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Case Reports

Successful Use of Continuous Erector Spinae Plane Blocks in a Patient With Variant Angina After Large Ventral Hernia Repair

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Coronary artery spasm constitutes the primary underlying pathology of variant angina. Because provocation of coronary artery spasm may occur with both excess sympathetic and excess parasympathetic stimulation, patients with this disorder have extremely limited options for perioperative pain control. This is especially true for procedures involving extensive abdominal incision/manipulation. Whereas neuraxial analgesia might otherwise be appropriate in these cases, several studies have demonstrated that coronary artery spasm can occur as a result of epidural placement, and therefore, that this may not be an optimal choice for patients with variant angina. This report discusses the case of a patient with a preexisting diagnosis of variant angina who underwent an exploratory laparotomy with large ventral hernia repair and for whom continuous erector spinae plane blocks were successfully used as analgesic adjuncts without triggering coronary artery spasm. ***(Tex Heart Inst J. 2022;49(6):e217624)***

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Variant (Prinzmetal) angina was first described by Myron Prinzmetal in a preliminary report published in 1959.[1] The primary pathophysiology is that of hyperreactive large coronary arteries in response to a vasoconstrictive stimulus.[2] Importantly, coronary artery spasm (CAS) may be triggered by both medications and techniques commonly used for postoperative pain control, including neuraxial anesthesia.[3-7] Multiple reports have described the occurrence of CAS resulting from epidural catheter placement and/or injection. Postoperative pain management may therefore be extremely challenging, especially after extensive abdominal procedures. Unfortunately, descriptions of alternate analgesic options for patients with variant angina who undergo large abdominal surgeries are virtually nonexistent in the literature. This case study describes the successful, nontriggering use of bilateral erector spinae plane (ESP) blocks as adjuncts in the analgesic treatment of a patient with variant angina undergoing large ventral hernia repair with component separation and open cholecystectomy. This case report adheres to the Enhancing the QUAlity and Transparency Of health Research (EQUATOR) guidelines, and written Health Insurance Portability and Accountability Act (HIPAA)-compliant authorization was obtained from the patient.

Case Report

The patient was a 68-year-old woman (167.5 cm, 87 kg) with a medical history significant for variant angina, hypertension, chronic renal disease, and hypothyroidism; she presented to the hospital with worsening abdominal pain. The diagnosis of variant angina had been made approximately 20 years prior as a result of an episode in which she experienced chest pain, "heart pounding," palpitations, anterior neck discomfort, and difficulty breathing and after undergoing a cardiac catheterization for the same. In addition, she had a history of multiple abdominal surgeries secondary to small bowel obstruction and diverticulitis. On admission, she was found to have an incarcerated

incisional hernia and was scheduled for an exploratory laparotomy, ventral hernia repair with component separation, and open cholecystectomy.

Given the urgent nature of the case, the patient was interviewed by the anesthesia team shortly before being taken to the operating room. Many of her previous abdominal surgeries had occurred over a span of several years and at outside institutions; unfortunately, whether she had experienced symptomatic perioperative CAS with these procedures is not fully known. She was aware that she had, at a minimum, received general anesthesia (it was unclear whether regional anesthesia had been used, as well) and denied having issues with any prior anesthetics. She did assure clinicians that her variant angina was well controlled with daily extended-release diltiazem and that she was infrequently experiencing symptoms of CAS.

As the planned surgery was extensive, bilateral ESP catheters were placed preoperatively for analgesia. To perform the blocks, standard monitors (as recommended by the American Society of Anesthesiologists) and supplemental oxygen administered via nasal cannula were placed on the patient. A timeout was then completed, followed by premedication with 50 μg fentanyl and 1 mg midazolam. The patient was placed in the prone position, prepped, and draped. The right T7 transverse process and erector spinae muscle were identified using a high-frequency linear ultrasound probe in the longitudinal plane. An 18G needle was advanced in the cephalocaudal direction toward the transverse process (TP), which was used as a backstop during injection of local anesthetic between the TP and the erector spinae muscle. Then, 12.5 mL 0.5% ropivacaine was injected (Fig. 1) and a 20G nonstimulating catheter was threaded at the site. This process was then repeated on the left side.

