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ORIGINAL ARTICLE

Preemptive multimodal analgesia facilitates same-day discharge following robot-assisted hysterectomy

Thomas M. Shultz

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Abstract We aimed to determine whether early hospital discharge following minimally invasive surgery can be achieved through the use of preemptive multimodal analgesia without compromising patient safety or comfort. Data were retrospectively collected for 150 patients who underwent robotic-assisted laparoscopic hysterectomy for benign indications from 9 December 2009 to 6 October 2010 at Cox Health Systems (Springfield, MO, USA). One surgeon performed 100 consecutive cases with all patients receiving preemptive multimodal treatment with celecoxib and ropivacaine. These cases were compared with 50 patients treated with an opioid-based postoperative analgesia regimen by one of four other surgeons at the same center. Patient characteristics, perioperative outcomes, opioid requirement, and time to discharge were compared between groups. The patients in the multimodal group had significantly reduced opioid requirements intraoperatively (25.0 mg vs. 29.9 mg, $P = 0.0077$), postoperatively on the day of surgery (10.9 mg vs. 17.9 mg, $P = 0.0030$), and on the first postoperative day (3.1 mg vs. 15.3 mg, $P = 0.0001$). There were no differences in procedure time, transfusions, or readmission rates between groups. Time in the Post-Anesthesia Care Unit (PACU) was decreased in the multimodal group (72.0 min vs. 88.4 min, $P < 0.0001$), as was time to discharge from the hospital (8.5 h vs. 30.2 h, $P < 0.0001$). Age and body mass index were both significantly lower in the multimodal group; however, regression analyses demonstrated that analgesia regimen was the only parameter that predicted opioid requirement and time to discharge. Preemptive multimodal analgesia reduced the total dose of rescue opioids, facilitating same-day discharge without compromising patient comfort or safety.

Keywords Celecoxib · Early discharge · NSAIDs · Outpatient · Robotic-assisted laparoscopic hysterectomy · Ropivacaine

Introduction

Minimally invasive surgery has provided patient benefits for a variety of procedures when compared to an abdominal approach, often resulting in reduced pain and hospital stay [1–5]. However, many patients undergoing laparoscopic or robotic-assisted procedures such as robotic-assisted laparoscopic hysterectomy (RALH) still require opioid analgesia [6]. Opioid analgesics have significant side effects that can prolong an otherwise uncomplicated postoperative hospital recovery, including nausea, vomiting, ileus, constipation, urinary retention, sedation, immune suppression, and respiratory depression. Minimization of pain and opioid use would be beneficial to the patient and could decrease the need for an overnight hospital stay.

Preemptive analgesia involves the preoperative and intraoperative administration of pain medications. It has its basis in research showing that surgery causes central and peripheral nervous system sensitization that results in altered sensory processing, which amplifies postoperative pain [7]. By preventing this initial sensitization, postoperative pain levels are reduced [8].

Multimodal pain regimens use more than one modality of pain control to obtain additive or synergistic effects. One example would be the use of ropivacaine and celecoxib to

T. M. Shultz (✉)
Primrose OB/GYN, Cox Health Systems,
1000 E. Primrose #270, Springfield, MO 65807, USA
e-mail: tshultz@primroseobgyn.com

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block both the initial nerve-mediated pain signals (ropivacaine) and the secondary prostaglandin-mediated inflammation response (celecoxib). Other multimodal pain regimens have been shown to reduce the opioid requirement following multiple procedures, including robotic-assisted laparoscopic prostatectomy [9], knee arthroplasty [10], operative laparoscopy [11], and laparoscopic gynecologic surgery [12].

The reduction of pain through the use of preemptive analgesia combined with the administration of pain medications with improved safety profiles when compared to opioids could permit earlier patient discharge from the hospital. Our goal was to determine whether early (same-day) discharge following RALH could be achieved by decreasing the total dose of opioids through the use of preemptive multimodal analgesia (celecoxib and ropivacaine) without compromising patient safety and comfort.

