

On-Q Pump for Pain Control After Orbital Implant Surgery

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Purpose: To introduce an elastomeric continuous infusion pump for pain control after outpatient orbital implant surgery.

Methods: Retrospective, noncomparative consecutive case series of all patients undergoing enucleation, evisceration, or secondary orbital implantation using the On-Q pain system between August 2004 and January 2006. Postoperative pain score, need for narcotics, and adverse events were recorded. The On-Q catheter is inserted intraoperatively through the lateral lower eyelid into the muscle cone under direct visualization, prior to the orbital implant placement. The On-Q system continually infuses anesthesia (bupivacaine) to the retrobulbar site for 5 days.

Results: Among 20 patients, mean postoperative period pain score, with On-Q in place, was 1.3 (scale of 0 to 10). Nine patients (45%) did not need any adjunctive oral narcotics. Two patients experienced postoperative nausea. One catheter connector leaked, thereby decreasing delivery of retrobulbar anesthetic resulting a pain level of 6, the highest level in the study. There were no postoperative infections. No systemic toxic effects from bupivacaine were observed clinically.

Conclusion: The On-Q pain pump is widely available, low cost, and requires minimal patient manipulation for the use in orbital implant surgery. The device was safe and appeared to minimize postoperative pain in the authors' case series.

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Patients often experience significant pain after enucleation, evisceration, or secondary orbital implantation.^{1–3} Prophylactically, a postoperative retrobulbar injection of local anesthetic provides effective, but temporary, relief.¹ The remaining postoperative pain is usually treated with oral narcotics, which are associated with systemic side effects such as nausea, vomiting, sedation, pruritus, constipation, lightheadedness, and confusion. Some patients require hospitalization and intravenous analgesia.

To maximize postoperative patient comfort and minimize systemic effects, local anesthesia systems have been described. Fezza et al.⁴ described the placement of an epidural catheter into the orbit, with delivery of local anesthetic (bupivacaine)

through a computerized patient-controlled analgesia (PCA) pump in conjunction with daily visits by a home health nurse. Merbs et al.⁵ described the placement of an intravenous catheter into the orbit with 2 syringes of local anesthetic (lidocaine and bupivacaine mixture) given to a caregiver with instructions on how to inject the local anesthetic into the orbital catheter when the patient reported pain.

Use of an extended local pain management system has not gained widespread use. An ideal postorbital surgery pain management system would provide effective local anesthesia, be widely available, easy to insert with low risk for complication, low cost, portable, and require minimal manipulation by patient or caregiver.

The On-Q provides continuous delivery of local anesthetic such as bupivacaine without epinephrine through the tip of an implanted catheter. The elastomeric membrane provides positive pressure, which squeezes the bulb reservoir of anesthetic. The purpose of this study is to introduce the On-Q pain pump for use after enucleation, evisceration, or secondary orbital implantation. The authors describe their insertion technique and present the results of postoperative pain management in a case series of patients.

METHODS

A retrospective case series review was performed on consecutive patients undergoing enucleation, evisceration, or secondary orbital implantation who received the On-Q system from August 2004 to January 2006. Charts without detailed pain information were excluded. Charts were reviewed, and demographic and clinical information were documented. Markers of postoperative pain including numerical pain score, use of narcotics, and physician notes regarding patient symptoms and complications were noted. Pain score was defined as the amount of pain in the period between surgery and the first postoperative visit on a scale from 0 to 10, 0 signifying no pain and 10 the worst pain imaginable. Informed consent was obtained for each procedure. Internal review board (IRB) approval was not obtained because none of the patients in this study came from an institution with an IRB or were operated or seen at an institution with an IRB. The review was Health Insurance Portability and Accountability Act compliant and adhered to the standards of the Declaration of Helsinki.

The On-Q is FDA approved for continuous and/or intermittent delivery of medication (such as local anesthetics) to surgical wound sites. The elastomeric membrane provides positive pressure, which squeezes the bulb reservoir of anesthetic at approximately 10 PSI. A flow rate restrictor in line with the tubing restricts the flow to the rate of the pump kit ordered, such as 0.5, 1, and 4 ml/hour.

