

# Reduced Postoperative Pain and Complications after a Modified Multidisciplinary Approach for Bariatric Surgery

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**Abstract:** *Background:* There are considerable implications for pain management in morbidly obese patients undergoing weight loss operations. The purpose of this study was to determine if a modified postoperative analgesic regimen and a dedicated postoperative bariatric team reduced pain scores, length of stay and postoperative complications.

*Materials and Methods:* We performed a retrospective analysis of morbidly obese patients admitted to our medical center for laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic adjustable gastric banding (LAGB). Our previous postoperative pain regimen was ketorolac (30 mg IV plus 15 mg q6h) and patient controlled analgesia (PCA) morphine and was converted to ketorolac (30 mg IV and 30 mg i.m. plus 15 mg q6h), and IV PCA hydromorphone. Visual analog scale (VAS) pain scores from the post-operative care unit were collected retrospectively. The bariatric team was led by a nurse practitioner consisted of a psychologist, exercise physiologist, and nutritionist.

*Results:* Eighty-five patients underwent bariatric operations in the year prior to implementation of the revised postoperative pain management regimen and 372 patients underwent bariatric surgery in the 2 years following implementation. Patient age, gender and BMI were evenly distributed for both groups. Mean VAS scores on postoperative days 1 through 5 were significantly lower after implanting our modified pain regimen ( $p < 0.0001$ ). Pain scores were significantly higher for patients that underwent LRYGB compared to LAGB ( $p < 0.0001$ ). Overall, length of hospital stay was unaffected by the new pain regimen, however a significant reduction was found in patients that underwent LAGB (0.8 days less;  $p = 0.0001$ ).

*Conclusion:* Use of our modified pain regimen resulted in a more effective analgesic protocol and a reduction of hospital stay, without added complications or side effects.

**Keywords:** Analgesia, gastric banding, gastric bypass, hydromorphone, ketorolac, laparoscopic, Obesity, Roux-en-Y.

## INTRODUCTION

The prevalence of clinically severe obesity is increasing at a fast rate among adults in the United States. [1] As a result, the number of bariatric surgical procedures has also increased [2-4]. The implications for anesthetic and perioperative care of severely obese patients are considerable, and are believed to escalate in the presence of co-morbidities [5, 6]. Postoperative pain management strategies for obesity surgery should focus on adequate pain relief while mitigating the risk of complications, such as respiratory depression, ileus, and reduced intestinal mobility.

As part of our performance measures for Joint Commission on Accreditation of Healthcare Organizations

(JCAHO) disease-specific accreditation, we monitor and report pain relief during hospitalization for bariatric surgery. Upon review, our visual analog scores (VAS) were high, therefore we modified our postoperative pain management protocol in 2008 to include more acceptable analgesic orders and a dedicated interdisciplinary bariatric team.

The primary objective of our study was to assess if implementation of the modified postoperative analgesia protocol reduced pain scores, length of stay, or post-operative complications in patients undergoing laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic adjustable gastric banding (LAGB).

## METHODS

This before and after concurrence study was approved by the University of South Florida institutional review board (IRB). A retrospective analysis of data from the medical records of 85 patients admitted to our medical center for bariatric surgery between January 2006 and January 2007

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and 372 patients admitted between January 2008 and January 2010 was completed. Patients admitted between 2008 and 2010 were given a modified postoperative pain regimen. We also implemented an interdisciplinary bariatric team in 2008, directed by an Advanced Registered Nurse Practitioner, comprising of a dedicated bariatric psychologist, exercise physiologist and a bariatric nutritionist [7]. The main outcome of the study was to assess pain up to five days postoperatively.

Our clinical database was used to select patients with procedure codes for laparoscopic Roux-en Y gastric bypass (44.38) and laparoscopic adjustable gastric banding (44.95) with a body mass index (BMI) of 40 kg/m<sup>2</sup> or greater. All procedures were primary laparoscopic cases and all were performed the same surgeon (MM). Revisions and open cases were excluded. Surgical techniques were unchanged after the modified pain regimen including: type of stapler used for bypass, number of trocars, size of trocars, and types of trocars.

