–12
Eptifibatide	8–24 h	8–12
Tirofiban	8–24 h	8–12

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ASA, aspirin; LMWH, low-molecular-weight heparin; INR, International Normalized Ratio; IV, indicates intravenous.

Anticoagulation needs to be held anywhere from 4 hours (with normal PTT) to 5 days depending on the specific anticoagulant (Table 6).^{62,63}

Alternative analgesic modalities for postoperative pain include TAP blocks and paravertebral blocks. TAP blocks performed with ultrasound guidance allow for direct visualization of local anesthetic spread in the appropriate tissue plane. This allows for better accuracy and analgesia compared with the traditional landmark and double pop techniques.⁶⁴ Thoracic paravertebral blocks (TPVBs) have been extensively studied and utilized for thoracic and breast surgery; however, more practitioners are starting to assess their functionality for abdominal surgeries. Ultrasound allows practitioners to deposit local anesthetic in a more precise location, possibly providing a more consistent block compared with the landmark technique. Both visceral and somatic analgesia can be supplied by TPVBs, making this technique superior to TAP blocks for open abdominal surgeries. In recent studies, the adverse event rate for TPVBs was 1.2%, including intravascular puncture and epidural spread of local anesthetic, with no incidence of pneumothorax. A catheter infusing a low concentration of local anesthetic is another option for

practitioner utilizing TPVBs who want longer postoperative analgesia.⁶⁵

One recent study compared thoracic epidurals with TPVBs for abdominal surgery and found superior pain control with thoracic epidurals at both 24 and 48 hours postoperatively. However, as previously been demonstrated with epidurals, patients' mean arterial pressure was significantly decreased from baseline at 24 hours compared with bilateral TPVBs.⁶⁶

At our institution, we found the use of epidural catheters to be superior to paravertebral catheters for large abdominal wall cases, due to their efficacy in covering a very large area, ease of placement (1 indwelling catheter versus 2), and postoperative care and floor management of the patient (1 drug delivery pump versus 2). In addition, the technical skill required to perform ultrasound-guided paravertebral catheter placement severely limits the number of providers who are comfortable performing the procedure.

We found that the use of multimodal analgesia approached statistical significance in predicting lower postoperative narcotic needs. Our oral multimodal analgesia regimen included celecoxib, gabapentin, and acetaminophen. These drugs reduce pain via distinct mechanisms: NSAIDs, most notably cyclooxygenase-2 inhibitors, act by decreasing the synthesis of prostaglandins involved in pain generation, namely prostaglandin E2 and prostacyclin.⁶⁷ Gabapentin decreases current through membrane voltage-gated calcium channels in neurons of dorsal root ganglia.⁶⁸ The analgesic mechanism of action of acetaminophen is unclear, but it seems to involve upregulation of serotonin activity in the spinal cord and brain.⁶⁹ Despite the published evidence in favor of multimodal analgesia, we were unable to demonstrate a statistically significant benefit in our study, likely due to underpowering, although this approached significance at $P = 0.06$.

We also found that patients who had mesh fixated using transfascial sutures had more pain than those who had sutureless self-gripping mesh, or no mesh, a finding that we have previously demonstrated.⁴⁰ Although transfascial sutures are often necessary to anchor mesh, they can entrap sensory intercostal nerves and cause significant discomfort postoperatively. In noncontaminated cases where fascial reapproximation can be achieved, we have found retrorectus placement of sutureless self-gripping mesh to be as reliable, and less painful, than the placement of transfascially sutured conventional mesh with low rates of recurrence.⁴⁰ Another strategy we employ is minimizing transfascial suture fixation of mesh when the mesh is placed in the retromuscular plane after posterior components separation/transversus abdominis release (usually no more than 8 sutures in total placed in cardinal positions). However, in cases where the fascia cannot be reapproximated, we continue to use biologic or barrier-coated synthetic mesh in a wide intraperitoneal underlay position with transfascial sutures, knowing that these patients will likely have more pain postoperatively due to the higher number of sutures required to prevent internal herniation.

We found that preoperative chronic narcotic usage increased postoperative narcotic need. This is an expected finding, owing to the known tolerance that develops

after chronic narcotic usage. Interestingly, we also found that intraoperative administration of high-dose narcotics was an independent predictor of higher postoperative narcotic requirement. This is likely a result of the rapid development of tolerance to opioids.¹⁷ Minimizing opioid administration during anesthesia may therefore help minimize postoperative narcotic requirements.

This study is not without limitations. First, our study is retrospective in nature. Second, patients were not randomized to receiving any interventions and therefore confounders can affect our results, although we attenuated the effect of confounders through the use of multivariate logistic regression. Even though we demonstrated decreased narcotic requirements with epidural catheter placement, this did not translate into improved overall outcomes or shortened length of stay. Although there was a tendency toward decreased narcotic requirements in patients who received multimodal analgesia, this did not reach statistical significance due to underpowering, which is another limitation. Nevertheless, this is the first study to examine multiple elements that contribute to pain control in the abdominal wall reconstruction patient, including the effects of neuraxial analgesia, multimodal analgesia, mesh fixation techniques, preoperative narcotic use, and intraoperative narcotic use on postoperative opioid requirements. This study allows the identification of patients at risk of requiring high doses of narcotics postoperatively, patients on chronic narcotics preoperatively, and patients in whom transfascial sutures are used for mesh fixation. This study also provides strategies to decrease postoperative narcotic requirements in patients undergoing abdominal wall reconstruction, epidural catheterization, minimizing intraoperative narcotic administration, and possibly administering multimodal analgesia. These are components of an Enhanced Recovery After Surgery protocol that we are currently developing at our institution for abdominal wall reconstruction.

CONCLUSIONS

We found that, in abdominal wall reconstruction, the use of epidural analgesia was associated with lower postoperative narcotic requirements, whereas the use of transfascially sutured mesh, the use of higher doses of narcotics intraoperatively, and the preoperative chronic usage of narcotics were associated with higher postoperative narcotic requirements.

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