Original Article

Postoperative Opioid Requirements Following Roux-en-Y Gastric Bypass in Patients Receiving Continuous Bupivacaine Through a Pump System: A Retrospective Review

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Abstract

Background: Patients who undergo Roux-en-Y gastric bypass (RYGB) surgery have self-reported considerable postoperative pain, often requiring opioid administration.

Objective: To determine whether continuous delivery of local anesthetic via an infusion pump system decreased postoperative opioid usage in post-RYGB patients.

Methods: The electronic health record was used to identify and review 289 patients who underwent RYGB at our institution from January 2009 to October 2011. The treatment group received a continuous infusion of 0.375% bupivacaine administered by intraperitoneal soaker catheter for 48 hours via an infusion pump; the control group did not receive a pump or local anesthetic. Both groups received general anesthesia, nausea prophylaxis, and pain medication. Pain management consisted of opioid-containing patient-controlled analgesia (PCA) for the first 24 hours. Patients transitioned to supplemental intravenous opioid boluses, plus an oral opioid, for the remainder of their stay. Opioid use was measured in terms of morphine equivalents. Secondary outcomes included visual analog scale (VAS) pain scores and length of hospitalization.

Results: Morphine equivalents over the postoperative time period studied were significantly lower in the bupivacaine group than the control group (133 vs 106 mg, respectively; $P = .001$). There was no significant difference in VAS scores between the 2 groups ($P = .80$). Finally, the length of hospitalization between the 2 groups did not differ ($P = .77$).

Conclusions: We have shown that continuous infusion of bupivacaine, administered via a pain pump system, may have decreased postoperative opioid utilization. There were no differences in VAS scores or length of hospitalization between groups.

Key Words—bariatric surgery, bupivacaine, gastric bypass, local anesthetic, morbid obesity, pain management, postoperative pain

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Laparoscopic Roux-en-Y-gastric bypass (RYGB) is preferred over open surgery due to quicker recovery time and a possible reduction in postoperative pain.¹ Laparoscopic procedures are performed using small incisions through which surgical instruments and cameras are inserted. This surgical approach is less invasive than open surgery, which uses one large incision across the abdomen. Regardless of surgical technique, most RYGB patients experience postoperative

pain severe enough to require systemic opioid therapy. Systemic opioids are often associated with significant side effects such as sedation, nausea and vomiting, ileus, and pruritus.² Furthermore, increased pain is self-reported at laparoscopic incision sites.³

Local anesthetic infusion pumps allow the delivery of continuous local anesthetic to the surgical incision or working trocar sites via soaker catheters placed prior to skin closure. The *On-Q PainBuster* pump (I-Flow

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Corporation, Lake Forest, CA) used in this study consists of a local anesthetic-containing bulb attached to a flow-restricted soaker catheter. Prior to skin closure, the soaker catheters are tunneled under the skin close to the incision, trochar, or drain sites.⁴ Over time, the elastomeric bulb slowly releases the local anesthetic to soak the surrounding area.

Bupivacaine is a local anesthetic that blocks visceral nociceptive pain signals without the systemic side effects associated with opioids.⁵ Local anesthetics, including bupivacaine, have been reviewed in the literature involving surgical patients with inconsistent results relative to their utility in reducing postoperative pain.^{2,3,5,6} In this study, we retrospectively reviewed adult inpatients who have undergone RYGB at our institution and the impact of continuous infusion of bupivacaine on postoperative opioid requirements.

METHODS

The research protocol for this study was a retrospective electronic chart review approved by our institutional review board. We reviewed 289 adult inpatients who underwent RYGB at our hospital from January 2009 to November 2011. Relevant demographic information was collected on each patient and included age, gender, body mass index, and comorbid disease states. Comorbidities at the time of preoperative history and physical were obtained. Patients were excluded if they had a documented hypersensitivity reaction to bupivacaine, utilized neuraxial anesthesia during the procedure, had incomplete documentation of opioid utilization or pain scores postoperatively, or met the definition of opioid tolerance (60 mg oral morphine, 30 mg oral oxycodone, or therapeutic equivalence per day at least 1 week prior to procedure date).^{7,8}