**Anesthesia:** Anesthetic management was provided by members of our anesthesiology staff for all preoperative, intraoperative, and postoperative care. Standard general anesthesia with desflurane, 2 mg Versed and a dexmedetomidine drip started at 0.5 to 1.0 microgram per kilogram and maintained at 0.25 to 0.5 microgram per kilogram per hour was utilized in all cases. After administration of propofol, ventilation was assured, cricoid pressure applied and succinylcholine administered. If the airway was not visualized, intubation was performed with fiberoptic endoscopy. All patients received an oral gastric tube after induction, radial artery catheterization for continuous blood pressure monitoring, and a central venous catheter line for postoperative blood draws and intravenous access. Narcotics were avoided until the patient was extubated. Patients were extubated after they demonstrated adequate respiratory drive, respiratory muscle strength, cough reflex to clear secretions, laryngeal function and clearance of sedative, neuromuscular blocking medications. In addition patients were kept intubated until adequate tidal volume, respiratory rate, and a negative inspiratory force > -25 cmH<sub>2</sub>O were observed.

**Pain Control:** As a pain management strategy, all patients received preoperative education, counseling and routine postoperative monitoring. The postoperative pain order-set from January 2006 to January 2007 was a single dose of ketorolac 30 mg intravenous (IV) in the post-anesthesia care unit (PACU) followed by 15 mg IV every 6 hours for 24 hours (four-15mg doses total). In addition, patient controlled analgesia (PCA) with intravenous morphine at a demand dose of 1-2 mg per 10 minutes with a maximum of 6 mg per hour and no basal rate was utilized. In January 2008, our postoperative pain management orders were modified to include a standing dose of ketorolac 60 mg in the post anesthesia care unit (30 mg IV. plus 30 mg *i.m.*), then 15 mg IV every 6 hours for 24 hours (four-15mg doses total) and IV PCA with hydromorphone at a demand dose of 0.2 mg per 10 minutes with a maximum of 1.2 mg per hour, but no basal rate.

**Role of interdisciplinary bariatric team:** The interdisciplinary bariatric team was developed, parallel to the modified analgesic regimen, to work alongside the surgical

team and the nursing staff in the care of the bariatric patient. The psychologist preoperatively assessed the patient with motivational interviewing to determine the patient's well-being and willingness to participate in postoperative treatment and documented incidences of depression, anxiety, or body image disorders. Postoperatively the psychologist followed up with the patients to counsel to support a sustainable weight loss program. The bariatric nutritionist assessed the patient's nutritional status and aided in preoperative and postoperative patient education, counseling, and meal planning. The exercise physiologist assessed the patient's physical ability preoperatively and helped design a sustaining exercise program postoperatively.

The parameters that were evaluated before and after the implementation of the modified analgesic protocol included: procedure type, length of stay, co-morbid diseases, postoperative complications, and assessment of pain. The quality of postoperative analgesia was based on a visual analog scale (VAS) 10 centimeter line (where 0 = no pain, and 10 = unbearable pain), and was averaged each day to generate a daily VAS score. The VAS scores were recorded as standard of care by the nurses every 4 hours starting in the PACU and continuing until the patient was discharged from the hospital. Pain was assessed while the patients were resting.

Postoperative complications were recorded based upon occurrence, not severity (Table 1). The postoperative complications evaluated were surgical wound infection and postoperative ileus defined by the surgical team as: prolonged return of gastrointestinal movements, longer than 24 hours, accompanied by nausea and vomiting.

