

Bilateral continuous thoracic paravertebral block for chronic pancreatitis pain management

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Abstract

Thoracic paravertebral (TPV) block is a technique that has been shown to be effective for both the prevention and treatment of chronic pain. We report the case of a 42-year-old man with persistent chronic postoperative pain due to a pancreatic pseudocyst. Chronic pancreatitis is characterized by altered pancreatic innervation and neuronal remodeling. This phenomenon leads to chronic and neuropathic pain, which persists for years even in the absence of nociceptive stimuli. Laparoscopic surgical drainage is the method of choice for the treatment of pseudocysts of the pancreas. Despite laparoscopic gastropancreatic surgery for the removal of the

pseudocyst, the patient continued to report persistent pain. We describe our experience with a continuous TPV block, which resulted in complete pain resolution.

Introduction

Pain mechanisms in chronic pancreatitis are complex, and although driven by pancreatic damage, they also involve changes in nociceptive function and central pain perception.¹

The pancreatic afferents were equally distributed between right and left spinal ganglia; however, the innervation from the left nodose ganglia (NG) was significantly greater than from the right. For both spinal and vagal afferents, there was significantly greater innervation of the pancreatic head relative to the tail.

The pancreatic neural innervation network is composed of different types of nerve fibers, including spinal and vagal sensory afferent fibers, autonomic fibers divided into a sympathetic and a parasympathetic branch, fibers from the enteric nervous system (ENS), and intrapancreatic ganglia.^{1,2}

Both spinal and vagal pathways are responsible for releasing the tissue information to the central nervous system (CNS) and regulating pancreatic functions and homeostasis through neuropeptides. Spinal and vagal sensory afferent fibers consist of small-diameter Aδ or C fibers that originate from the pseudounipolar neurons in the dorsal root ganglia (DRG) and thoracic 6 (T6)-lumbar 2 (L2) segmental levels of the spinal cord and the pseudounipolar sensory neurons in the bilateral NG, respectively.^{1,3}

Laparoscopic surgery with drainage is considered a valid therapeutic alternative to large pseudocysts of the pancreas with chronic pain, with a success rate of around 94%, pain resolution, and a low complication rate.⁴ However, chronic pain, whatever its location, pancreatic or other, regardless of the inflammatory, nociceptive, or neuropathic characteristics, can lead to a remodeling in the CNS and become persistent even in the absence of the stimuli.^{5,6} Bilateral thoracic paravertebral (TPV) block is a regional anesthesia technique that produces a bilateral somatic and sympathetic nerve block with high-quality analgesic power and has been shown to be effective for both the prevention and treatment of chronic pain.^{7,8}

Case Report

We describe the use of a bilateral continuous TPV block with a catheter for the management of persistent pancreatic chronic pain despite the laparoscopic cystogastrostomy surgery.

In January 2020, a 42-year-old man, weighing 65 kg and measuring 170 cm in height, was admitted to our Internal Medicine

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Department with severe epigastric pain, persistent with irradiation in the left hypochondrium and in the back.

The patient, with a history of alcoholism, had suffered from chronic pancreatitis with epigastric pain that had been radiating in the left hypochondrium for more than six years.

Abdominal ultrasound, computed tomography (CT), and magnetic resonance imaging highlighted the presence of a single pseudo-cystic intraparenchymal lesion of the body and tail of the pancreas, with axial diameters from 85-80 mm to 75-80 mm, not communicating with the Wirsung canal, which compressed the back surface of the stomach.

For the control of pain, which was constantly referred to as Numerical Rating Scale (NRS) 7-8, the patient had used oxycodone 40 mg twice a day without significant benefits.

In 2018, the patient was treated with an endoscopic procedure with alcoholization of the celiac plexus without long-term success in managing pain.

In 2019, due to the persistence of symptoms, the patient underwent intraperitoneal cystogastrostomy by laparoscopy with drainage and cholecystectomy.

Six months after surgery, the patient again reported this epigastric pain that radiated to the left hypochondrium and back intermittently during the day, with an NRS of 7-8.

Subsequently, any follow-up CT of the abdomen did not reveal any recurrence of the pseudocyst, and gastroscopy excluded a gastric and duodenal ulcer.

The persistence of pain and the lack of response to drug therapy required hospitalization in our internal medicine department. Platelet count was $80,000 \mu/\text{mm}^3$ and the comprehensive coagulation profile was normal.