Surgery was performed by 1 of 2 experienced bariatric surgeons. Patients were stratified into 2 groups by surgeon. One surgeon uses the continuous infusion bupivacaine pump on all his patients and the other surgeon does not use the pump on any of his patients (Figure 1). Almost all operations were done laparoscopically, with very few patients either started or converted to open surgery. The bupivacaine group received a continuous infusion of 0.375% bupivacaine administered at a rate of approximately 4 to 7 mL/h by an intraperitoneal soaker catheter for 48 hours via an *On-Q PainBuster* pump that was placed just prior to skin closure. The control group underwent the same RYGB operation, using a similar technique and very similar operative time, without implantation of the continuous infusion pump. Both groups received postoperative standard-of-care pain

management that included morphine patient-controlled analgesia (PCA) for the first 24 hours after surgery (basal rate 2 mg/mL, demand 1 mg every 15 minutes), followed by supplemental intravenous morphine boluses if needed (1-2 mg IV every 2 hours as needed for severe pain) and/or an oral opioid (hydrocodone/acetaminophen elixir 7.5/500 mg per 15 mL, 10-15 mL orally every 4 hours as needed for mild to moderate pain). In the case of a true morphine allergy, hydromorphone or meperidine PCA and supplemental intravenous boluses were substituted. In the case of true hydrocodone allergy, oxycodone oral solution was substituted. Patient's postoperative opioid usage was expressed in terms of morphine equivalents and recorded for up to 72 hours. Morphine equivalents were determined retrospectively from medication administration records and *Pyxis* waste logs. Secondary outcomes included pain as measured by visual analog scale (VAS) pain scores and length of hospitalization. VAS scores were recorded regularly by nursing staff to assess postoperative pain. A score of 0 meant the patient was experiencing no pain, and a score of 10 meant the patient was experiencing maximal pain.

Statistical analyses were performed using the *Predictive Analytics SoftWare (PASW) Statistics19* (IBM Corp., Somers, NY). The mixed-design analysis of variance model was used to determine whether there was a significant change over time and whether there was a difference between the 2 groups in terms of morphine equivalents and VAS pain scores.

RESULTS

A total of 207 patients met the inclusion criteria for the primary outcome of opioid utilization. A total of 119 of those patients had complete data for VAS scores. Baseline demographics and comorbid disease states were collected and were well-matched (Table 1). Patients in both groups were predominantly female and had multiple comorbid disease states such as hypertension, diabetes, and psychiatric-related conditions.

There was a significant decrease in opioid usage in both groups over each postoperative time interval, $F(2.99, 612.58) = 432.93$ ($r = 0.64$; $P < .01$). The average morphine equivalents were significantly lower in the bupivacaine group than the control group over the entire postoperative time period (measured out to 72 hours): 133 versus 106 mg, respectively, $F(1, 205) = 11.43$ ($r = 0.23$; $P = .001$) (Figure 2).

The average VAS ratings for both groups were significantly decreased, $F(6.55, 765.90) = 11.60$ ($r = 0.12$; $P < .01$), during the first 8-hour postoperative time period and remained relatively unchanged over

Figure 1. Patient enrollment and allocation. Patients meeting the inclusion criteria were separated into 2 groups, Bupivacaine and Control, based on the respective surgeon. Patients were excluded if they were opioid tolerant, had incomplete documentation of opioid utilization, or had incomplete documentation of visual analog scale (VAS) pain scores. RYGB = Roux-en-Y gastric bypass surgery.

Table 1. Patient baseline demographics and clinical characteristics

Patient data	Bupivacaine (n=204)	Control (n=74)	P*
Mean age $\pm$ SD, years	42.4 $\pm$ 12.5	44.4 $\pm$ 11.2	.21
Gender (% male)	37 (18.1)	12 (16.2)	.75
Mean body mass index $\pm$ SD	47.2 $\pm$ 8.4	48.7 $\pm$ 8.2	.18
Hypertension	115 (56.4)	37 (50)	.41
Diabetes mellitus	79 (38.7)	25 (33.8)	.51
Hyperlipidemia	68 (33.3)	28 (37.8)	.43
Coronary artery disease	9 (4.4)	3 (4.1)	1.00
Asthma	21 (10.3)	12 (16.2)	.16
Congestive heart failure	6 (2.9)	1 (1.4)	.68
Psychiatric ^a	84 (41.2)	26 (35.1)	.48

Note: Values are given as n (%), unless noted otherwise.