Before surgery, the patient received her usual dose of 240 mg extended-release diltiazem for management of variant angina, as well as an additional 2 mg midazolam. She was induced with 100 mg lidocaine, 200 μg fentanyl, 170 mg propofol, and 50 mg rocuronium. The patient was intubated uneventfully, and no abrupt hemodynamic or electrocardiographic (ECG) changes were noted throughout this period. She then underwent the approximately 4-hour surgery without complications. Intraoperatively, she did not demonstrate any additional analgesic requirement for the duration of the procedure. She ultimately received an additional 50 μg fentanyl (after extubation) as well as a total of 32 μg dexmedetomidine shortly before emergence. She was transferred to the postanesthesia care unit (PACU) in stable condition and received a total of 1 mg hydromorphone for the duration of her stay there.

In the PACU, the patient began to report severe abdominal pain, although she had difficulty quantifying it on a numeric scale. A sensory level was assessed to cold/pinprick and was found to extend from approximately T10 to L1. Boluses of 10 mL 0.5% ropivacaine were administered bilaterally, with extension of her level to T6 and T7. Postbolus, she stated that her pain was "almost gone," and she appeared markedly less distressed. Five-milliliter pump boluses were then given bilaterally before initiating infusions of 0.125% bupivacaine at 14 mL/hour. The patient was reassessed approximately 4 hours later and again complained of moderate pain. At that time, she was found to have a T10 level to cold. She was given an additional 10 mL 0.5% ropivacaine bilaterally, again with substantial reported improvement in pain to "mild," per her description. She was also started on hydromorphone patient-controlled analgesia (PCA) with settings of 0.1 mg every 10 minutes with a 1-hour limit of 0.6 mg. Later that evening and again the next morning, she was reassessed and her level was found to be T5 to T6 with a pain score of 2 or 3 out of 10. Her PCA use over the first 48 postoperative hours totaled 13.6 mg hydromorphone, with a notable pattern of increased demands as the time interval from receipt of catheter boluses lengthened. On postoperative day 5, the ESP catheters were removed. Throughout this time, she did not receive any additional adjunctive pain medications apart from PCA requests. After the catheters were removed, the hydromorphone PCA was discontinued and the patient was transitioned to oral pain medications, which included oxycodone and acetaminophen as needed. On postoperative day 6, she was discharged home. Because she remained asymptomatic throughout this time, a postoperative ECG was not performed.

Discussion

In patients with variant angina, CAS may be precipitated by a number of stimuli. These include physiologic alterations (circadian variation in autonomic tone, Valsalva maneuver, stress, magnesium deficiency) as well as environmental exposures and/or medications, ranging from tobacco, alcohol, and recreational marijuana to sympathomimetics, anticholinesterases, chemotherapeutic agents, β-blockers, and antimigraine medications, among others.[8-10]

Although the overall incidence of CAS events occurring in the perioperative period is unknown, several case reports describing CAS resulting from anesthesia (both general and neuraxial) have been published.[3-7] Major adverse outcomes have included myocardial infarction, severe hypotension, malignant cardiac arrhythmias, and even death.[7] Arrhythmias—including both tachyarrhythmias and bradyarrhythmias—may be related to the episode duration and degree of specific