All patients underwent surgery and received the On-Q pain pump with a flow rate of 0.5 ml/hour and a bulb reservoir size of 65 ml packaged with a 19-gauge catheter. Surgery was performed on an outpatient basis. Patients were discharged home with On-Q and adhesive

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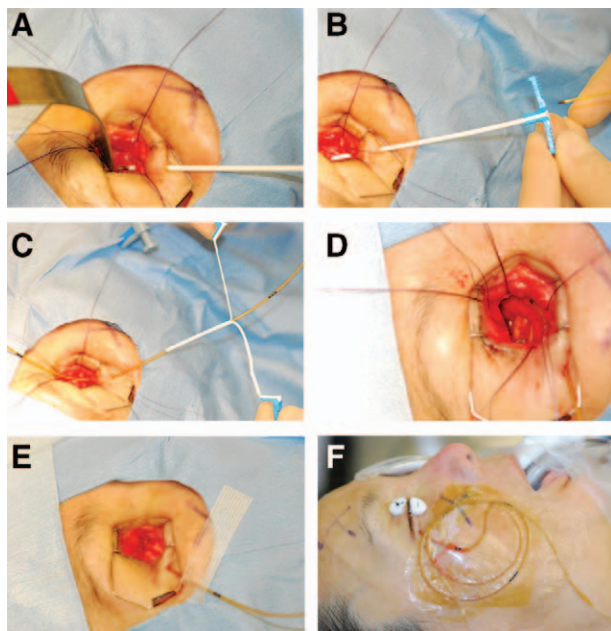
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eye patch pressure dressing in place, with instructions to keep patch dry while still adherent. Patients were given prescriptions for oral vicodin and cephalexin antibiotic, adjusted in event of patient allergy.

Surgical Technique. Enucleation, evisceration, orbital implant exchange, or secondary orbital implantation was begun in standard fashion. Intraoperatively, the indwelling catheter was placed transcutaneously through the lateral lower eyelid into the muscle cone under direct visualization immediately after enucleation or evisceration and just prior to the orbital implant placement.

With the eyelid speculum in place and muscle cone in view, the introducer guide and introducer needle were inserted through the lateral lower eyelid and into the muscle cone. A malleable retractor is placed superiorly to protect the orbital roof during insertion (Fig. A). The introducer needle was removed and the catheter (19 gauge) fed through the introducer guide (Fig. B). The introducer guide was removed (Fig. C). The catheter tip was placed or coiled within the muscle cone as the surgeon sees fit to prevent intravascular, intramuscular, and intracranial placement (Fig. D). A small amount of local anesthetic was injected through the catheter to assure proper functioning. Once in correct position, the catheter was temporarily adhered to the cheek with steri-strip or tape near the dermal entry site to avoid movement. The markings on the catheter were noted to recall the length of catheter in the orbit.



On-Q pain pump kit intraoperative insertion. **A**, With an eyelid speculum in place and malleable retractor shielding the orbital roof, the introducer guide and needle are inserted through the lateral lower eyelid immediately after enucleation or evisceration and just prior to the orbital implant placement. **B**, The introducer needle is removed and the 19-gauge catheter fed through the introducer guide into the muscle cone. **C**, The introducer guide is removed leaving the catheter in place. **D**, The catheter tip is coiled within the muscle cone under direct visualization to prevent intravascular, intramuscular or intracranial placement. **E**, Once in correct position, the catheter is temporarily adhered to the cheek with steri-strip or tape near the dermal entry site to avoid movement. The markings on the catheter are noted to recall the length of catheter in the orbit and the implant is inserted in standard fashion. **F**, A small bolus of bupivacaine is injected to confirm catheter function and placement in orbit, avoiding external leakage. The catheter is affixed to the cheek and connected to the continuous infusion bulb, which is clipped to the patients clothing.

The orbital implant was then inserted, and the surgery is completed in standard fashion (Fig. E).

A syringe with bupivacaine, without epinephrine, was connected to the On-Q catheter. The syringe was drawn back to reconfirm non-intravascular placement, and 2ml is slowly injected to reconfirm that catheter is working and to give a bolus of retrobulbar anesthesia. The catheter was secured in place, either with a suture tied around catheter and sutured to skin or with Tegaderm (3M, St. Paul, MN, U.S.A.) (Fig. F). The catheter was then connected to the continuous infusion bulb that delivers local anesthesia to the retrobulbar site at 0.5 ml/hour for approximately 5 days. The reservoir bulb holds 65 ml of anesthetic; the surgeons used either 0.25% or 0.50% bupivacaine without epinephrine. A pressure patch was placed on the eyelids, and an additional patch placed on the secured, coiled catheter. The bulb, smaller in size than a tennis ball, was clipped to the patient's clothing. The patient was discharged home with the aforementioned oral narcotic and antibiotic medications. The catheter with On-Q pain pump was removed in the office at the first postoperative visit usually in 5 to 8 days.