Methods

We performed a retrospective review of 150 RALH cases from 9 December 2009 to 6 October 2010 at Cox Health Systems (Springfield, MO, USA) by five surgeons. One surgeon treated 100 consecutive patients (Multimodal Analgesia Group) using a preemptive multimodal pain regimen that included celecoxib and ropivacaine. These 100 cases were compared to a control group of 50 patients (Control Group) who underwent RALH performed by four other surgeons at the same hospital. These surgeons used the same preoperative medications, anesthesia induction protocol, surgical technique, and discharge criteria but did not include a preemptive multimodal analgesia regimen of celecoxib or ropivacaine. Both groups received a variety of opioids postoperatively based on their Visual Analog Scale (VAS) pain scores. Multiple methods of administration were used, including oral, intravenous (IV), or intramuscular administration of fentanyl, dilaudid, demerol, oxycodone, hydrocodone, hydromorphone, or codeine. All surgeons had at least 18 months of prior robotic experience and had completed at least 20 robotic cases. Patients undergoing RALH for benign indications with or without concurrent removal of adnexa within the study period were included. Exclusion criteria included gynecologic malignancy and cases with conversion to open laparotomy.

Anesthesia protocol

Patients in both groups (all 150) received the same anesthetic induction and maintenance technique allowing for minor provider variations and adjustments according to individual patient co-morbidity. Patients were premedicated with midazolam 1–2 mg IV titrated to effect, ondansetron 4 mg IV, and dexamethasone 6–10 mg IV to treat anxiety and postoperative nausea and vomiting (PONV) prophylaxis. In the operating room, standard ASA (American Society of Anesthesia) monitors were applied and the patients were administered oxygen for 3–4 min. Anesthesia was induced with propofol 2 mg/kg IV and fentanyl 1–2 μg/kg IV. Laryngoscopy and tracheal intubation were facilitated with either succinylcholine 1 mg/kg IV or rocuronium 0.6 mg/kg IV. Anesthesia was maintained with a mixture of air and oxygen (50:50%) supplemented with sevoflurane or desflurane 1–1.5 minimum alveolar concentration. Supplemental bolus doses of fentanyl 25–50 μg IV were administered, at the discretion of the attending physician or anesthetist, for persistent hypertension or/and tachycardia that did not respond to increases in the dose of the maintenance anesthetic. Muscle relaxation was maintained with bolus doses of rocuronium 0.15 mg/kg IV. At the end of surgery, the neuromuscular block was antagonized with neostigmine 0.035–0.07 mg/kg and glycopyrrolate 7 μg/kg, the trachea was extubated, and the patient was transferred to the Post-Anesthesia Care Unit (PACU).

Multimodal analgesia protocol

Patients in the multimodal group were required to undergo patient education and training 1 week prior to surgery along with their chosen postoperative caregiver. Once discharge criteria were satisfied, all patients were given the option of same-day discharge or an overnight stay. Preoperative analgesia consisted of 200 mg celecoxib twice daily for 2 days followed by 400 mg celecoxib 1 h prior to surgery. Following the induction of anesthesia (see above), a total of 250–300 mg ropivacaine was administered intraoperatively, including injection of the vaginal mucosa, an intraperitoneal bath, and pre-incisional skin and facia injections at each trocar site, with the total amount based on the number of trocar sites. This total dose has been shown to be safe and has been suggested for long-lasting analgesia after surgery [13]. For injection of the vaginal mucosa, 2.5 ml of 2.5 mg/ml ropivacaine was injected per site using a Pudendal needle (Becton–Dickinson, Franklin Lakes, NJ, USA) clockwise at the 10, 2, 4, and 8 positions at the upper margin of the KOH (CooperSurgical, Trumbull, CT, USA) cup (see Fig. 1) prior to placement of the uterine manipulator, for a total of 10 ml (25 mg), with care to avoid the vascular pedicles at the 9 and 3 positions. Immediately following the establishment of pneumoperitoneum, an intraperitoneal spray of 60 ml of 2.5 mg/ml ropivacaine (150 mg) was instilled. The patient was placed in the reverse Trendelenburg position for 10 min for the pelvic field effect (see Fig. 2). During these 10 min, 2.5 ml of 2.5 mg/ml ropivacaine was injected into the skin at each trocar site (3–5 sites, 18.75–31.25 mg) and 7.5 ml of 2.5 mg/ml ropivacaine