^aAny psychiatric condition that was included in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)*.

*Independent *t* test: None of the baseline characteristics were statistically significant ($P < .05$).

the rest of the postoperative time periods. There were no significant differences in average VAS ratings between the 2 groups, $F(1, 117) = 0.062$ ($r = 0.08$; $P = .80$) (Figure 3). Length of hospitalization did not differ significantly between the 2 groups (3.01 days bupivacaine vs 3.08 control group; $P = .77$).

DISCUSSION

We have demonstrated that RYGB patients at our institution who received bupivacaine, administered to their surgical incision sites via a continuous infusion pump, required less postoperative opioids. However, the patients in both groups had a similar but significant reduction in VAS pain ratings during the first 8-hour postoperative time period but no significant difference over the entire postoperative time period. Patients in both groups also did not have a significant difference in length of hospitalization. These results are consistent with current literature that suggests anesthetic infusion pumps administered directly to surgical incision sites have a variable effect on postoperative opioid requirements and self-reported pain scores.^{3,6,9,10}

Although the between-group difference for postoperative opioid usage was statistically significant, the clinical significance of these data is open for discussion, especially since there was not a significant difference in VAS scores or length of hospitalization. The absolute difference in morphine equivalent utilization in this study was 27 mg over 72 hours. The price of obtaining the continuous infusion pain pump at our institution is just under \$1,000 versus roughly \$10 for 27 mg of intravenous morphine. Although this study was not designed as a cost-effectiveness analysis, this cost difference is something to consider in the rapidly changing era of health care reform and decreasing reimbursements.

Figure 2. Average post Roux-en-Y gastric bypass (RYGB) surgery morphine equivalent utilization for adult inpatients. Values are shown in terms of average morphine equivalent use over each 8-hour assessment period with time "0" being arrival to the postanesthesia care unit.

Limitations of our study include the subjective nature of the VAS system for rating pain and the inconsistency with which these pain scores are obtained and recorded by nursing staff. We elected to exclude patients from the analysis if they had missing documentation of either opioid usage or VAS scores for any given time period (ie, 0-8 hours postoperative, 8-16 hours postoperative, etc). The statistical software used was unable to perform its analysis of the data when there were missing values for a defined time period. We

also acknowledge that there were many more patients in the bupivacaine group versus the control group. We were unable to control for this difference in patient numbers as the surgeon who does not use the local anesthetic pump has only been performing bariatric surgery at our institution since late 2008, thus the January 2009 start date for data collection. Another limitation was our inability to accurately collect information from the electronic health record on potential opioid-related side effects such as nausea, vomiting, constipation, and sedation.

Figure 3. Average post Roux-en-Y gastric bypass (RYGB) surgery visual analog scale (VAS) pain scores for adult inpatients. Values are shown in terms of average VAS ratings over each 8-hour assessment period with time "0" being arrival to the postanesthesia care unit.

A final consideration for our study is any potential difference in surgical technique between the 2 surgeons that could impact pain control. We believe that any differences are negligible, because both surgeons use similar surgical technique, surgical instruments, and anesthesia protocols and have very similar operative times.

CONCLUSION

We have shown that utilization of a continuous infusion of bupivacaine administered via a pain pump system showed a small decrease in postoperative opioid requirements in our patient population. Although the treatment group used less morphine equivalents, there was no significant difference in pain scores or length of stay when compared to the control group. However, the pump did increase total hospital costs for the institution and the patient. Larger, prospective trials are needed to further assess the benefit of continuous infusion local anesthetic devices in the management of postoperative pain in the RYGB patient.

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