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CASE REPORT

Rectus sheath catheters—a novel approach to perioperative analgesia for colorectal surgery in an enhanced recovery after surgery (ERAS) protocol: a case series

David Rotstein[1] · Chang Park[1] · Sergey Khaitov[2] · Elisha Dickstein[1]

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Abstract

Introduction Opioids have played a critical role in the management of perioperative pain following abdominal surgery. Increasing attention is being paid to the deleterious side effects and limitations of this practice. This case report offers a novel alternative to opioid-based analgesia in the form of rectus sheath catheters (RSCs) which we employed as part of an enhanced recovery after surgery (ERAS) protocol.

Methods Three patients underwent laparoscopic- assisted colorectal surgery and were treated intra- and postoperatively with local anesthesia administered via bilateral rectus sheath catheters as well as by multimodal adjuncts. Evaluations of the patients' pain scores, opioid usage, and abdominal sensitivity to sharp stimuli were conducted daily.

Results The patients demonstrated a substantially lessened opioid requirement over their hospital stay with two of them requiring no opioid analgesic medications postoperatively.

Discussion We suggest that the incorporation of these catheters into an ERAS protocol can play an important role in further reducing perioperative opioid usage for procedures in which pain control can be especially challenging.

Keywords Regional · Catheter · Pain · Opioids · ERAS

Introduction

The prevention and treatment of postoperative pain after abdominal surgery plays a crucial role diminishing hospital stays, lowering hospital costs, and—ultimately—improving patient satisfaction. In this case series, we explored the postoperative analgesic effects of bilateral RSCs in patients undergoing colorectal surgery with a midline incision as part of an enhanced recovery protocol. Enhanced recovery after surgery (ERAS) protocols provide physicians with evidence-based pathways that take a multimodal approach to issues such as postoperative pain [1]. While the administration of opioids has served as the traditional approach to postoperative pain treatment, a multimodal approach of local anesthetics and non-opioid analgesics has emerged as a potential alternative [2].

We present three patients for whom we placed intraoperative bilateral RSCs. These patients were then managed postoperatively with minimal use of opioids and without epidural analgesia. Each patient's analgesia regimen included gabapentin, acetaminophen, and regular boluses of these catheters. Ketorolac was avoided at the request of the surgeon. This approach represents a reproducible effort to extend the possibilities of truncal anesthesia beyond the first postoperative day and fits in seamlessly with our ERAS-based approach to patient care.

Written informed consent was provided by all patients for the use of images and inclusion in this case series.

Case description

As per our institutional colorectal ERAS protocol, each patient received preoperative oral acetaminophen 975 mg and gabapentin 600 mg. During the patient's pre-anesthetic interview, he or she was offered the option of bilateral RSCs for treatment of postoperative pain. The risks of infection, bleeding, nerve injury, peritoneal puncture, and anesthetic toxicity were discussed.

✉ David Rotstein
david.rotstein@mountsinai.org

[1] Department of Anesthesiology, Perioperative, and Pain Medicine, Icahn School of Medicine at Mount Sinai, One Gustave L. Levy Place, Box 1010, New York, NY 10029, USA

[2] Department of Surgery, Icahn School of Medicine at Mount Sinai, New York, NY, USA

Intraoperatively, general anesthesia was induced with propofol, fentanyl, and rocuronium. Anesthesia was maintained with isoflurane and oxygen/air and rocuronium was administered for further muscle relaxation. After successful induction and intubation, a timeout was performed for placement of bilateral RSCs. The upper and lower abdominal wall was prepped with 2% chlorhexidine gluconate in 70% isopropyl alcohol. The field and ultrasound probe were draped and dressed employing the sterile technique.