RESULTS

The On-Q system was used in 22 patients during the study period. Two patients without complication were excluded from the study due to inadequate postoperative pain documentation. Of the remaining 20, 12 (60%) were men with mean age of 58 (range, 26–86 years). There were 7 enucleations, 8 eviscerations, and 5 secondary orbital implantations. Patients underwent surgery for diagnoses of blind painful eyes (11), endophthalmitis (2), choroidal melanoma (2), and socket volume deficiency (5). Orbital implants included 8 porous polyethylene (Medpor, Stryker, Kalamazoo, MI, U.S.A.) and 12 hydroxyapatite (Bio-Eye, Integrated Orbital Implants, Inc., San Diego, CA, U.S.A.). The On-Q catheter was removed at mean 5 days (range, 2–8 days) during the first scheduled postoperative visit.

The mean postoperative pain score during the first week, with On-Q in place, was 1.3 on a scale of 0 to 10 (range, 0–6 pain level). Nine patients (45%) did not need any oral narcotics to supplement their local anesthetic pain relief. Two patients (10%) had mild postoperative nausea on postoperative days 2 or 3. One catheter connector leaked, thereby decreasing delivery of retrobulbar anesthetic, and this patient had a pain level of 6, which was the highest level in the study. The On-Q manufacturer subsequently changed connector systems, and none of the new connector systems leaked. One patient returned to office work the next day and believed that he would not have been able to work had he taken narcotic for pain control because of the typical side effect profile. Removal of the catheter was complete and painless in all patients at week 1. There were no postoperative infections. No systemic toxic effects from bupivacaine were observed clinically.

DISCUSSION

This study introduces the On-Q pain management system for use after enucleation, evisceration, or secondary orbital implantation. In this series of 20 patients, the authors found the On-Q system was technically easy to insert, had no complications, and resulted in low patient-reported pain score. Almost half of the patients avoided the use of any systemic oral narcotics. The authors believe that the On-Q device approaches an ideal local anesthesia system for outpatient orbital surgery.

An indwelling catheter for infusion of local anesthetic near the surgical wound for postoperative pain control has been evaluated for many types of operations by a variety of specialties.^{6,7} A meta-analysis of 44 randomized controlled trials between 1983 and 2006 included 2,141 patients with indwelling catheters for local anesthetic.⁷ Use of continuous wound catheters consistently reduced the need for opioids. Catheters provided effective analgesia with reduced pain scores for all surgical subgroups. There was a reduction in postoperative nausea

and vomiting presumably due to reduction in opioid use. There was increased patient satisfaction.

The On-Q system for infusion of local anesthetic near the surgical wound in the ambulatory setting has been widely studied. Ninety-two studies have been published or presented in a broad area of specialties including general surgery, cardiothoracic, plastic, bariatric, orthopedic, pediatric, urology, and obstetrics gynecology. Many have been prospective, randomized, double-blind, placebo-controlled studies.^{8–24} Others are prospective or retrospective case studies.^{25–27} This would be the first On-Q pilot study in oculo-facial surgery.

The first report of continuous retrobulbar anesthesia through an indwelling catheter described was by Scheie²⁸ in 1956. Scheie²⁸ describes its use after intraocular surgery, enucleations, conditions with protracted ocular pain such as “acute congestive glaucoma,” and conditions with multiple minor operative procedures such as repeated paracenteses. In most of the 125 patients, the catheter was removed in 24 hours with excellent postoperative pain relief. Since then, retrobulbar catheters have been used for intraoperative pain control^{29–33} and the first 24 hours postoperatively in an inpatient setting^{34–36} for retina surgery without complications.

