



ORIGINAL ARTICLE

Local injection of liposomal bupivacaine combined with intravenous dexamethasone reduces postoperative pain and hospital stay after shoulder arthroplasty

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Background: Alternative techniques have been developed to address pain after shoulder arthroplasty and are well documented. We evaluated the effect of adding intraoperative liposomal bupivacaine and intravenous dexamethasone during shoulder arthroplasty.

Methods: We retrospectively reviewed 2 consecutive cohorts undergoing elective shoulder arthroplasty. The 24 patients in cohort 1 and the 31 patients in cohort 2 received perioperative multimodal management with preoperative and postoperative intravenous and oral narcotics, gabapentin, nonsteroidal anti-inflammatory drugs, acetaminophen, and single-injection interscalene block. Cohort 2 also received 8 to 10 mg of intravenous dexamethasone intraoperatively after the skin incision and liposomal bupivacaine injected at surgery. Patients who did and did not use preoperative narcotics were analyzed together and separately. We evaluated hospitalization length of stay, narcotic use, and visual analog scale pain before and after the change in the perioperative protocol.

Results: Cohort 1 was hospitalized longer (2 vs. 1 day; $P < .001$), required more narcotics on postoperative day 1 (21.0 vs. 10.0 mg; $P < .001$) and days 0 and 1 cumulatively (30.5 vs. 17.5 mg; $P = .001$), and had more pain on postoperative days 0 (6.5 vs. 3.5; $P < .001$) and 1 (7.5 vs. 3.5; $P < .001$) than cohort 2. In patients using preoperative narcotics, cohort 2 had less pain on postoperative day 1 (3.5 vs. 7.0; $P = .006$), less cumulative narcotic use (20 vs. 58.5 mg; $P = .03$), and shorter hospitalization (1 vs. 2 days; $P = .052$) than cohort 1.

Conclusion: These changes to the perioperative shoulder arthroplasty protocol decreased hospitalization length of stay, narcotic requirement, and pain.

Level of evidence: Level III; Retrospective Cohort Design; Treatment Study

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Keywords: pain management; shoulder replacement; length of stay; narcotic use; liposomal bupivacaine; multimodal pain management; pain control

The Western Institutional Review Board (investigation #159904) approved the study.

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Shoulder arthroplasty procedures have been performed at an increasing rate during the last decade. The annual incidence of major shoulder surgery rose from 19,000 in 2000 to 36,000 in 2008,²³ demonstrating a yearly rate increase ranging from 6% to 13%.¹¹ Shoulder surgical techniques and implant designs are improving, and the applications have been expanding since the approval of the reverse total shoulder procedure by the US Food and Drug Administration in 2003.^{5,14,27} As the popularity of these procedures increases, research involving postoperative pain management guidelines needs further study. Postoperative pain control has been studied more commonly among patients undergoing hip and knee joint replacement surgery because these procedures are performed more frequently than shoulder arthroplasty. Therefore, research into the management of postoperative pain after shoulder arthroplasty requires further exploration.

Uncontrolled postoperative pain is one of the predominant adverse outcomes that distresses patients. It leads to prolonged stays in ambulatory care units and increases the incidence of unanticipated admissions after surgery.²⁰ In total knee arthroplasty (TKA) procedures, poorly controlled postoperative pain has been shown to delay rehabilitation, prolong hospital stays, increase patient dissatisfaction, exacerbate chronic pain syndromes after surgery, and possibly increase postoperative morbidities.^{32,39} Protocols for postoperative pain management have become more advanced with the use of regional anesthetics, multimodal techniques, and innovative methods to deliver medication.

Multimodal pain management involves the combination of different medications acting on multiple pain receptors. In addition to opioids, regional and local blocks are used with nonsteroidal anti-inflammatory drugs in most regimens. Regional blockade methods are used to combat the transmission of pain through the central nervous system. Local anesthetics block the sympathetic efferent and axon reflex to decrease pain transmission from tissues and decrease inflammation.¹⁰ Nonsteroidal anti-inflammatory drugs reduce pain through the peripheral blockade of the cyclooxygenase pathways. This combination is hypothesized to produce a synergistic effect to reduce the total doses of any 1 medication, with the intention of limiting drug adverse effects and decreasing narcotic consumption.^{12,20} Large doses of opioids are associated with nausea or vomiting, hypotension, sedation, ileus, constipation, and respiratory depression,⁸ which can affect the postoperative hospital length of stay.⁴⁰

Liposomal bupivacaine (Exparel; Pacira Pharmaceuticals, Inc., Parsippany, NJ, USA) is a medication created to decrease postoperative pain through a local extended-release formulation. The medication provides up to 72-hours extended release of bupivacaine that can be concentrated into local tissue injections. It comprises multivesicular liposomes with nonconcentric lipid bilayers containing bupivacaine. These liposomes are organized in a honeycomb-like structure that causes degeneration in a predictable manner to produce a slowly sustained release of the medication.⁸

Adding dexamethasone to a multimodal pain regimen may contribute to decreasing postoperative pain as well. Although intravenous dexamethasone does not directly affect one of the traditional pain pathways, it decreases C-reactive protein and proinflammatory interleukin 6 levels after TKA and total hip arthroplasty.^{15,37} Theoretically, suppressing the inflammatory response to surgical trauma can decrease pain levels, leading to shorter hospital stays.^{24,28}

Researchers have observed varying benefits when applying multimodal pain strategies to orthopedic operations.^{1,4,16,17,33,34,38} Therefore, the purpose of our study was to evaluate the effect of adding an intraoperative wound injection of liposomal bupivacaine and intravenous administration of dexamethasone (Decadron; Merck and Company, Inc., Kenilworth, NJ, USA) during shoulder arthroplasty procedures. We hypothesized that when added to a standardized multimodal pain regimen, the combination of liposomal bupivacaine and intravenous dexamethasone would decrease visual analog scale (VAS) pain, the postoperative hospital length of stay, and narcotic consumption after shoulder arthroplasty procedures.

Materials and methods

Study participants

During 2013 and 2014, a 90-day consecutive surgical-practice window of a single fellowship-trained shoulder surgeon (H.D.R.) was referenced to identify all elective shoulder arthroplasty cases. We identified 33 patients in 2013 and 34 patients in 2014, yielding a sample of 67 patients. Patients were excluded if they had active infections, did not consent to the study, or had weight-bearing shoulders. We did not exclude patients who had used or were actively using outpatient narcotics preoperatively or patients with revision arthroplasties. After the exclusion of 12 patients, the sample included 55 patients (28 women, 27 men): 24 patients in the 2013 group (cohort 1) and 31 patients in the 2014 group (cohort 2). Their median age was 67 years (range, 44–89 years).

We diagnosed osteoarthritis in 50 patients. Primary total shoulder arthroplasty was performed in 25, primary reverse shoulder arthroplasty in 23, and hemiarthroplasty in 2. Unsuccessful shoulder arthroplasties were diagnosed in 5 patients. Procedures in these patients were revision total shoulder arthroplasty in 2, revision reverse shoulder arthroplasty in 2, and hardware removal in 1.

For analytical purposes, patients were classified according to the intraoperative administration of liposomal bupivacaine and intravenous dexamethasone and further stratified by the presence of preoperative opioid use. All patients provided written informed consent.

Pain management protocols

Patients in cohort 1 received a standardized multimodal pain management approach. General anesthetic with a single-injection interscalene block with preoperative use of 1000 mg of intravenous acetaminophen, 600 mg of oral gabapentin, 10 mg of oral oxycodone, and 200 mg of oral celecoxib was used for all patients. Postoperatively, the use of ketorolac and acetaminophen

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