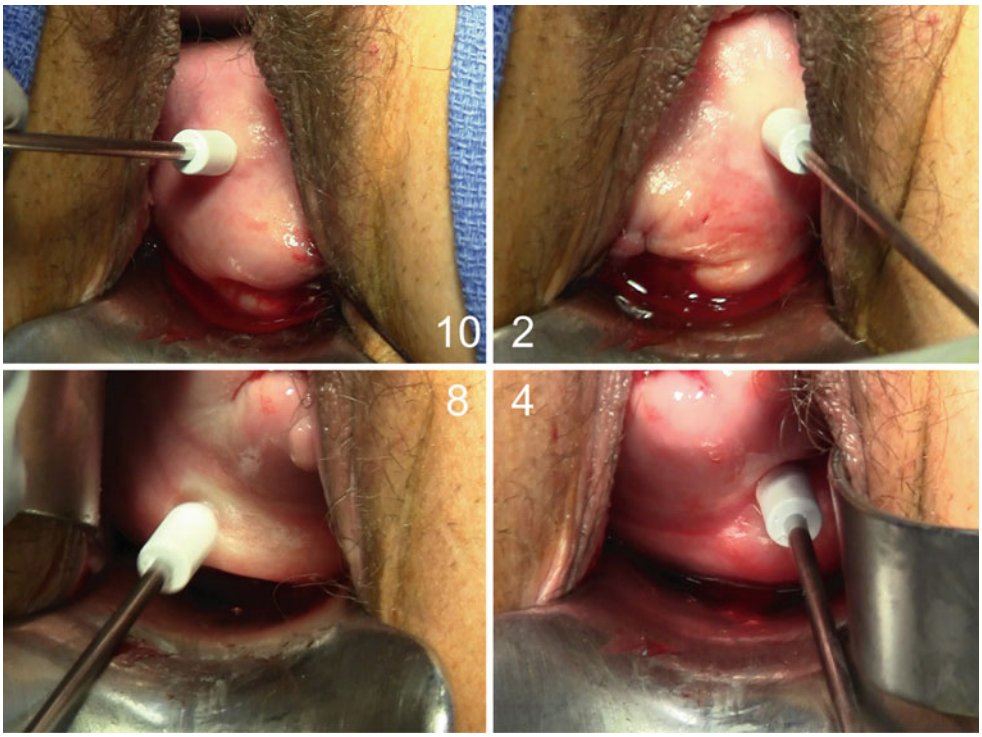

Fig. 1 Locations of cervical vaginal reflection injections of 2.5 ml (2.5 mg/ml) ropivacaine into the mucosa clockwise at the 10, 2, 4, and 8 positions

was injected into the fascia and subperitoneal bleb (3–5 sites, 56.25–93.75 mg) (see Fig. 3). Trocars were placed following the trajectory of the anesthetic needle. The patient was then placed in the Trendelenburg position for robotic docking, allowing the original 60 ml of pelvic ropivacaine to migrate to the subdiaphragmatic peritoneum for an additional field effect on the phrenic nerve. The robotic platform was then docked and patients underwent RALH, with or without removal of adnexa when indicated as previously described [14]. Following the procedure, while the patient was still in steep Trendelenburg, CO_2 gas from the peritoneal cavity was expelled through the highest trocar using anesthesiologist-assisted deep inspiration (for maximum diaphragm excursion) and surgeon massage of the abdominal wall. This was performed in an effort to prevent shoulder pain. Skin incisions were closed, the bladder was filled with 200 ml of saline, and a limited post-procedure cystoscopy with indigo carmine was performed to confirm ureteral orifice patency. The saline was left in the bladder to expedite voiding to meet discharge criteria. The patient was then transferred to the PACU. Hospital recovery protocol was standard for these patients with the addition of patients taking 200 mg celecoxib twice daily for 3 days and oxycodone tablets as needed after discharge. All patients in this group were contacted by telephone to determine the exact number of oxycodone tablets taken both on the day of surgery and on the first postoperative day. These tablets were included in the calculations of postoperative opioid use for comparison with the control group.