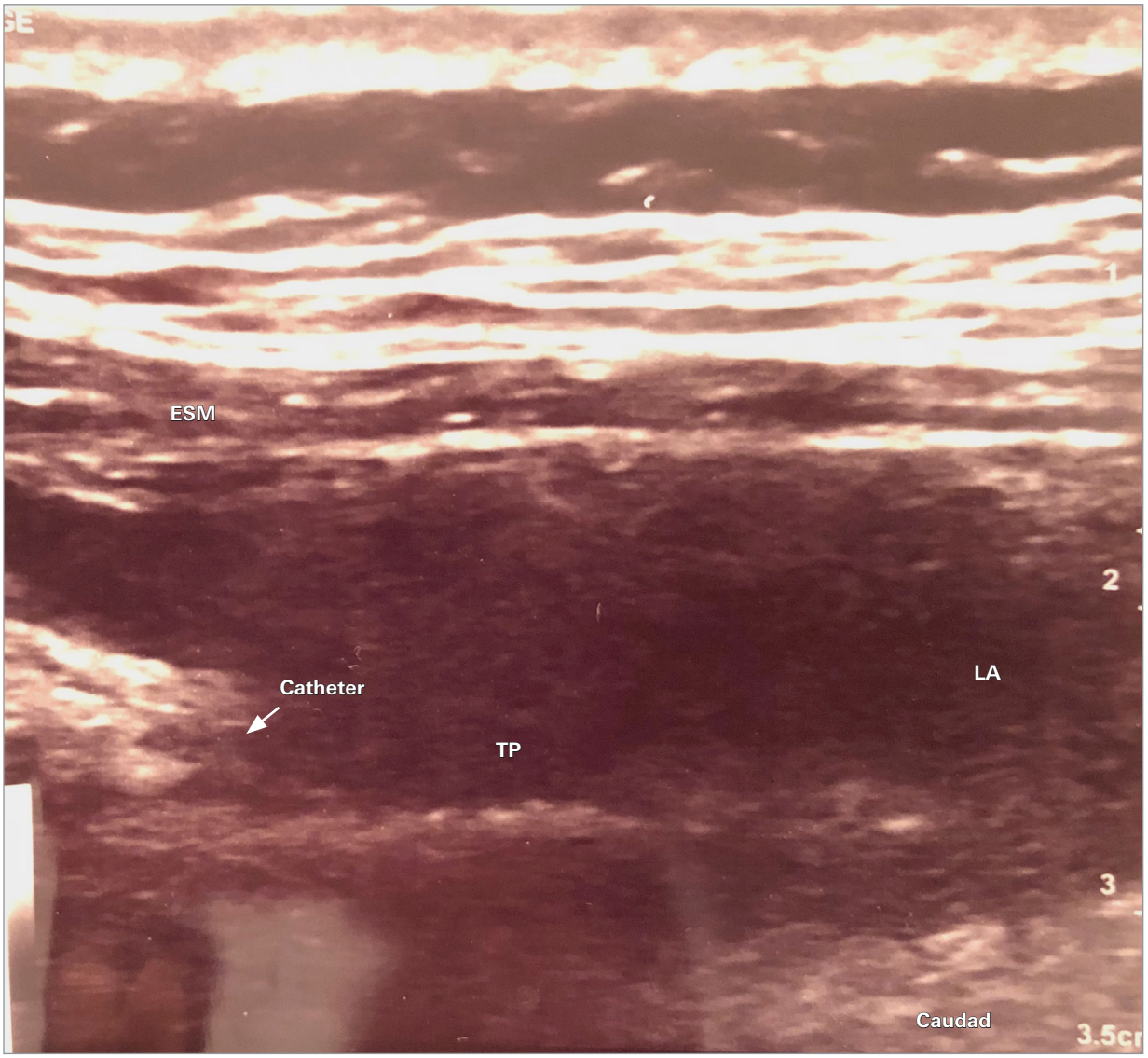

Fig. 1 *Ultrasound image of catheter placed during erector spinae plane block in sagittal plane.*

ESM, erector spinae muscle; LA, local anesthetic; TP, transverse process.

ECG changes.[8] Thus, awareness of the diagnosis, rapid implementation of effective treatment if necessary (in the form of short-acting nitrates and/or calcium channel blockers) and, perhaps most importantly, avoidance of vasoconstrictive stimuli are paramount in the treatment of these patients.[11,12]

This management strategy closely parallels the approach to chronic management of variant angina, for which avoidance of CAS triggers and lifestyle/risk factor modifications (eg, smoking cessation, alcohol avoidance) constitute a major component of symptom control. Suppressive therapy with long-acting calcium channel blockers and/or long-acting nitrates as a second-line medication represent the mainstays of medical therapy.[8] As was previously mentioned, the patient's symptoms in this case were well controlled on a long-acting calcium channel blocker regimen, which was continued uninterrupted throughout the perioperative period. This is consistent with the few published recommendations for preoperative management vasospastic angina, most of which are derived from case reports.[13] Notably, even with chronically well-managed vasospastic angina, the frequency of CAS events may vary dramatically, with the incidence of recurrent symptomatic episodes ranging from days to months to years[10] and, in 1 description, emerging perioperatively after 5 years of well-controlled symptoms.[13]

Thus, given the range of potential physiologic triggers, prevention of perioperative CAS mandates avoidance of a wide range of stimuli and medications common in this period. These include physical/mental stress, cold, Valsalva maneuver, and hyperventilation. Pain itself may induce sympathetic activation.