All data were analyzed to represent outcomes before and after the implementation of the modified pain protocol. Data were analyzed using Software or Predictive Analytics 17.0 (SPSS Inc, IL). Categorical variables were analyzed using either Chi-square or Fisher Exact tests. Patient demographics were summarized using conventional descriptive statistics. To evaluate if age or BMI correlated to increased length of stay, a multivariable linear regression model was used. Results are expressed as mean (SD) (medians for nonparametric) for continuous variables and as frequencies and percentages for categorical variables. A *p* value of <0.05 was considered statistically significant.

## RESULTS

Eighty-five patients underwent bariatric operations in the year prior to the implementation of the new postoperative pain management regimen. Three hundred seventy-two patients underwent bariatric surgery in the 2 years after and received the modified pain management regimen. Patient age, gender and BMI were evenly distributed for both groups (Table 1). The patient population before our modified pain management strategy had a higher incidence of obstructive sleep apnea, diabetes, and hypertension (Table 1). Of the two surgical procedures included in the analysis, LRYGB was the most common comprising 72.9 % and 77.7% of all cases before and after the modified regimen respectively. There was no significant difference in the percentage of LRYGB and LAGB procedures between the before and after group (Table 1) (*p* = 0.3495). The group of patients evaluated following the modified pain regimen postoperatively showed

**Table 1. Patient Characteristics Before and After**

	Before	After	P-Value
Number of Subjects	85	372	
Gender (male/female)	15/70	70/302	0.8025
Age (yr) mean (SD)	46.5 (11.2)	46.6 (12)	0.9584
BMI (kg/m <sup>2</sup> ) mean (SD)	47.9 (7.2)	49.2 (8.8)	0.1976
Length of Hospital Stay mean (SD)	3.6 (3.3)	3.3 (4.2)	0.5166
<b>Surgery Type</b>			
Laparoscopic Roux-en-Y [n (%)]	62 (72.9)	289 (77.7)	0.3495
Laparoscopic Gastric Banding [n (%)]	23 (27.1)	83 (22.3)	
<b>Pre-operative Co Morbidities</b>			
Diabetes Mellitus [n (%)]	33 (38.8)	80 (21.5)	0.001
Hypertension [n (%)]	48 (56.5)	121 (32.5)	<0.0001
Sleep Apnea [n (%)]	37 (43.5)	106 (28.5)	0.007
<b>Post-Operative Complications</b>			
Wound Infection [n (%)]	6 (7.1)	5 (1.3)	0.0019
Ileus [n (%)]	4 (4.7)	2 (0.5)	0.0124

P values of <0.05 are considered statistically significant based upon the Chi-square test or Fisher's exact test. BMI=Body Mass Index

significant reductions in wound infection and postoperative ileus (Table 1).

### POSTOPERATIVE PAIN

Mean VAS scores significantly decreased on postoperative days 1 through 5 after implementing our modified pain regimen (Fig. 1). Compared with the old group, the average VAS score during the 5 days post operation was 3.27 lower with the modified regimen ( $p < 0.001$ ). When stratified by procedure type, VAS scores were significantly lower following the modified pain regimen for both LRYGB and LAGB ( $p < 0.0001$  and  $p < 0.0001$  respectively). When comparing females to males within the groups, it was found that on average the VAS score on five day follow up was higher in females compared to males, but not statistically significant ( $p = 0.059$ ). In addition, older patients had lower VAS scores when compared to younger patients ( $p = 0.003$ ). As expected, patients who underwent LRYGB group had significantly higher VAS scores when compared with patients that underwent LAGB ( $p < 0.0001$ ). Those with and without the comorbidities listed in Table 1, both before and after the pain management modification, did not differ in their VAS score response to pain.