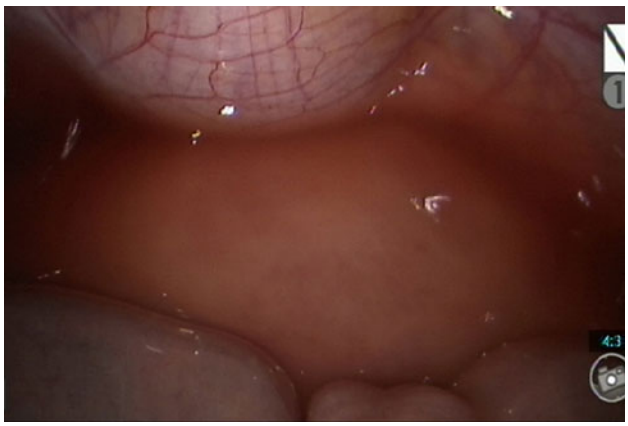

Fig. 2 Ropivacaine pelvic bath with submerged uterine fundus

Control group protocol

The control group of patients had the same anesthesia protocol as the multimodal group but did not receive the multimodal analgesia protocol. The RALH techniques, with or without removal of adnexa, were similar in both groups. The postoperative assessment of pain and nausea in PACU and discharge criteria were the same for the both groups.

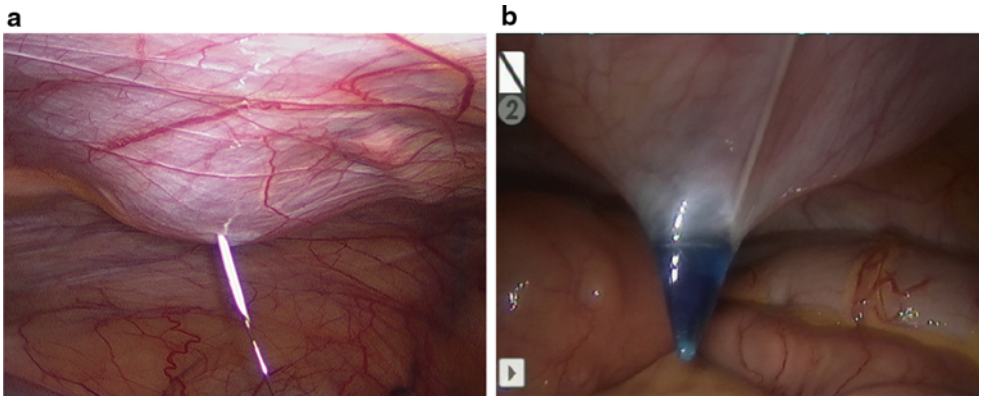

Fig. 3 **a** Injection of 7.5 ml of 2.5 mg/ml ropivacaine into the fascia and subperitoneal bleb at a representative trocar site. **b** Trocar insertion along injected path

Discharge criteria

Medically defined discharge criteria were applied uniformly for all patients regardless of analgesic regimen (all 150 patients) and included a separate review for discharge from the PACU and from the hospital. For discharge from the PACU, patients were required to have minimal or no pain, as documented by VAS pain scores of 0–3, and minimal or no nausea or vomiting. Patients were also required to be awake, responsive, and easily aroused, to have mild to no anxiety, and to demonstrate some understanding of patient teaching. Criteria also required the patient to be afebrile with stable vital signs and adequately hydrated and to have a Post-Anesthesia Recovery (PAR) score between 11 and 13 (moves extremities, able to breath, adequate blood pressure, alert, adequate blood oxygen saturation). For discharge from the hospital, the following criteria were required: nausea and vomiting controlled, pain controlled with oral medications to a VAS score of 0–3, clear liquids tolerated, stable hematocrit, ambulate comfortably, and void successfully by passing a post-void bladder scan with less than 200 ml residual.

Measurements

Chart review was performed in accordance with institutional review board approval and included collecting data on patient characteristics, perioperative outcomes, medications, length of stay in the PACU, and time to hospital discharge, i.e. length of stay (LOS). Length of PACU stay and time to discharge were recorded in hours and minutes. Operative time was defined as the time from the start of the procedure to the end. For analgesia use, the type and amount of opioids used on the day of surgery and on the first postoperative day were recorded in four phases: intraoperative, PACU, phase 2 recovery and first postoperative day. Phase 2 recovery included all pain medication on the day of surgery taken after leaving the PACU and included the Same-Day Surgery (SDS) unit, the hospital floor, and/or at home, depending on when the patient was discharged. Calculations for the first postoperative day included pain medication taken on the hospital floor and at home. These were converted to a morphine (IV/IM) equivalent dose (mg) for comparison between groups.

