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Impact of long-acting local anesthesia on clinical and financial outcomes in laparoscopic colorectal surgery

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Enhanced recovery;
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Abstract

BACKGROUND: Our objective was to assess clinical and financial outcomes with long-acting liposomal bupicavaine (LB) in laparoscopic colorectal surgery.

METHODS: Patients that received local infiltration with LB were strictly matched to a control group, and compared for postoperative pain, opioid use, length of stay (LOS), hospital costs, and complication, readmission, and reoperation rates.

RESULTS: A total of 70 patients were evaluated in each cohort. Operative times and conversion rates were similar. LB patients had lower post-anesthesia care unit pain scores ($P = .001$) and used less opioids through postoperative day 3 (day 0 $P < .01$; day 1 $P = .03$; day 2 $P = .02$; day 3 $P < .01$). Daily pain scores were comparable. LB had shorter LOS (mean 2.96 vs 3.93 days; $P = .003$) and trended toward lower readmission, complication, and reoperation rates. Total costs/patient were $746 less with LB, a savings of $52,200 across the cohort.

CONCLUSIONS: Using local wound infiltration with LB, opioid use, LOS, and costs were improved after laparoscopic colorectal surgery. The additional medication cost was overshadowed by the overall cost benefits. Incorporating LB into a multimodal pain regiment had a benefit on patient outcomes and health care utilization.

Pain control is paramount to optimizing postoperative patient care. Inadequate pain control is associated with poor postoperative outcomes, higher risks of readmission, increased health care costs, and lower patient satisfaction.[1]

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Pain management is a tenet of enhanced recovery after surgery protocols.[2–9] Recent experience and controlled trials have proven enhanced recovery pathways (ERPs) are the ideal tool to optimize patient and financial outcomes after laparoscopic colorectal surgery.[8,10,11] However, little progress has been made to advance pain management during the time of enhanced recovery with multimodal pain control.

New modalities to manage postoperative pain after laparoscopic surgery include wound infiltration and transversus abdominis plane blocks with local anesthesia.[12–20] Most trials found TAP blocks are effective for reducing immediate postoperative pain and opioid use with an established ERP. However, there these modalities have not optimized pain management. TAP blocks with local anesthesia have not translated to consistently improved outcomes for overall opioid use, pain scores, length of stay (LOS), or readmission rates,[17,18,20–22] and outcomes for local wound infiltration are not well described in the existing literature. One tool to reduce postoperative pain and the need for opioids is wound infiltration with long-acting liposomal bupivacaine (LB).

LB is an extended-release injectable anesthetic approved by the US Food and Drug Administration for single-dose injection into the surgical site to produce postsurgical analgesia for up to 96 hours. The administration and safety of long-acting LB has been previously demonstrated,[23] and efficacy has been described in orthopedics, hemorrhoidectomy, and certain abdominal procedures.[24–34] Furthermore, no prior study evaluated the impact of local wound infiltration with long-acting liposome bupivacaine in regards to patient and financial costs or benefits.

The goal of this study was to evaluate postoperative pain, opioid use, and quality outcomes after laparoscopic colorectal surgery using local wound infiltration with long-acting liposome bupivacaine. Our hypothesis was that local wound infiltration with long-acting liposome bupivacaine as the anesthetic agent results in improved patient and financial outcomes in laparoscopic colorectal surgery with a multimodal ERP.

Methods

After institutional review board approval, review of a prospectively maintained departmental database was performed to identify elective laparoscopic colectomy patients from 2011 to 2014. To reduce variability, a single surgeon performed all cases surgeon through a single-port laparoscopic approach. Patients that received local wound infiltration with LB were matched to a historic control group that received no local wound infiltration on age, gender, body mass index (BMI), diagnosis, procedure performed, surgeon, and operative approach. The control group had no local anesthesia for wound infiltration, as the surgeon's clinical experiences found no benefit with regular bupivacaine, and this was omitted from practice and the ERP before the study period. Patients were excluded if less than 18 years of age, cases were performed emergently, cases were converted to open intraoperatively, cases were performed through an endoscopic or anorectal approach, or medical records were incomplete. In the experimental group, local wound infiltration with LB was performed at the laparoscopic port site at the end of the procedure. The 20 mL vial of LB (266 mg) was expanded with 20 mL of normal saline and 20 mL of .25% regular bupivacaine to a total volume of 60 mL. The mixture was injected using deep infiltration to the 3 distinct layers of the dermis, deep tissue, and preperitoneal space. Postoperatively, all patients were placed on identical standardized ERPs. This included alvimopan from the preoperative period through the hospital stay, limited intraoperative opioids, glucocorticosteroids, and antiemetics intraoperatively, scheduled nonopioids postoperatively, early oral analgesia and diet, early ambulation, and defined discharge criteria. The full details are summarized in Table 1.

Preoperative patient demographics, perioperative details, and postoperative outcome data were evaluated. Analysis included the 3 postoperative days, as after postoperative day 3, only 5 LB patients remained. Data fields assessed included age, gender, BMI, American Society of Anesthesiologists (ASA) score, indication for operation, operative approach, procedure performed, intraoperative complications, operative time, post-anesthesia care unit (PACU) opiate use, PACU pain scores, daily pain scores, hospital LOS, hospital costs, and readmission, complication, reoperation, and mortality rates within 30 days. The main outcome measures were postoperative pain scores, opioid use, LOS, cost of care, and complication, readmission, and reoperation rates. Cost was defined as the actual total costs for the entire inpatient episode, as reported by our institution's accounting system. Drug utilization was described using the World Health Organization's defined daily dose (DDD) for opioids, with each medication converted to a DDD scale and summed for 1 DDD score per day.[35] The conversion formula for each drug consumed was Fentanyl intravenous (IV) (1 DDD = 100 mcg), Dilaudid IV (1 DDD = 2 mg), Dilaudid per oral (PO) (1 DDD = 4 mg), Oxycodone PO (1 DDD = 20 mg), and Hydrocodone (1 DDD = 10 mg). Pain scores were measures using a visual analog scale (0 to 10), which has been previously described and validated for postoperative pain.[36]

An a priori power analysis was performed to determine the sample size needed to ensure differences between groups were due to LB and not chance alone. With an alpha level of .05, a minimum sample size of 54 was needed to detect differences between the matched groups with 95% power. For statistical analysis, normally distributed data were presented as means (standard deviation), non-normally distributed data as medians (range), and categorical data as frequencies (percent). Univariate analysis was performed using Student's *t*-test for continuous variables and Fisher's exact test for categorical variables. Statistical significance was defined at a level of alpha less than .05.