### LENGTH OF STAY

Overall, there were no differences in length of hospital stay (LOS) before and after our modified pain regimen ( $p = 0.634$ ). When stratified by procedure type however, a significant reduction in LOS for patients that underwent LAGB (0.8 days less;  $p = 0.0001$ ) after implementing our pain regimen. For both types of surgery, older patients tend to stay longer than younger patients (0.08 days and 0.03 days longer,  $p < 0.0001$  and  $p = 0.0011$  for LRYGB and LAGB

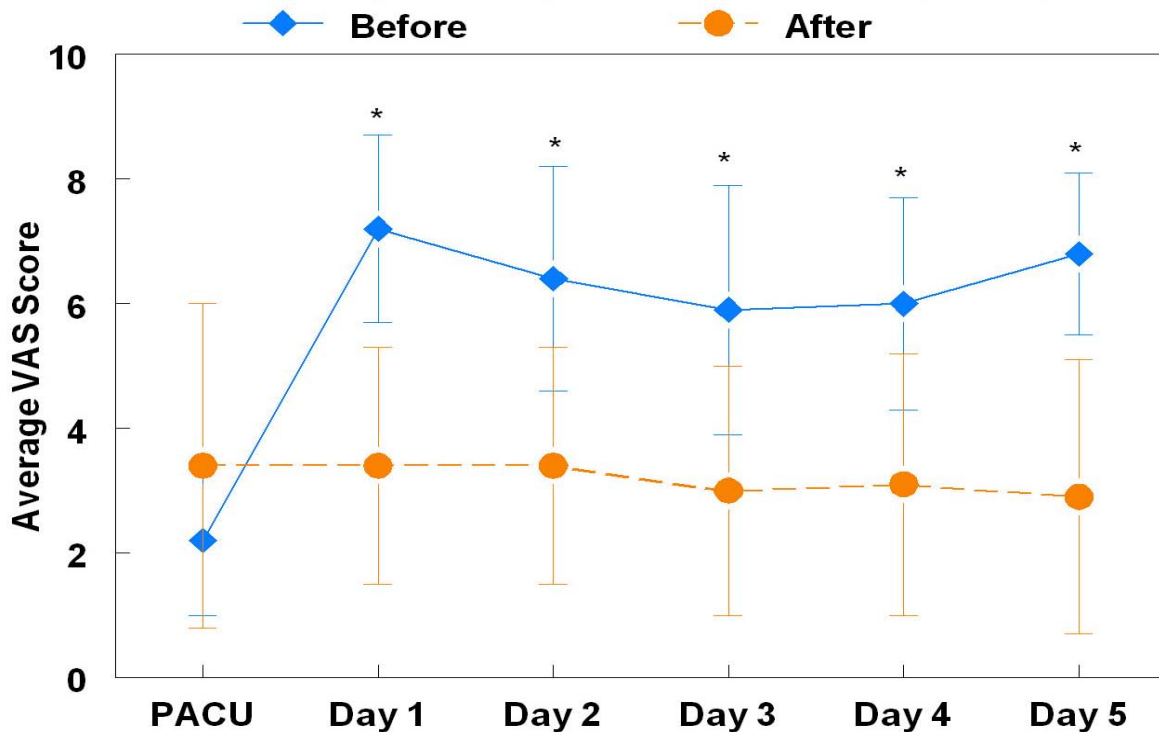
respectively). Patients with higher BMIs stayed 0.05 days longer when undergoing LRYGB ( $p = 0.002$ ), but no relationship between BMI and LOS was found with LAGB procedures. Females that underwent LAGB had a LOS of 1.11 days less than males ( $p < 0.0001$ ), but no differences in LOS for LRYGB procedures were found.

### DISCUSSION

Bariatric surgery is widely performed to achieve sustained weight loss in severely obese patients. One of the most common complications after laparoscopic bariatric surgery is severe pain. Our data revealed that our earlier analgesic regimen in this patient population was not sufficient to properly control postoperative pain. However, after implementing our modified pain regimen, VAS scores significantly reduced from 6 to 3 on post-operative day 3 (Fig. 1).