The rectus sheath was identified 3–5 cm lateral to the midline and cephalad to the umbilicus. The ultrasound probe was then turned 90 degrees to visualize the rectus muscle in the longitudinal position. The probe was placed as lateral and cephalad as possible to allow for positioning of the catheters as remotely as possible from the surgical field. A 2-in 18 gauge Tuohy needle was inserted in the plane with the ultrasound probe just below the costal margin at a 45° angle to the skin. The needle was advanced posterior to the rectus muscle and anterior to the posterior sheath (Fig. 1). After a negative aspiration test, space was dilated with 20–30 mL of 0.25% bupivacaine and 10–30 mL of sterile saline in order to hydrodissect the muscle off of its posterior sheath. A 20 gauge multi-orifice catheter was advanced up to 15 cm. The Tuohy needle was removed and the catheter connector was attached. The catheter was reimaged and its tip was confirmed with a small 2-mL injection of air. The catheters were secured at approximately 11–13 cm at the skin with the catheter tip visualized at the level of the umbilicus. The catheter was secured at the skin with Dermabond and then sterilely dressed with an integrated chlorhexidine gluconate gel pad dressing (Fig. 2). The procedure was then duplicated on the alternate side.

Postoperatively, the catheters were connected to a pump that delivered continuous infusions of 0.1% bupivacaine at a rate of 2 mL/h to ensure catheter patency. A bolus of 10 mL of 0.25% bupivacaine with 10 mL of sterile saline was administered two to three times per day through each catheter for up to 4 days postoperatively. Evaluations of the patient's pain score, opioid usage, and abdominal sensitivity to sharp stimuli were conducted daily.

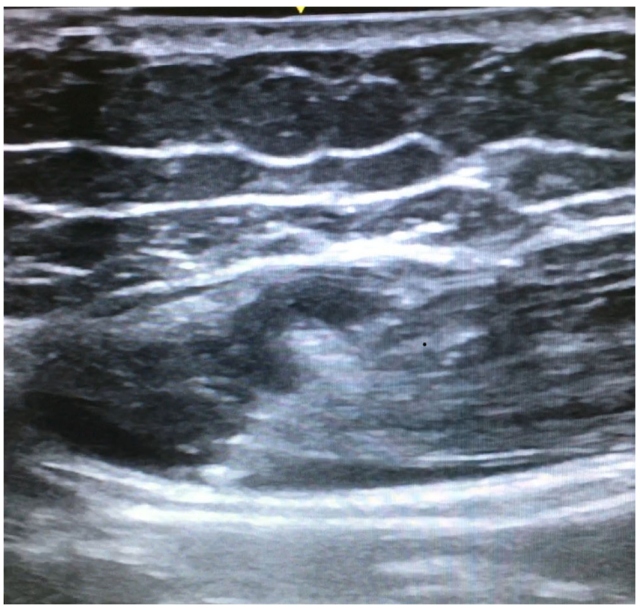

Fig. 1 Local anesthetic injected via Tuohy needle posterior to rectus muscle and anterior to the posterior rectus sheath

Fig. 2 Bilateral rectus sheath catheters secured in place with sterile chlorhexidine dressings

A brief profile of each patient and his/her results is as follows:

- Case 1

An 18-year-old female weighing 60 kg with a PMHx of Crohn's disease underwent a laparoscopic ileocolic resection under general anesthesia. Bilateral RSCs were placed after induction of general anesthesia. The patient received a total of 300 mcg of fentanyl and 50 mg of ketamine intraoperatively. The patient's postoperative pain intensity was assessed by a numerical rating scale (NRS: no pain, 0; worst pain, 10). The patient's peak pain intensity forty-eight hours postoperatively was 3/10. The patient did not require any use of opioid for breakthrough pain (Table 1). The catheter was removed after 64 h postoperatively in anticipation of discharge.

- Case 2

A 65-year-old female weighing 74 kg with a PMHx of hyperlipidemia, ulcerative colitis, and newly diagnosed ileocecal valve cancer underwent a laparoscopic right hemicolectomy with a midline extraction site. Bilateral RSCs were placed after induction of general anesthesia. The patient received a total of 250 mcg of fentanyl and 0.5 mg of hydromorphone intraoperatively. Three hours postoperatively, the patient's peak pain intensity was 0/10. Forty-eight hours postoperatively, the peak pain intensity was 6/10. The patient

Table 1 Postoperative opioid usage and pain score

		Case 1		Case 2		Case 3	
Time to opioid rescue (min)		0		0		81	
Morphine equivalents (mg)	PACU	0		0		6	
	Post-PACU—24 h	0		0		0	
	24–48 h	0		0		0	
	48 h+	0		0		4	
	Total	0		0		10	
Pain scores (0–10)		Median	Peak	Median	Peak	Median	Peak
	PACU	0	0	0	0	3	5
	Post-PACU—24 h	2	3	0.5	3	3	6
	24–48 h	2	2	2	6	2.5	3
	48 h+	0	1	0	7	0	7

PACU, post-anesthesia care unit

did not require any use of opioid for breakthrough pain. The catheter was removed after 137 h postoperatively in anticipation of discharge.