On an outpatient basis, others have described their techniques to address postoperative pain control with indwelling catheters after orbital implant surgery. Fezza et al.⁴ described their technique of placing an epidural catheter into the orbit with delivery of local anesthetic (0.5% bupivacaine) using a computerized PCA pump and added labor cost of daily visits by a home health nurse. Their catheter was placed transcutaneously in the lateral orbital space after completion of surgery, without direct visualization of final catheter location. The PCA was set with a continuous infusion of 1 ml/hour with demand bolus of 1 ml every 3 hours as needed for pain. They reported a mean pain score of 2.8 (scale, 0–10) during the first postoperative week. Their low complication rate included 1 retrobulbar hemorrhage and 4 minor catheter obstructions or positional flow. The average plasma bupivacaine level in 4 patients in whom this was measured was 0.38 ug/ml, which is well below the toxic level of 4.0 ug/ml. Merbs et al.⁵ described their technique of placing an intravenous catheter into the orbit via a transconjunctival approach under direct visualization. Caregivers were sent home with two 10-ml syringes of 50:50 mixture of 0.75% bupivacaine and 4% lidocaine with instructions to slowly inject up to 2 ml every 4 hours as needed for pain. They reported that 87% patients used the pain-control catheter at home at least once. Of the patients who used the catheter, 17% reported mild discomfort with catheter use, but no patients discontinued catheter use due to discomfort. Seven percent reported postoperative nausea. No complications, including postoperative infection, retrobulbar hemorrhage, or clinical systemic toxic effects of bupivacaine were observed.

The placement of indwelling orbital catheters is not without risk of severe complication. The death of a patient with Stickler syndrome has been reported by Garg et al.³⁷ when an indwelling retrobulbar catheter migrated through the superior orbital fissure. It is presumed that a lethal bolus dose of bupivacaine was injected into the subarachnoid space with likely brainstem anesthesia. There are important lessons to be learned. First, the patient had a 14-gauge orbital catheter, which is more rigid than the 18–2 to 28-gauge³² catheters reported in the literature. Second, a full 63.5 mm of catheter was intraorbital, whereas the length of the orbit is approximately 40 to 48 mm.³⁸ Indeed, reports recommend that the intraorbital portion of the catheter be between 20 and 35 mm.^{2,3,37} Third, patients with Stickler syndrome have connective tissue

weakness.³⁷ The combination of a more rigid catheter, a longer length of catheter placed intraorbitally, and a patient with connective tissue weakness allowed catheter penetration through the superior orbital fissure. The finer 19-gauge catheter and the length markings on the catheter of the On-Q system are critical for safe catheter placement. In addition, placement under direct visualization allows proper orbital position in the muscle cone and minimizes the risk of intravascular, intramuscular, or intracranial placement. The On-Q should not be used in patients with connective tissue disorders.

The retail cost of an On-Q kit is under \$150, with volume discounts available. This cost is small compared with the cost of hospitalization either for pain control or a postsurgical admission that may occur due to narcotic side effects such as abdominal pain, constipation, nausea, or vomiting. In 2010, the I-flow Corporation (Lake Forest, CA, U.S.A.) discontinued the 65-ml model. Since the discontinuation of the 65-ml model, the authors have used the 100-ml model at 1 ml/hour flow rate with similar efficacy in pain control and with no observed systemic toxic effects from bupivacaine. The authors chose bupivacaine concentration (0.25% vs. 0.5%) based on availability in the operative facility. Although this was not studied specifically, there were no differences in analgesic efficacy noted between the concentrations leading the authors to recommend the 0.25% concentration when available.

There are several limitations to this retrospective study. There are no comparative controls, which would be helpful in measuring true efficacy of the pain pump, and the series is relatively small. In the authors' experience prior to use of the pump, over 90% of patients needed postoperative systemic narcotics. The authors have found a notable improvement in patient comfort when using the pump and hesitate to randomize patients who would benefit from the improved pain relief. However, a larger randomized prospective study with more rigorous pain measurement tools would more definitively exhibit safety and efficacy of this device.

In summary, this is the first study to introduce the On-Q pain system for use in outpatient enucleation, evisceration, and secondary orbital implant surgery. The On-Q has several advantages over the previously described systems by Fezza et al.⁴ and Merbs et al.⁵ The On-Q setup comes in a premade kit designed for the purpose of postoperative wound analgesia, averting the need to make one from spare parts. It requires no costly home health care nursing visits or PCA pump. It requires no caregiver injections, thereby decreasing opportunity of error, and the continuous slow rate of infusion eliminates the discomfort of bolus injections. Further, the On-Q catheter is placed under direct visualization, reducing the risk of intravascular or intracranial placement and toxic effects of bupivacaine. The 19-gauge catheter and length markings on the catheter address safety concerns regarding catheter placement. The device was safe and appeared to minimize pain and need for narcotics in this small outpatient series. Further study to confirm safety and efficacy is needed.

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