Statistical analysis

Patient characteristics and perioperative outcomes are presented as mean, standard deviation, and range unless otherwise stated. Proportions are presented as percentages. Two-tailed *t* tests were used to compare patient characteristics and perioperative outcomes and one-tailed *t* tests were used to test for a decrease in morphine equivalents and length of hospital stay. Correlations between parameters were studied using regression analysis. $P < 0.05$ was considered statistically significant.

Results

The patients in the multimodal treatment group had a significantly reduced intraoperative opioid requirement, as measured by the mean morphine equivalent dose administered (25.0 ± 9.7 mg vs. 29.9 ± 12.2 mg, $P = 0.0077$). Postoperative use of opioids was reduced at each stage of recovery (see Fig. 4a), including the PACU stay (7.0 ± 9.1 mg vs. 10.5 ± 9.3 mg, $P = 0.0165$), secondary recovery at the hospital or at home on the day of surgery (3.9 ± 3.7 mg vs. 7.4 ± 10.2 mg, $P = 0.0012$), and during the first postoperative day (3.1 ± 7.0 mg vs. 15.3 ± 17.3 mg, $P = 0.0001$).

The average for the first postoperative day for the multimodal group consisted of 64 (64%) patients who did not take any pain medicine, 29 (29%) patients who took 1–2 tablets of pain medicine, and seven (7%) patients who took more than two tablets (see Fig. 4b). The most common reasons given for taking medication were fear of waking in

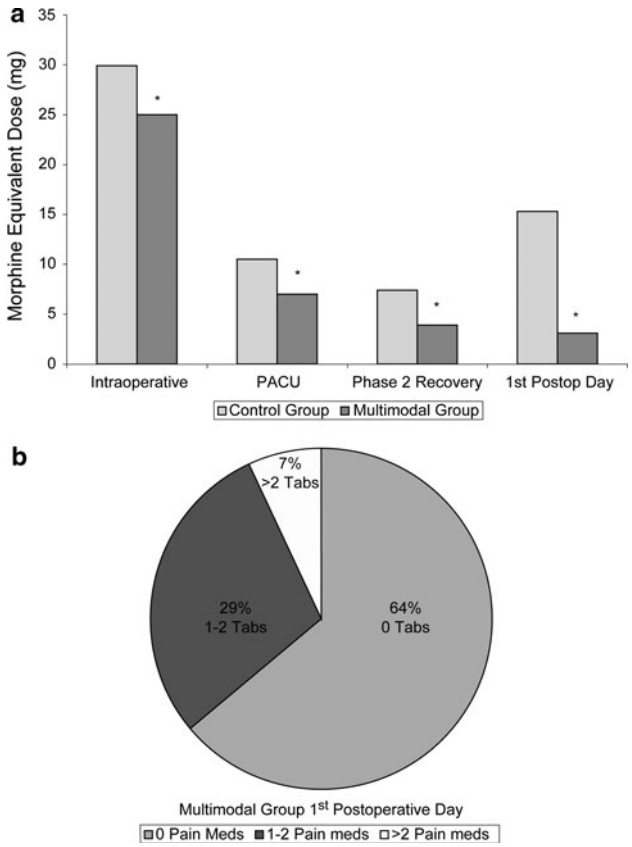

Fig. 4 Opioid usage for robotic-assisted laparoscopic hysterectomy. **a** Opioid usage throughout recovery for the control group versus the multimodal group. *Light gray bars*, control group; *dark gray bars*, multimodal group. Opioid requirement is represented as morphine equivalent dose in mg. *Asterisk*, significance at $P < 0.05$. Significant differences in opioid requirement were seen intraoperatively ($P = 0.0077$), during the stay in the PACU ($P = 0.0165$), during phase 2 recovery ($P = 0.0012$), and during the first postoperative day ($P = 0.0001$). **b** Opioid usage in the multimodal group on the first postoperative day. *Light gray section*, percentage of patients who took no narcotic tablets (64%); *dark gray section*, percentage of patients who took one or two narcotic tablets (29%); *white section*, percentage of patients who took more than two narcotic tablets (7%)

pain and as a sleep aid. The overall morphine equivalent dose administered was also significantly decreased in the multimodal group (39.0 ± 17.3 mg vs. 70.1 ± 42.1 mg, $P < 0.0001$).

