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Original Article

Subacromial pain pump use is safe after arthroscopic rotator cuff repair

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ABSTRACT

Background: Intra-articular pain pumps with local anesthetics have been implicated as a potential cause of post-arthroscopic glenohumeral chondrolysis (PAGCL) of the shoulder. In short-term studies, subacromial pain pump use is effective and safe without association with PAGCL. Patients with full thickness rotator cuff tears may be at high risk of PAGCL given disruption of the tendinous integrity which may allow intra-articular infusion of local anesthetics. We hypothesized that subacromial pain pump use after arthroscopic rotator cuff repair would not result in PAGCL.

Methods: We analyzed a consecutive series of 34 patients treated with subacromial pain pump placement after arthroscopic rotator cuff repair and subacromial decompression for full thickness rotator cuff tears. Thirty patients met inclusion criteria of greater than 12-month follow-up with an average age of 51 (28–68). All patients had the subacromial pain pumps placed under arthroscopic visualization and infused 0.25% bupivacaine without epinephrine at 2 cc/h for 48 h. All patients had clinical examinations and radiographic studies performed more than 1 year after surgery.

Results: Patients had an average rotator cuff size of 1.6 cm and fixation was performed with bioabsorbable suture anchors. All patients had at least 150° of abduction and forward flexion at latest follow-up without palpable crepitus and no patients had any evidence of joint space narrowing on post-operative radiographs.

Conclusion: Subacromial pain pump use after arthroscopic rotator cuff repair is safe. Despite probable lack of a water-tight seal from repair, there were no cases of PAGCL.

Level of evidence: IV.

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1. Introduction

Pain modalities, along with advances in arthroscopy, have allowed many operations to be performed as ambulatory surgery. In addition to the use of oral opiate and pain medications, local anesthetics injections have also been utilized. Alternatively, regional anesthesia can be performed as a single injection nerve block or with a pain pump. Trained anesthesiologists are necessary to administer these interscalene regional nerve blocks in the shoulder and are not always available.¹ Pain pumps administering local anesthetic medications have been used in both the knee and shoulder for post-operative pain control that allow the patient to continue to receive the pain medication through a self-contained unit after discharge home. These units are self-contained storage and delivery systems and typically are filled with lidocaine or bupivacaine. Pain pumps placed in the intra-articular space of both the shoulder and knee have recently been associated with post-arthroscopic glenohumeral chondrolysis (PAGCL).^{2–7}

For the shoulder, post-arthroscopic glenohumeral chondrolysis (PAGCL) has been associated with thermal electrocautery, bioabsorbable anchors, and pain pumps administering local anesthetics with or without epinephrine. In one study with at least 1-year follow-up, no patients developed PAGCL with subacromial pain pump placement or with intra-articular pain pumps using 0.5% bupivacaine at 2.08 mL/h.⁸ However, of the 16 patients with pain pump use at the higher flow rate of 4.16 mL/h, 3 developed PAGCL. All pain pumps were used for 65 h which is longer than has typically been used in other clinical studies.⁸ Although several reports have associated intra-articular pain pumps and local anesthetics with PAGCL, only one case report has been published documenting a case of PAGCL with subacromial pain pump use.²

Our previous study found the subacromial pain pump to be very safe in the short-term after arthroscopic shoulder surgery.⁹ In our previous study of 583 patients with greater than one month follow-up after various surgeries and use of a subacromial pain pump administering bupivacaine for 48 h, we found only one minor complication of external catheter breakage that did not require any surgical intervention.⁹ From this study, we decided to focus on the arthroscopic rotator cuff repair patient subset longer term to determine if there were any cases of PAGCL. We assumed that this subset of patients would be at higher risk for PAGCL with the use of a subacromial pain pump with bupivacaine because of the lack of a water-tight seal that is not uncommon after rotator cuff repair. This may expose the intra-articular space to greater concentrations of bupivacaine. We hypothesized that no patients would have developed PAGCL after arthroscopic rotator cuff repair and use of a subacromial pain pump.

2. Materials and methods

We analyzed a single surgeon consecutive series of 34 patients treated with subacromial pain pumps after arthroscopic rotator cuff repair and subacromial decompression for full

thickness tears treated by a single surgeon. Thirty patients met inclusion criteria of greater than 12-month follow-up. The average age was 51 (28–68), with 67% male and 33% female patients. The left and right shoulders were involved in 13 (43%) and 17 (57%), respectively.

Although all patients underwent arthroscopic rotator cuff repair and subacromial decompression, other concomitant surgeries were also performed. None had concomitant labral surgeries, 4 (13%) had biceps tendinopathy partial thickness debridement without tenotomy or tenodesis, and 3 (10%) had distal clavicle resection performed arthroscopically. Six (30%) of the cases were revision surgery for rotator cuff repair. Patients were positioned in the lateral decubitus position for arthroscopy. Rotator cuff repair was performed with bioabsorbable anchors. Subacromial decompression was routinely performed with removal of the bursa and burring of the undersurface of the anterolateral acromion.

After completion of the arthroscopic surgery, all patients had a subacromial pain pump placed under arthroscopic visualization using a percutaneous technique. With the arthroscope in the posterior portal in the subacromial space, the insertion sheath for the pain pump catheter is placed 1 cm off the anterolateral acromion. With placement confirmed, the pain pump catheter is placed into the subacromial space. This allows confirmation of pain pump placement and to place it independent of any arthroscopic portals. The Pain Care 3000 pump (BREG, Vista, CA) was used for all cases and infused with 0.25% bupivacaine without epinephrine at 2 cc/h for 48 h. This pump offers a patient-controlled bolus option of 4 cc up to every 2 h beyond the basal rate. Total amount of bupivacaine used and bolus doses were not recorded. Supplemental oral opiate medication use was not recorded.