After obtaining the patient's informed consent, we decided to perform an ultrasound-guided bilateral TPV block with positioning of a catheter at thoracic levels T4-T5 on the left and T5-T6 on the right. The procedure was carried out under sterile conditions with the patient in a seated position. No contraindications to the TPV block were present. Heart rate, non-invasive arterial pressure, peripheral oxygen saturation, and respiratory rate were monitored.

The paravertebral space was identified using a high-frequency ultrasound linear probe with a paramedian sagittal approach, with the upper part of the transducer tilted slightly obliquely medially in the sagittal axis; the transverse process, costotransverse ligament, and pleura were observed. An 18-G needle was inserted using the "in-plane technique" and advanced under the costotransverse ligament. The correct position of the needle in the paravertebral space was confirmed by injecting 3 mL of saline solution, resulting in a lowering of the pleura, and a multi-orifice catheter (a Pajunk Sonolong Curl Echo catheter, PAJUNK GmbH Medizintechnologie, Geisingen, Germany) with a closed distal tip and three distal holes from the tip at 1.5 cm was inserted. After tunneling for 3 cm and fixing the catheters to the skin, 7 mL of 1% lidocaine were administered immediately on each side.

Through a patient-controlled analgesia pump (CADD-Solis, Smith Medical ASD, Minneapolis, USA), intermittent boluses of 7 mL of 0.375% levobupivacaine were administered bilaterally every 12 hours for 72 hours with NRS control at 1, 6, 12, 24, 48, and 72 hours, with total pain relief from the first hour. Furthermore, heart rate, blood pressure, peripheral blood oxygen, and respiratory rate were monitored throughout the hospitalization period, without complications.

We continued treatment with oxycodone 40 mg 2/day. We removed the catheter after 6 days, and the pain remained well controlled with only two extra boluses of 7 mL of 0.375% levobupivacaine needed (on the fourth and fifth day, NRS of 4).

The day after catheter removal, on the seventh day, the patient

was discharged with the following home drug therapy: oxycodone 30 mg 2/day.

At 1, 3, 6, 8, and 10 months of follow-up, the patient did not report any pain and reported a good quality of sleep and life. Oxycodone was tapered and suspended four months after discharge from the hospital.

Discussion

Chronic pancreatitis is an irreversible disease that damages the pancreas, leading to long-term pain and other symptoms, and remains refractory to effective treatment in many cases, which is associated with reduced quality of life. Opioid dependence can be a particular problem in these patients.⁹

This condition represents a persistent peripheral nociceptive input that evolves into central neuroplastic changes, resulting in CNS sensitization and chronic pain, which can persist even in the absence of the initial trigger. Chronic pain may present with disproportionate intensity relative to the original lesion and is often associated with a significant psychological impact on the patient's daily life.^{10,11}

Hutchins *et al.*¹² conducted a randomized controlled trial comparing TPV block with thoracic epidural analgesia in patients undergoing open pancreatic surgery. Their findings showed that paravertebral block provided comparable pain control to epidural analgesia during the first five postoperative days, with no significant differences in hospital length of stay or the incidence of nausea and vomiting. However, paravertebral block was associated with fewer technique-related adverse events ($p=0.02$), suggesting a superior safety profile compared to thoracic epidural analgesia.

These results support the hypothesis that paravertebral block could serve as a viable alternative for analgesia in pancreatic surgery, reducing risks associated with epidural analgesia, such as hypotension and urinary retention. Additionally, ultrasound-guided catheter placement could improve the reliability of the technique and further minimize complications. While Hutchins *et al.* found that paravertebral block did not significantly reduce opioid consumption compared to epidural, other studies suggest that this technique may contribute to lowering opioid requirements.¹³

Indeed, Han Y *et al.* published the first randomized trial evaluating the analgesic efficacy and safety of bilateral ultrasound-guided TPV block in pancreatic cancer resection. This controlled trial enrolled 153 patients, of whom 119 were analyzed. The TPV block group received the block in combination with general anesthesia, whereas the control group underwent general anesthesia alone. Results showed that the TPV block group required significantly lower doses of sufentanil perioperatively and intraoperatively. Pain scores, complication rates, and postoperative opioid use were comparable between groups.