Average age and body mass index (BMI) were significantly lower in the multimodal group when compared to the control group (see Table 1). Operative time was similar ($P = 0.3436$), as was uterine weight ($P = 0.0713$) and the rate of blood transfusions (0 vs. 2%, $P = 0.1559$).

Length of time in the PACU was significantly decreased in the multimodal group (72.0 ± 20.1 min vs. 88.4 ± 18.4 min, $P < 0.0001$), as was time to discharge from the end of surgery (5.8 ± 3.6 h vs. 27.2 ± 18.2 h, $P < 0.0001$), and overall length of hospital stay (8.5 ± 3.8 h vs. 30.2 ± 18.6 h, $P < 0.0001$) (see Table 2). Of the 100 patients in the multimodal group, 95 (95%) were successfully discharged on the day of surgery, with a single readmission (1%) for a cuff hemorrhage requiring a single suture placed at the cuff. Of the five multimodal patients who stayed in the hospital overnight, two did not meet discharge criteria; one due to urinary retention (requiring a Foley catheter) and the other due to postoperative nausea. The other three patients stayed in the hospital by choice.

Table 1 Patient characteristics and perioperative outcomes

Parameter	Multimodal ($n = 100$)	Control ($n = 50$)	P value*
Age (years)			
Mean (SD)	43.7 (6.4)	49.0 (11.1)	0.0028
Range	31–69	33–84	
BMI[a] (kg/m^2)			
Mean (SD)	29.1 (6.6)	33.6 (10.3)	0.0070
Range	19.6–55.2	20.0–65.0	
Operative time (min)			
Mean (SD)	139.3 (35.3)	148.0 (59.6)	0.3436
Range	86–310	73–376	
Hemoglobin drop (Hg/dL)			
Mean (SD)	0.4 (1.6)	1.7 (1.2)	<0.0001
Range	2.1–13.7	0.5–6.3	
Uterine weight (g)			
Mean (SD)	139.6 (64.3)	183.2 (161.5)	0.0713
Range	42–431	25–921	
Blood transfusions, n (%)	0 (0)	1 (2%)	0.1559
Readmissions, n (%)	1 (1%)	2 (4%)	0.2160
	Cuff hemorrhage	Cuff dehiscence Cuff hematoma	

* Independent two-tailed t test

[a] Body mass index

Table 2 Length of stay

Parameter	Multimodal ($n = 100$)	Control ($n = 50$)	P value*
PACU[a] time (min)			
Mean (SD)	72.0 (20.1)	88.4 (18.4)	<0.0001
Range	13–181	21–130	
Time from end of procedure to discharge (h)			
Mean (SD)	5.8 (3.6)	27.6 (18.2)	<0.0001
Range	0.6–20.6	3.2–76.3	
LOS[b] (h)			
Mean (SD)	8.5 (3.8)	30.2 (18.6)	<0.0001
Range	3.5–25.1	5.1–78.3	

* Independent one-tailed t test

[a] Post-anesthesia care unit

[b] Length of hospital stay

In the control group, 12 (24%) were discharged on the day of surgery with no readmissions. There were 38 (76%) patients who required at least an overnight hospital stay. One case of pneumonia in an elderly patient resulted in a 46-day hospital stay as the patient did not have access to a home caregiver. This patient was not included in the overall average for total length of stay or time from end of procedure to discharge. There were two (4%) patients in the control group who required readmission and reoperation, including one patient with cuff dehiscence and another with cuff hematoma (vs. 1% readmission rate for the multimodal group, $P = 0.2160$).

Regression analyses were performed to test for the effects of age, BMI, uterine weight, and procedure time as well as analgesia group for each of the outcomes of interest. In each case, analgesia group was the only factor that was a significant predictor of opioid use and length of hospital stay.

