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ORIGINAL ARTICLE

Bridging multimodal pain management provides 48-hour pain control in patients undergoing total shoulder replacement

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Background: We report our experience with a bridging multimodal pain management program that provides comprehensive 48-hour pain control in patients undergoing total shoulder replacement (TSR).

Methods: The study included all patients undergoing unilateral TSR by 1 surgeon between May 2015 and April 2017. There were 62 patients (23 men, 39 women) with an average age of 68 years (range 38-92 years). Of these, 31 underwent standard nonconstrained TSR and 31 underwent reverse TSR. The bridging multimodal pain management protocol included scalene block regional anesthesia using 0.25% bupivacaine enhanced with 4 mg of dexamethasone, application of 20 mg of liposomal bupivacaine diluted with 40 mL of normal saline in the periarticular soft tissues at time of closure, scheduled 24 hours of intravenous acetaminophen and ketorolac, and immediate cryotherapy. Parameters measured included hospital length of stay, postoperative use of intravenous narcotics, and 30-day hospital readmission.

Results: The median length of stay was 1 day (range, 1-6; average, 1.5 days). Overall, 41 patients (66%) were discharged on postoperative day 1. Intravenous narcotics were required postoperatively in 22 patients (35.5%). There were no 30-day readmissions.

Conclusion: This bridging multimodal pain management protocol resulted in a length of stay of 1 day for 66% of patients, even for higher-risk patients with American Society of Anesthesiologists Physical Status Classification III (63%). Of the 62 patients, 64% (n = 40) did not require postoperative intravenous narcotics. For properly selected patients, this program may be considered for performing TSR as an ambulatory procedure.

Level of evidence: Level IV; Case Series; Treatment Study

Keywords: multimodal pain management; total shoulder replacement; scalene block regional anesthesia; liposomal bupivacaine; dexamethasone; opioid consumption

Pain management after orthopedic operations is important for many reasons, among them are improving patient satisfaction, decreasing hospital length of stay (LOS), and minimizing the need for postoperative narcotic medication with its inherent risks.[9] We report the results of an Initial quality improvement (QI) project and a Subsequent QI project,

Approval from the Mount Sinai Beth Israel Institutional Review Board was not requested for this study because the data were routinely gathered monthly as part of a Department of Orthopedic Surgery quality improvement project.

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prompted by our experience with the Initial QI project, with bridging multimodal pain management to provide comprehensive 48-hour pain control in patients undergoing total shoulder replacement. We proposed that this program, by minimizing the need for intravenous narcotics during the immediate postoperative period, would decrease LOS and provide the framework to offer ambulatory total shoulder replacement in properly selected patients.

Materials and methods

Initial QI project

Liposomal bupivacaine is a new formulation designed to provide delayed-release bupivacaine in surgical wounds.[4] The Mount Sinai Beth Israel Department of Orthopedic Surgery undertook a QI project to determine whether the addition of intraoperative liposomal bupivacaine to an existing multimodal pain management protocol might decrease LOS and postoperative narcotic use after total shoulder replacement.

All patients undergoing total shoulder replacement between October 2014 and through 2015 received bridging multimodal pain management protocol consisting of scalene block regional anesthesia using 0.25% bupivacaine enhanced with 4 mg of preservative-free dexamethasone (standard for scalene block anesthesia at our institution since 2012) providing pain control in the first 24 hours; application of 20 mL of liposomal bupivacaine diluted in 40 mL of normal saline in the periarticular soft tissues at the time of closure providing pain control between 18 and 48 hours postoperatively; scheduled, not when necessary, 24 hours of intravenous acetaminophen (3 doses of 1000 mg every 8 hours; Johnson & Johnson, New Brunswick, NJ, USA), and ketorolac (3 doses of 15 mg every 8 hours) beginning in the recovery room with immediate cryotherapy. Breakthrough pain was controlled first with oral oxycodone (5-15 mg every 4-6 h), followed by intravenous morphine (2-4 g every 2-4 hours)/hydromorphone (0.4-0.8 mg every 2-4 hours) as necessary.

This case cohort consisted of 22 patients (16 nonconstrained total shoulder replacements, 6 reverse total shoulder replacements) who were compared with a control group of all patients undergoing total shoulder replacement (5 nonconstrained and 7 reverse total shoulder replacement) who received the identical pain management protocol but without liposomal bupivacaine during the preceding 12 months, October 2013 through September 2014. The mean hospital LOS and the mean pain score on postoperative day (POD) 1 were recorded and compared between the case and control groups using the unpaired *t* test.

Subsequent QI project

On the basis of the findings of the Initial QI project, a formal protocol was developed for a Subsequent QI project that included surgeon-directed preoperative patient education anticipating a hospital stay of 1 night and the new bridging multimodal 48-hour pain management protocol. The study included all patients undergoing unilateral total shoulder replacement by the senior author (P.D.M.) between May 2015 and April 2017 (Table I). There were 62 patients (23 men, 39 women) with an average age 68 years (range, 38-92 years). The American Society of Anesthesiologists Physical Status (ASA-PS) Classification scale, created to classify preoperative health status, was used to predict perioperative risk and consists of the following classes:

ASA-PS I: normal healthy patient
ASA-PS II: patient with mild systemic disease
ASA-PS III: patient with severe systemic disease
ASA-PS IV: patient with severe systemic disease that is a constant threat to life
ASA-PS V: moribund patient who is not expected to survive without the operation
ASA-PS VI: declared brain-dead patient whose organs are being removed for donor purposes[1,13]

The ASA-PS class of each patient was recorded.

Procedures performed were nonconstrained total shoulder replacement (Global Advantage; DePuy Synthes, Warsaw, IN, USA) in 31 patients and reverse total shoulder replacement (Delta Xtend; DePuy Synthes) in 31 patients. Outcome measures were LOS (median and mean), rate of postoperative use of intravenous narcotics, and 30-day readmission rate.

Table I Demographic data of 62 patients in the Subsequent Quality Improvement project

Variable	Patients (No.)
Sex	
Male	23
Female	39
Age, yr	
<50	1
51-60	10
61-70	28
71-80	16
81-90	6
>90	1
ASA-PS* class	
I	1
II	37
III	22
IV	2
Procedure	
TSR	31
Reverse TSR	31

ASA-PS, American Society of Anesthesiologists Physical Status scale; *TSR*, total shoulder replacement.
* *I*, normal healthy patient; *II*, patient with mild systemic disease; *III*, patient with severe systemic disease; *IV*, patient with severe systemic disease that is a constant threat to life.

Results

Initial QI project

The mean LOS of the experimental study cohort and the control group were 2 and 3.5 days, respectively, and the difference was significant ($P < .05$). The mean pain scores of the study cohort and the control group on POD 1 were 3.4