

The Difficulty to Remove Perineural Catheter: A Technique for Removing an Intact Catheter

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Received May 15th, 2013; revised June 19th, 2013; accepted July 9th, 2013

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ABSTRACT

Continuous perineural catheters are used for postoperative pain management following inpatient or outpatient orthopedic surgery. One of the potential complications is shearing and breaking of the catheters during removal. The metallic coiled tip Stimu Cath catheter may contribute to formation of adhesions. Depletion of the local anesthetic infusion prior to attempted removal of the catheter may contribute to formation of adhesions around the catheter. Once the infusion of local anesthetic is finished, there is no longer a pocket of fluid around the catheter and tissue may begin to collapse and form adhesions, making removal difficult. Our strategy in dealing with a catheter that is difficult to remove is to keep the catheter connected to the pump, avoiding contamination as well as preserving the integrity of the catheter by avoiding shearing and breakage. One of the concerns with a “stuck” catheter is that the catheter may have adhered to a neural structure and that pulling and tugging could cause nerve damage. Prior to manipulating the catheter, we perform an ultrasound examination to ascertain its exact location, we then bolus sterile saline through the catheter. We feel that infusing 30 to 50 ml of sterile saline, slowly and incrementally will expand the area around the catheter and aid in removal without significant risk of compression neuropathy.

Keywords: Regional Anesthesia; Ultrasound; Peripheral Nerve Catheter; Acute Pain Management

1. Introduction

Continuous perineural catheters are used for postoperative pain management following inpatient or outpatient orthopedic surgery [1-7]. At the completion of the infusion of local anesthetic, the catheter may be removed by the patient or a healthcare provider in either outpatient or inpatient settings. A potential complication associated with perineural catheter use is difficulty removing the catheter. There are several case reports of perineural catheters shearing and breaking during attempted removal [8-11]. Broken catheters can cause significant inconvenience and discomfort to the patient, with some requiring surgical removal. Here we describe four cases of difficult catheter removal in which the catheter was successfully removed intact without breakage or shearing. Three of the cases involved an interscalene catheter, and one involved a femoral nerve catheter.

2. Interscalene Catheter Cases

The same method of insertion was used for all three interscalene catheters. Preoperatively, an interscalene bra-

chial plexus catheter (19 gauge 60 cm StimuCath Arrow International, Reading, PA, USA) was placed using ultrasound guidance via an in plane approach. The patient received a 20 ml bolus of ropivacaine 0.5% through a 17 g Tuohy needle; the catheter was advanced 4 centimeters past the needle tip with constant ultrasound visualization and positioned next to the brachial plexus and 10 ml of ropivacaine 0.5% was injected through the catheter to aid in confirming position of catheter tip. The catheter is secured to the patient. Following surgery, an elastomeric pump attached to the catheter in the post anesthesia care unit (PACU).

2.1. Interscalene Catheter Case 1

Case #1 was a 63-year-old female, American Society of Anesthesiologists (ASA), 3 patients who underwent a left total shoulder arthroplasty as an inpatient. On post op day (POD) #2, during afternoon rounds, the acute pain service noted the patient's perineural pump was empty. Catheter removal was attempted by applying continuous traction and rotation to the catheter. Ultrasound was util-

ized to observe the catheter adjacent to the brachial plexus. Catheter manipulation did not elicit pain or paresthesia. Sterile saline, 38 ml was injected slowly and incrementally until the saline began to leak out around the catheter entry site, at which point the catheter was removed intact with minimal traction and rotation.

2.2. Interscalene Catheter Case 2

Case #2 was a 59-year-old male, ASA 2 patient who underwent a right rotator cuff repair with subacromial decompression as an outpatient. After completion of the surgery, in the PACU, an elastomeric pump (On-Q C-Block with ONDemand) filled with 550 ml of ropivacaine 0.2% was connected to the catheter and an infusion of 8 ml per hour with a patient controlled analgesia (PCA) bolus of 5 ml every 30 minutes was started. On POD # 2 the patient called the on call anesthesiologist reporting difficulty removing the catheter. The patient was asked to return to the hospital for examination by the anesthesiologist. Ultrasound was used to visualize the location of the catheter with respect to the brachial plexus. The catheter could be seen traveling in a straight path and laying near the brachial plexus. The catheter could not be removed by using continuous traction and rotation. Catheter manipulation did not elicit pain or paresthesia. Under ultrasound visualization, ropivacaine 0.5% was injected slowly through the catheter to expand the perineural space. Following injection of 32 ml of ropivacaine 0.5%, local anesthetic began to leak out around the catheter entry site at which point the catheter was easily removed intact with minimal traction. No shearing or breaks in the catheter occurred during removal. Expansion of the perineural space was performed using ropivacaine instead of saline to treat the moderate to severe pain the patient had been experiencing after infusion of local anesthetic was depleted.

2.3. Interscalene Catheter Case 3

Case #3 was a 48-year-old ASA 2 female who underwent a right rotator cuff repair as an outpatient. After completion of the surgery, in the PACU, an elastomeric pump (On-Q C-Block) filled with 550 ml of ropivacaine 0.2% was connected to the catheter and an infusion of 10 ml per hour was started. Due a manufacturer's recall of the On-Q C-Block with ONDemand, an On-Q C-Block was used for this patient. On POD # 3 the patient called the on call anesthesiologist reporting difficulty removing the catheter. The patient was asked to return to the hospital for examination by the anesthesiologist. Ultrasound was used to visualize the location of the catheter with respect to the brachial plexus. The catheter tip could be seen lying near the brachial plexus. During visualization with ultrasound, slight traction on the catheter did not elicit

any paresthesia or pain nor was any movement of the brachial plexus appreciated. The anesthesiologist was unable to remove the catheter by applying traction and rotation. Since the depletion of the local anesthetic the patient had been in considerable amount of pain and requested if we could "re-block" her. Ropivacaine 0.5% 20 ml followed by sterile saline 20 ml was injected slowly incrementally through the catheter until leakage of local anesthetic was seen around the catheter insertion site. The intact catheter was then easily removed by applying gentle traction.