Discussion

The reduction in trauma provided by the introduction of minimally invasive techniques to gynecologic surgery has resulted in patients experiencing fewer complications and a shorter hospital stay [15, 16]. Hospital admission following hysterectomy for benign indications has decreased over time from an average of 3–5 days with an abdominal approach to 1–2 days with the introduction of conventional or robotic-assisted laparoscopic approaches [17, 18]. However, crossing the barrier from an overnight hospital stay to an outpatient procedure has been difficult due to the continued need for opioid analgesia and the associated side effects. We developed an analgesic regimen based on the principles of a preemptive multimodal approach that has resulted in a decreased opioid requirement and discharge from the hospital on the day of surgery.

The two modalities used in this approach included ropivacaine to block the initial nerve-mediated pain signals and celecoxib to block the secondary prostaglandin-mediated inflammation response.

Ropivacaine is a long-acting amide-type local anesthetic that causes reversible blockade of impulse propagation along nerve fibers. It has similar pharmacokinetic properties to bupivacaine [19–21], but has been shown to be more effective [12] and to be less likely to elicit adverse effects from the CNS and circulatory system due to delayed diffusion outside the site of infiltration and its intrinsic vasoconstrictive properties [22, 23].

The analgesic benefits of intraperitoneal spray and incisional injection of ropivacaine have been demonstrated in other studies [12, 13, 24]; however, these studies employed a postoperative administration protocol and in order to be effective in blocking the establishment of nervous system sensitization, the analgesia treatment needs to cover the entire duration of high-intensity noxious stimulation. The protocol observed in the current study addresses all areas of tissue trauma by including pre-incisional injection of ropivacaine into the skin and fascia along the exact path of the trocar, an intraperitoneal spray bathing both the pelvic and subdiaphragmatic fields/areas, and injections into the vaginal mucosa prior to the start of the RALH. Ropivacaine is fast-acting [21] and this administration protocol provides nerve blockade during surgery and the initial postoperative period.

Celecoxib, a non-steroidal anti-inflammatory drug (NSAID), selectively inhibits the inducible cyclooxygenase type-2 (COX-2) enzyme to block the synthesis of prostaglandins. Celecoxib has analgesic properties without the adverse effects on platelet function, gastrointestinal mucosa, and renal tubular function normally associated with non-selective NSAIDs such as ketorolac [25]. NSAIDs have been increasingly used as part of a multimodal approach to improve the management of pain after ambulatory surgery. They have been shown to reduce opioid requirement and thus opioid-related side effects such as PONV and sedation. [26]. However, studies combining celecoxib and ropivacaine have only recently appeared and have been reported to reduce opioid use for knee arthroplasty [10, 27] and to reduce pain scores after thoracotomy when compared to ropivacaine use alone [28]. To the best of our knowledge, no one has utilized the combination of celecoxib and ropivacaine with a preoperative administration protocol for gynecological surgery.

Our goal was for robotic-assisted laparoscopic hysterectomy to become an outpatient procedure, with the majority of patients discharged on the day of surgery with minimal pain and no increase in readmissions. This goal was achieved in 95% of patients in the multimodal group, with an average time to discharge of 8.5 h (LOS 0.3 days). We used a novel preemptive multimodal analgesia regimen to reduce pain as indicated by a significant decrease in the opioid requirement intraoperatively and at each stage of recovery, including the initial postoperative period when the patient was in the PACU, phase 2 recovery at the hospital or at home on the day of surgery, and on the first postoperative day. This reduced opioid requirement was naturally accompanied by a decrease in known toxic side effects. It was this decrease, combined with the benefits of minimally invasive surgery, which allowed us to reach this goal. This is in contrast to the control group with an average time to discharge of 30.2 h (LOS 1.3 days), which was significantly longer than the LOS for the multimodal group and is consistent with other reports of LOS following RALH using conventional surgical and pain management techniques [6, 14, 29–33].