Common analgesics, such as morphine, are among the many medications that may trigger spasm.[10,14] This, combined with the possibility of inducing spasm via neuraxial analgesic methods, renders postoperative pain management extremely difficult.

ESP catheters were placed for several reasons. The primary goal was to provide enhanced analgesia while limiting the need for CAS-triggering medications. Although a thoracic epidural would perhaps have been a more traditional choice, multiple cases of CAS resulting from epidural catheter placement and/or injections have been described.[3,5,7] Purported mechanisms include either excessive parasympathetic activity in sensitized coronary vasculature or a compensatory sympathetic response above the level of the block. Paravertebral nerve blocks were rejected because of the likelihood of requiring multiple catheters to cover the extent of the incision. Abdominal fascial plane blocks were deemed unlikely to provide sufficient coverage. Specifically, those that were considered for this procedure included quadratus lumborum (QL) blocks and transversus abdominus plane (TAP) blocks. Although multiple studies have demonstrated the efficacy of QL blocks for a wide range of abdominal procedures, the extent of dermatomal coverage is somewhat variable, with the majority of evidence pointing to consistent coverage of the T10-L3 dermatomes.[15] This was deemed likely to be insufficient for the proposed extent of the incision and intra-abdominal manipulation (ultimately, epigastrium to supraumbilical region). Alternatively, multiple reviews have now documented substantial variability in the dermatomal coverage and quality of postoperative analgesia provided by traditional TAP blocks.[16-18] This, along with the likelihood of the need for multiple injections given the proposed extent of the incision (ie, subcostal as well as lateral TAPs) and the lack of prolonged analgesia with single injections and encroachment into the surgical field with placement of catheters, further influenced clinicians' decision not to use TAP or QL blocks.

Erector spinae plane catheters therefore appeared to be an ideal option given prior reports of extensive spread and apparently minimal effect on either the sympathetic or parasympathetic nervous systems.[19,20] Although there has been some controversy related to their mechanism of action—including recent cadaver/imaging studies that have indicated that the effects of ESPs may be caused at least in part to epidural spread—currently available evidence suggests that even if this is the case, the concentration of local anesthetic within the epidural space is comparatively low and would not be expected to affect the sympathetic/parasympathetic nervous system to the same extent that an epidural injection would.[21]

Erector spinae plane catheters, combined with the patient's hydromorphone PCA, provided acceptable analgesic coverage in the immediate perioperative period. The patient had minimal intraoperative opioid requirements despite a large incision and extensive intra-abdominal manipulation. While in the PACU, she did report pain once awake; however, this was likely a result of block regression and almost immediately improved with rescue boluses. Although she ultimately required supplementation via PCA, it is believed that this, again, was because of block regression between supplemental boluses. This was demonstrated by her decreased PCA requests in the several hours immediately following catheter boluses, followed by gradually increasing usage. This requirement for intermittent boluses (and possible superiority to continuous infusions) with ESP blocks has been demonstrated in other reports,[19,22] but to date, no randomized controlled trials have been conducted on optimal dosing regimens. Finally, and most importantly, she did not demonstrate any adverse effects from the blocks, nor was there any evidence of perioperative CAS or other adverse cardiovascular events.

In summary, given the physiology associated with variant angina, this patient presented a challenge in regard to her perioperative pain management. This report demonstrates that performing continuous ESP blocks may be an acceptable method of providing postoperative analgesia with a limited risk profile; unfortunately, the rarity of this condition renders true randomized controlled trials on this subject exceptionally difficult. In this case, ESPs could not be used as a sole method of providing postoperative pain control, and this may be because of a number of factors, including a relatively low initial injection volume and the patient's apparent requirement for intermittent large-volume boluses. This should not preclude the use of ESPs as a primary or sole analgesic, as has been demonstrated in multiple case reports.[23,24] From a CAS standpoint, these nerve blocks may be considered for use as a potentially safer alternative to epidural analgesia in similar cases for patients with variant angina, although this is a matter that would benefit from further study.

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