2.4. Femoral Catheter Case 1

A 35-year-old male, ASA 1 patient underwent a right anterior cruciate ligament repair as an outpatient. Postoperatively, a femoral nerve catheter (19 gauge 60 cm StimuCath) was placed using ultrasound guidance via an in plane approach. The patient received a 20 ml bolus of ropivacaine 0.2% through a 17 g Tuohy needle; the catheter was advanced 5 centimeters past the needle tip with constant ultrasound visualization and positioned next to the femoral nerve and 10 ml of ropivacaine 0.2% was injected through the catheter to aid in confirming position of catheter tip. In the PACU, an elastomeric pump (On-Q C-Block with ONDemand) filled with 550 ml of ropivacaine 0.1% was connected to the catheter and an infusion of 10 ml per hour with a PCA bolus of 5 ml every 30 minutes was started. On POD #2, the patient paged the acute pain pager stating that he was having difficulty removing the catheter at which point he was instructed to return to the hospital. Ultrasound examination showed the catheter positioned beneath the femoral nerve. Gentle traction and rotation was used unsuccessfully to remove the catheter. Catheter manipulation did not elicit pain or paresthesia. Sterile saline, 42 ml, was injected slowly and incrementally until the saline began to leak out around the catheter entry site, at which point the intact catheter was removed using traction and rotation.

3. Discussion

Perineural catheters are commonly used for postoperative pain management in patients undergoing orthopedic procedures [1-7]. One of the concerns associated with the use of perineural catheters in the outpatient setting is removal of the catheter once the infusion of local anesthetic is finished. Several strategies can be used for outpatient removal of catheters. At our institution, patients or their caretakers, remove outpatient perineural catheters. Patients are given a pager number to contact a member of the acute pain team 24 hours a day, seven days a week, if they have any questions or concerns regarding their perineural catheter.

We have placed over 3000 ultrasound guided perineural catheters. During this time, we experienced shearing and breakage of 2 outpatient perineural catheters during attempted removal by patients. Other institutions have also reported cases of difficulty in removing catheters as well as catheters shearing and breaking during removal [8-10]. Difficulty in removing a perineural catheter and/or breakage of a perineural catheter can be very anxiety provoking for patients as well as having potentially serious consequences, including the need for surgical exploration and removal of the retained portion of the catheter [11].

The cases in which we had difficulty removing the perineural catheter or the catheter broke during removal, all had in common that the initial attempt at removal was delayed for several hours or even days, following depletion of local anesthetic infusion [11,12]. Although, there are no large controlled studies looking at causes of difficult catheter removal and/or catheter breakage; in a small study, Buckenmaier et al reported formation of adhesions around the tip of indwelling StimuCath catheters in rats after 72 hours without an infusion [13]. They concluded that the StimuCath catheter has a metallic coiled tip that may contribute to formation of adhesions at the tip of the catheter when there is no active infusion (**Figure 1**). Based on the findings of Buckenmaier et al. we speculate that depletion of the local anesthetic infusion prior to attempted removal of the perineural catheter may lead to formation of adhesions around the catheter [13]. In addition, once the infusion of local anesthetic is finished, the potential space created by the infused or injected volume of local anesthetic may begin to collapse around the catheter thereby increasing the total area of the catheter in direct contact with the surrounding tissues which may become adherent to it.

Clendenen *et al.* report a novel and seemingly very effective technique for removal of sheared and broken catheters, by passing an angiocath over the retained portion and then removing the catheter and angiocath together [10]. Clendenen *et al.* noted that their retained catheters did not have any signs of adhesions once they were removed. It is possible that the evidence of any adhesions may have been destroyed during the removal process.

Our strategy in dealing with a catheter that is difficult to remove is first to preserve the integrity of the catheter and avoid shearing and breakage of the catheter. We try to keep the catheter connected to the pump and maintain a closed system to avoid introduction of any bacteria until we can examine the catheter. One of the concerns with a "stuck" catheter is that the catheter may have adhered to a neural structure and that pulling and tugging could cause nerve damage. Prior to manipulating the catheter, we scan the patient to ascertain the exact loca-



Figure 1. StimuCath catheter's metallic coiled tip, which may contribute to formation of adhesions at the tip of the catheter.

tion of the catheter. Once the location of the catheter is determined, we bolus sterile saline through the catheter. We feel that bolusing 30 to 50 ml of sterile saline through the catheter in order to expand the area around the catheter will aid in removal of difficult catheters as demonstrated by the three cases presented here. Concerns if larger volumes of local anesthetic are used may include compression neuropathy, pressure parasthesias or local anesthetic toxicity. Therefore, bolusing should be discontinued should the patient experience discomfort.

During placement of our perineural catheters we employ strategies to potentially decrease the chance of catheters being retained. We take care not to advance the catheter more than a few centimeters past the tip of the Tuohy needle. With interscalene catheters, we take care not to allow the Tuohy needle or catheter to traverse the trunks of the brachial plexus in order to decrease the chance of neural components becoming entangled within the catheter. When a pump with a PCA function is used, it is impossible to tell patients exactly when their pump will be empty; we encourage our patients to check their pump volume frequently and to not let their pump to become completely empty prior to removal of the catheter. During the informed consent process we address the potential risk of a difficult to remove catheter and the need to return to the hospital, to have it evaluated and removed by our staff.

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