Patient education regarding postoperative care instructions as well as home support provided by a family member or a friend is crucial to the ability to discharge patients on the day of surgery [34]. Early release from the hospital benefits the patient and increases the cost-effectiveness of minimally invasive surgery [34], but is only desirable if it does not compromise patient safety or comfort. The low incidence of readmission in the multimodal preemptive analgesia group (1% vs. 4%, $P = 0.2160$) demonstrated that patient safety was not compromised. We ensured that patient comfort was not compromised by including the requirement for a VAS pain score between 0 and 3 prior to discharge and by demonstrating that pain medication usage at home was minimal, with 93% of patients taking less than two tablets of narcotics and 64% of patients not taking any pain medication on the first postoperative day.

The time of discharge is often left to the surgeon's discretion and can vary between hospitals, surgeons, procedures, and surgical approaches. Ideally, the duration of hospitalization is based on the patient's health status, with any shift to a shorter stay based on changes in discharge practices implemented to reduce unnecessary care. However, there is concern that an earlier hospital discharge may be influenced by non-medical factors [35] and may be detrimental to the patient. To address this issue, we utilized a standardized set of medically defined discharge parameters that were applied uniformly to all patients regardless of surgeon or analgesic regimen, both for discharge from the PACU and from the hospital. Regarding the differences in discharge criteria between hospitals, procedures, and surgical approaches, we compared the length of hospitalization between two groups of patients undergoing the same procedure, RALH, using the same surgical technique at the same hospital. In addition, the discharge parameters utilized were sensitive to opioid requirement. For example, discharge from the PACU required the patient to exhibit minimal or no PONV (a side effect of opioid use), be awake, responsive and easily aroused (opioid-related sedation), and have a PAR score of 11–13 (opioid-related respiratory depression). To be discharged from the hospital, criteria included the ability to void (opioid-related urinary retention), have nausea and vomiting controlled, and tolerate clear liquids (opioid-related PONV).

Insuring a quick recovery and a shorter hospital stay involves many factors and coordination of the surgeon and anesthesiologist as well as the support staff (nurses) and the patient. In the future, with the continued use of preemptive multimodal analgesic protocols, it may be possible to utilize a fast-track scoring system that would evaluate the suitability of these patients to bypass the PACU as part of the outpatient protocol after undergoing a RALH with general anesthesia [36]. Although not addressed directly in this study, a fast-track anesthetic protocol combined with a multimodal analgesic regimen could further increase the cost-effectiveness of RALH by eliminating the time in the PACU. We have shown that we can safely reduce PACU time by 16 min and reduce admissions to the floor. Hopefully in the future this will reflect cost savings to the hospital and to the payer. The cost of robotics has been in constant debate and in this climate of healthcare reform, reducing costs is a high priority. This analgesic regimen provides a means to reduce costs and is not limited to RALH. This author has seen similar improvements in opioid reduction with conventional laparoscopic surgery, total laparoscopic hysterectomy, laparoscopic-assisted vaginal hysterectomy, and laparoscopic tubal ligation. However, it is not clear whether the outcomes are equivalent when compared to patients undergoing robotic-assisted hysterectomy. Prospective randomized trials would be needed to address this issue. Employing a preemptive multimodal analgesic approach is not the only way to reduce hospital stay [34, 37–40]; however, it may be the best way to ensure that patient comfort is not compromised.

The present study has some drawbacks. The retrospective nature of this study and ethical concerns did not allow for randomization. Also, we did not study the amounts of anti-emetic medications taken and their correlation to pain levels and opioid requirement. In addition, further follow-up with patients including an assessment of quality of life and the length of time in returning to normal activities and to work, relative to the control group, would be informative.

Conclusion

The reduction of pain through the use of preemptive multimodal analgesia significantly reduces the total dose of rescue opioids required by patients postoperatively, allowing for earlier patient discharge from the hospital without compromising patient safety or comfort. In the current health care environment, our patients have many concerns regarding their future access to, or potential rationing of, their health care choices. Decisions to proceed toward earlier discharge must first and foremost address the patient's safety and comfort. The added benefits of improved quality of life, faster recovery, less pain, and earlier return to work are all beneficial results of this multimodal technique when combined with minally invasive surgery. The employers, insurance companies and hospitals should all additionally benefit from the decrease in LOS when achieved in this manner. Therefore, we suggest the routine use of preemptive multimodal analgesia for minimally invasive hysterectomy.

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Conflict of interest Dr. Shultz is a proctor for Intuitive Surgical and is a member of their speaker's bureau.

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