Additionally, higher IL-10 levels were observed in the TPV block group, suggesting a potential anti-inflammatory benefit. The study concludes that paravertebral block can reduce opioid consumption by 45% in pancreatic surgery, offering a promising alternative analgesic strategy. Furthermore, the study raises the possibility that IL-10, a potent immune mediator with anti-inflammatory properties, may play a preventive role in the development of chronic pain. However, further research is needed to confirm this hypothesis.

Paravertebral block has also been shown to be effective in the treatment of chronic post-thoracotomy pain.¹³ The sensory afferent fibers of the vagus nerve originating from the pseudounipolar sensory neurons in the bilateral NG (the inferior ganglia of the vagus nerve) are either small-diameter myelinated A δ or unmyelinated C

fibers. The afferent fibers travel with efferent fibers, contribute to the celiac plexus, and continue to follow blood vessels to reach the pancreas.³ In patients with unilateral complex regional pain syndrome (CRPS), TPV block has demonstrated superiority over stellate ganglion block (SGB). In a prospective, randomized crossover trial, Kim *et al.*⁷ reported superior clinical outcomes with T2 TPV block compared to SGB, including greater sympatholytic effect, greater immediate pain reduction post-procedure, longer duration of effect, and higher subjective patient satisfaction.

Wayne-Bossert *et al.*¹⁴ also discussed interventional options for refractory cancer pain, citing paravertebral block for persistent post-surgical pain, particularly after breast cancer surgery.

To date, paravertebral block has never been specifically studied for chronic pancreatitis pain management. However, a review by Richardson *et al.*⁸ highlighted the efficacy of bilateral TPV block for chronic pain conditions. Their analysis of 12 studies involving 538 patients demonstrated that TPV block can provide effective analgesia for thoracic, abdominal, and pelvic surgeries, in some cases eliminating the need for general anesthesia. Additionally, TPV block has been utilized for persistent postoperative pain and neuropathic pain, with low complication rates such as pneumothorax and hypotension.

In the review by Kulesza *et al.*,¹⁵ paravertebral block is also suggested as a possible strategy for other types of chronic pain, including herpes zoster pain and rib fractures. Its mechanism of action involves blocking both somatic and sympathetic nerve fibers, thereby reducing peripheral and central sensitization, two key factors in pain chronification.

A recent case report¹⁶ described the use of a continuous TPV block in a 41-year-old woman with recurrent acute pancreatitis. The patient, previously managed with celiac plexus blocks and oxycodone, was admitted with severe abdominal pain; initial opioid treatment provided limited relief. However, after a left-sided T12-L1 paravertebral single-shot injection and catheter placement for continuous Marcaine infusion, the patient experienced immediate and sustained pain relief. She required no additional opioids during the catheter infusion and was discharged on hospital day six. This case highlights the potential of the TPV block as an effective analgesic technique in pancreatitis-related pain management. In our experience, no complications were observed, except for moderate hypotension occurring 30 minutes after each administration of local anesthetic, which resolved quickly without intervention.

The prolonged analgesic effect of the TPV block, achieved through the continuous administration of a long-acting local anesthetic, provided complete pain relief for one week during the treatment period. Drawing upon our experience, we propose that this “inflammatory rest” may have facilitated neuroplastic reorganization within the CNS, potentially contributing to long-term pain relief.

One year after the treatment, the patient was contacted every three months for follow-up assessments and consistently reported no residual pain and a significant improvement in quality of life.

Laparoscopic gastro-pancreatic cystostomy is considered a valid therapeutic alternative for large pancreatic pseudocysts. However, in this case, the patient continued to experience chronic and neuropathic pain despite the procedure.

The implementation of a bilateral ultrasound-guided continuous TPV block resulted in complete resolution of chronic pancreatic pain in our patient for 10 months and pain relief for almost 1 year. Integrating pharmacological and non-pharmacological interventions and collaborating with a multidisciplinary team are key components of effective chronic pancreatitis pain management.

In 2022, our patient underwent a pulsed radiofrequency procedure at a specialized interventional pain center.¹⁷

Conclusions

The management of chronic pancreatitis pain is complex and requires a multimodal, multidisciplinary approach that integrates both pharmacological and non-pharmacological interventions. Our experience suggests that continuous ultrasound-guided bilateral TPV block may represent an interesting therapeutic alternative for chronic pancreatitis, provide effective analgesia, and improve the quality of life of this patient for ten months. New pain management strategies also include radiofrequency, which represents a promising step and technique for chronic pancreatitis.

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