With the advent of Hospital Consumer Assessment of Health Provider and Systems (HCAHPS®) surveys, an increased effort to improve the quality of patient care is pertinent. The results of this study support the benefits of the modified bariatric protocol implemented at our facility parallel to a modified pain regimen. This multidisciplinary approach focused on a sustainable protocol that addressed comprehensive medical criteria such as psychological well-being, specific comorbidities, diet and exercise for weight loss surgery. After adopting these techniques our patients not only experienced a significant reduction in postoperative pain but also postoperative complications and length of stay.

The complications that were reduced in this study were postoperative ileus and wound infection. Length of stay in LAGB patients was also reduced after our bariatric protocol. Although this is likely unrelated to the type of analgesics given, we hypothesize the implementations of the dedicated



**Fig. (1).** Average Daily VAS Score Before and After Implementation of the Revised Pain Management Strategy. Data are presented as mean (SD). \*P values of <0.05 are considered statistically significant based upon the Wilcoxon sign rank test.

bariatric team contributed to the reduction of these complications and length of hospital stay due to increased mobility and daily activities promoted by the bariatric team.

There is a need for more research that examines the effect of markedly increased adiposity on analgesic drug requirements. Fear of overdosing pain medications may lead to insufficient pain management in the obese population. The physiological changes produced by obesity can markedly affect the pharmacokinetics of anesthetic drugs, and severe adverse events can occur if drug dosing is based only on the actual body weight [8, 9]. Drug distribution is dependent on permeability between tissues (between blood and tissues in particular), blood flow and perfusion rate of the tissue and the ability of the drug to bind plasma proteins and tissue [9]. Furthermore, bypass of the acidic environment of the stomach added to a dramatic loss of body mass may affect drug absorption in LRYGB patients [10].

Madan and colleagues [11] used a postoperative pain management strategy following LRYGB procedures that involved a dosing regimen of ketorolac that was similar to our modified regimen and double the amount of our previous regimen, as well as morphine sulphate 2 mg every 2 hours as needed. Using postoperative opiate consumption as the primary measurement, they concluded that patients experience better pain relief with ketorolac than with morphine. In addition, the authors emphasized the importance of treating the psychological component of pain by providing preoperative education and counseling and postoperative reassurance [11]. Their study did not use any direct methods to measure the amount of pain; such as a visual analog scale. They state it is possible their patients may have had a higher amount of pain due to their minimal narcotic use.

Weingarten and colleagues performed a retrospective study to identify preoperative patient factors associated with greater postoperative opioid use in patients undergoing laparoscopic bariatric surgery [12]. This study reviewed 384 consecutive patients who underwent laparoscopic bariatric surgery from January 2000 to December 2006. Patient characteristics included demographic and socioeconomic variables, tobacco or psychotropic medications use at the time of surgery and previous psychiatric hospitalization. The study concluded that patients undergoing laparoscopic bariatric surgery, who are younger, male, and who had been previously hospitalized for psychiatric disorders use more opioids in the first 48 postoperative hours. Our study showed similar VAS scores for younger patients, however differs in VAS scores of female patients which were similar to male counterparts in our study.

This study has several limitations. First, the data were collected retrospectively and depend on the accuracy of the medical record. Because this study had a before-and-after design, it is limited by confounding factors related to changes in environmental variables, such as increased experience and fine-tuning of the surgeon’s skills, increased patient size, variability in preoperative co-morbidities, changes in clinical management, and quality improvement measures of a dedicated postoperative team which was following daily the progress for our obese patients. There is also the possibility that increased awareness about patient satisfaction and postoperative pain could have lead to improved medical practice.

**CONCLUSION**

The rapid advancement of bariatric surgery has led to successful outcomes in weight loss but decreasing patients’

postoperative pain is an ongoing process. In conclusion, the implementation of our multidisciplinary approach for quality improvement resulted in a significant decrease in VAS scores through five postoperative days, complications and mean hospital stay for patients undergoing laparoscopic bariatric surgery.

### CONFLICT OF INTEREST

The authors confirm that this article content has no conflicts of interest.

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