All patients had clinical examinations for range of motion and crepitus, as well as radiographic studies both performed at greater than 12 months after surgery. Radiographs consisted of AP and scapular-Y views of the operative shoulder. Clinical examinations were performed by the senior author.

3. Results

All surgeries were performed arthroscopically with no conversion to open or mini-open approaches. The average tear size was 1.6 cm with a range from 1 cm to 2.5 cm. Rotator cuff repair was performed with bioabsorbable suture anchors. All cases had sufficient rotator cuff tissue for complete repair without excessive tension.

None of the patients had any short-term complications with pain pump use. There were no cases of infection, internal or external catheter breakage, or admission to the hospital for pain control. All patients took opiate medication as needed for pain after surgery and were discharge home after surgery. Although clinical outcomes scores were not used as they were not a focus of this study, no patients had any pain or limitation of activities.

All patients had at least 150° of abduction and forward flexion at latest follow-up without palpable crepitus and no patients had any evidence of joint space narrowing on radiographs.

4. Discussion

In 2007, Hansen et al coined the phrase post-arthroscopic glenohumeral chondrolysis (PAGCL) and brought the clinical association of pain pumps with bupivacaine to the forefront.⁶ The diagnostic criteria for PAGCL included increased pain, stiffness, crepitus (with or without a decreased range of motion) and loss of glenohumeral joint space on radiographs.⁶ All patients with PAGCL presented within 12 months of the surgery for shoulder complaints. This retrospective review, from a single surgeon, was the largest case series at the time and was an effort to discover any apparent association with operative factors.⁶ The authors found a strong association between pain pump use with 0.25% bupivacaine with epinephrine and PAGCL with 60% of patients affected after arthroscopic stabilization.⁶ Although 33% of the 12 cases involved thermal devices to “augment the capsular shift,” it was used in 29% of the other cases examine without PAGCL. Furthermore, the control group of shoulder surgeries from the same period of time without pain pump usage had no cases of PAGCL and no cases of PAGCL in patients who received the pain pump in the subacromial space.⁶ The authors concluded that “use of intra-articular pain pump catheters eluting bupivacaine with epinephrine appear highly associated with post-arthroscopic glenohumeral chondrolysis.”⁶ Further examination of the link between local anesthetics and chondrolysis in several laboratory studies have confirmed the chondrotoxicity from local anesthetics including bupivacaine.^{10–15}

Although Hansen et al found use of the pain pump in the subacromial to be safe with no cases of PAGCL,⁶ and another study found no cases in a the subacromial pain pump study group,⁸ one case has been reported of PAGCL in this setting.² Bailie and Ellenbecker reported a case series of PAGCL patients with 12 of 23 patients referred for care.² The remaining 11 of 23 patients had their index surgery performed by the senior author for this report. Although 17 of 23 (74%) of patients had a pain pump used in the initial surgery and subsequently developed PAGCL, only one of these cases involved extra-articular pain pump placement.² The catheter “was reportedly placed in the subacromial space after mini-open rotator cuff repair” and “other records (i.e., nursing operative records and anesthesia records) were not available, except in patients who had their index surgery at our clinic.”² Given the description of the case, this seems to have been a patient with the index surgery not performed by the senior author. The only other information available in the paper for this case was that it was a 47-year-old patient, the onset of symptoms was 10 months after surgery, a metal anchor was used, and the patient was treated for PAGCL with arthroplasty.²

Our initial study regarding our consecutive series of 583 patients with use of the subacromial pain pump after arthroscopic shoulder surgery showed the complication rate to me minimal with only one complication of external catheter breakage.⁹ The short-term follow-up at a minimum of one month was not adequate to determine if PAGCL would develop. The literature has consistently demonstrated a delayed onset typically within one-year of surgery and pain pump use with local anesthetics.^{2,6} With clinical examination

and radiographs taken at more than 12 months follow-up in this study, we found no cases of PAGCL in 30 patients after use of the subacromial pain pump.

Other than the single case of PAGCL after subacromial pain pump use reported, no other cases have been reported.² After bursectomy, the subacromial space has a much larger area for diffusion and dilution of the administered bupivacaine relative to the intra-articular space. Without violation of the rotator cuff and capsule that occurs with a rotator cuff tear, subacromial infusion of bupivacaine via a pain pump in the shoulder presumably would result in a very minimal amount, if any, of the local anesthetic reaching the articular cartilage. Other than potentially accessing the joint via the arthroscopic portal tracts, the only other route would be diffusion across the rotator interval or rotator cuff. It is for this reason that we chose to study the subset of patients who had undergone rotator cuff repair. Although repaired arthroscopically, the capsule and rotator cuff would presumably have increased permeability to bupivacaine from the subacromial space. Despite this likely increased risk, there were no cases of PAGCL. It is important to note that in our study used a low flow rate of 2 cc/h flow rate and conclusions about higher flow rates are uncertain. Although a single case of PAGCL has been reported in the literature with use of a subacromial pain pump with unclear details, our study supports the mid-term safety for use of subacromial pain pumps after arthroscopic shoulder surgery and rotator cuff repair.

Conflicts of interest

All authors have none to declare.

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