- Case 3

A 50-year-old male weighing 70 kg with a PMHx of asthma and newly diagnosed ascending colon colorectal cancer underwent a laparoscopic extended right hemicolectomy under general anesthesia. Bilateral RSCs were placed after induction of general anesthesia. The patient received a total of 250 mcg of fentanyl and 50 mg of ketamine intraoperatively. Three hours postoperatively, the patient's peak pain intensity was 4/10. Forty-eight hours postoperatively, the peak pain intensity was 3/10. The patient received a total of 9 mg morphine equivalents during the first 48 h postoperatively. The catheter was removed after 41 h postoperatively in anticipation of discharge.

Discussion

These three patients who received bilateral RSCs demonstrated a substantially lessened opioid requirement over their hospital stay, with two of them, notably, requiring zero opioid analgesic medications. This remarkable development stands in sharp contrast to our traditional approach to postoperative pain. At our institution, we had previously incorporated the rectus sheath block into the anesthetic plan for patients planning to undergo colorectal surgeries in which the primary extraction incision would be midline. This procedure involves the blockade of the anterior divisions of T6-L1 nerves that innervate the skin, muscles, and parietal peritoneum overlying these dermatomes [3]. Compared to a neuraxial technique, truncal blocks have the potential advantage of representing a lesser time commitment to place and a lower procedural risk profile [4]. They can additionally be performed in those patients for whom a neuraxial approach is contraindicated such as septic patients, coagulopathic patients, and those patients with spinal pathology. The absence of any neuraxial sympathectomy ensures that postoperative hypotension is not achieved and the compensatory liberal administration of fluids can be avoided (a frequent ERAS goal). Additionally, there is no risk of any motor blockade and thus allows patients to begin to ambulate virtually immediately following their procedures [5]. After performing the rectus sheath block for several years and observing positive results over those critical first 12 h postoperatively, we felt that the natural follow-up was to place catheters at the site to determine whether they could play a role in reducing patient pain scores, opioid usage, and perhaps time to discharge.

Rectus sheath catheters were first described in 2007 in a case report detailing the surgical placement of bilateral RSCs at the end of upper abdominal surgery with complete control of somatic pain [6]. In 2008, the use of ultrasound guidance facilitated the placement of these catheters by anesthesiologists [7]. The ability to more accurately identify the involved anatomy conferred the additional advantages of higher block success rates, shorter block onset times, and lower total doses of local anesthesia [8]. Several applications of this technique have been performed for gynecologic and colorectal surgery, with analgesic results surpassing those of neuraxial techniques. Notably, on these occasions, the catheters were placed postoperatively and, in conjunction with a regimen of alternative analgesic medications, demonstrated significant reductions in opioid requirements [9, 10].

Our efforts sought to draw on the successes of these examples but apply them within a slightly different clinical context. We hoped that by placing the catheters preoperatively, we might more effectively block surgical pain up front.

Additionally, at our institution, we see a large number of patients with inflammatory bowel disease (IBD) presenting for a variety of colorectal procedures. These patients have complex pain requirements and are well documented to represent a challenging patient group for analgesic management [11]. As such, this effort represented a novel approach to a patient population that would stand to benefit from alternative approaches to analgesia. Significantly, ketorolac and other nonsteroidal anti-inflammatory drugs were restricted from this patient cohort in order to lessen the probability of an anastomotic leak [12]. There were, therefore, particularly few non-opioid analgesic alternatives available to patients postoperatively for breakthrough pain.

The early findings associated with these catheters are encouraging. We expect to continue to gather data in an effort to further define the scenarios in which they can most effectively be utilized. As the IBD population represents a unique challenge in achieving satisfactory postoperative analgesia, these findings suggest that the incorporation of these catheters into a multimodal approach may contribute to improved pain control and, thus, to a more sophisticated and complete anesthetic plan.

Contribution statement DR contributed to the writing of the case series. SK was involved in patient recruitment. ED and CP performed the analysis and edited the final manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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