



Interventional anesthesia and palliative care collaboration to manage cancer pain: a narrative review

Compte rendu narratif d'une collaboration entre les services d'anesthésie interventionnelle et de soins palliatifs pour prendre en charge la douleur cancéreuse

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Abstract Pain is a common symptom associated with advanced cancer. An estimated 66.4% of people with advanced cancer experience pain from their disease or treatment. Pain management is an essential component of palliative care. Opioids and adjuvant therapies are the mainstay of cancer pain management. Nevertheless, a proportion of patients may experience complex pain that is not responsive to conventional analgesia. Interventional analgesia procedures may be appropriate and necessary to manage complex, cancer-related pain. This narrative

review uses a theoretical case to highlight core principles of palliative care and interventional anesthesia, and the importance of collaborative, interdisciplinary care. An overview and discussion of pragmatic considerations of peripheral nervous system interventional analgesic procedures and neuraxial analgesia infusions are provided.

Résumé La douleur est un symptôme courant associé aux cancers de stade avancé. On estime que 66,4 % des personnes atteintes d'un cancer de stade avancé souffrent de douleurs liées à leur maladie ou à leur traitement. La prise en charge de la douleur est une composante essentielle des soins palliatifs. Les opioïdes et traitements adjuvants sont les piliers de la prise en charge de la douleur cancéreuse. Toutefois, certains patients pourraient souffrir de douleurs complexes qui ne répondent pas à l'analgésie conventionnelle. Les procédures d'analgésie interventionnelle pourraient être adaptées et nécessaires pour prendre en charge des douleurs complexes liées au cancer. Ce compte rendu narratif se sert d'un cas théorique pour souligner les principes clés des soins palliatifs et de l'anesthésie interventionnelle, ainsi que l'importance de soins collaboratifs et interdisciplinaires. Nous présentons une vue d'ensemble et une discussion des considérations pragmatiques pour la réalisation de procédures analgésiques interventionnelles au niveau du système nerveux périphérique et des perfusions d'analgésie neuraxiale.

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Palliative care was established in Canada in the 1970s, and is now a recognized field with national organizations,

established principles, and norms of practices.^{1–4} The World Health Organization (WHO) defines palliative care as “an approach that improves the quality of life of patients and their families facing the problem[s] associated with life-threatening illness, through the prevention and relief of suffering by means of early identification and impeccable assessment and treatment of pain and other problems, physical, psychosocial and spiritual”.⁵ Originally, palliative care focused on end-of-life care for patients, but today, palliative care involvement in oncology can range from days to years; palliative services can now be integrated early on, and mortality has declined because of significant improvements in cancer treatments.^{6–9} Different pain management strategies are needed to support people in different phases of their disease journeys. Increasingly, anesthesia and palliative medicine specialists are collaborating to improve the quality of living and dying for people with life-limiting illnesses.

Pain is a common distressing symptom associated with cancer.^{10,11} Of those living with cancer, 38% will experience moderate to severe pain that will negatively impact their lives, and almost 32% will have undertreated pain.^{11,12} Typically, the frequency and intensity of cancer-related pain increases as disease progresses.¹³ An estimated 66% of people with advanced cancer will experience pain from their disease and/or its treatment.¹¹ The total pain experience is a result of the underlying mechanism of pain (nociceptive and/or neuropathic) influenced by the presence of incident pain, psychological distress, addictive behavior, and cognitive impairment.^{14,15}

Since 1986, the WHO Cancer Pain Ladder for Adults has served as a framework for the treatment of cancer-related pain. Their three-step approach recommends initial pain management with “non-opioids”, followed by “mild opioids” (e.g., codeine) for mild to moderate pain, and lastly “strong opioids” (e.g., morphine) for moderate to severe pain.^{16,17} Adjuvant medications should be considered at all steps to “calm fears and anxiety” with the goal being “freedom from cancer pain.” The WHO claims this approach effectively manages 80–90% of cancer pain.¹⁶

Interventional pain management strategies are increasingly being explored to assist with complex cancer-related pain. Historically, they have been reserved as “last resort options” for patients where the three-step WHO approach has failed.^{18–20} There is, however, growing evidence that early access to interventional analgesia can significantly decrease pain scores and improve overall quality of life.^{20–22} The current opioid crisis further highlights the importance of incorporating novel pain management strategies. More than 10,000 apparent opioid-related deaths occurred between January 2016 and September 2018.²³ Approximately 25% of these deaths

are attributed to non-fentanyl related opioids including common prescription opioids, such as codeine and morphine.²³ Interventional pain techniques can decrease opioid consumption and adverse effects. Whether it is early or late in the disease process, the role for interventions should be considered when conventional analgesics do not offer adequate pain relief or result in side effects that are intolerable.

This narrative review will present a theoretical patient case that shows how collaborative, interdisciplinary care can be used to manage complex cancer-related pain. A discussion is interwoven into the case to highlight key features of palliative care and interventional pain management strategies within the context of life-threatening illnesses. This review will address the more common interventional techniques available to patients suffering from cancer-related pain, with a focus on sympathetic nerve blocks and neuraxial analgesia infusions.

Case: Introduction to Ms. Jane Doe

Ms. Jane Doe is a 70-yr-old previously healthy woman who presents to the emergency department with severe abdominal pain. This pain was present for the last six months but significantly worsened in the last week. Computerized tomography (CT) scans of her abdomen and pelvis reveals a 5 x 5 cm mass associated with enlarged regional lymph nodes and invasion into her pelvic wall, bladder, and rectum. There is no clinical or radiological evidence of hydronephrosis, bladder outlet obstruction, or bowel obstruction. She is subsequently admitted to hospital and further investigations confirm a diagnosis of stage IVa T4N1M0 squamous cell cervical cancer.

Given the locally advanced nature of her disease, the oncology team offers palliative chemotherapy or the option of enrolling in a clinical trial. Ms. Doe makes an informed decision to forgo chemotherapy and instead to focus on a comfort-measures approach to her care. She does not want cardiopulmonary resuscitation if she becomes medically unstable. Her current goal is to return home but her severe abdominal pain is not well controlled. Therefore, Ms. Doe is transferred to the cancer centre’s acute palliative care unit (APCU) for pain and symptom management.

Ms. Doe reports experiencing a deep, constant ache in her pelvis. On average, she rates her pain as 10 in the last 24 hr, where 10 is the worst possible rating on the numerical rating scale for pain.²⁴ This pain prevents her from interacting with her loved ones during the day and disrupts her sleep. She is now mainly bed-bound because of the severe pain. The APCU team identifies that because of

her severe symptoms, Ms. Doe is experiencing significant psychological distress, loss of function, and that her new advanced diagnosis is contributing to her pain experience and overall reported poor quality of life. Spiritual care, music therapy, and the clinical team (nursing and physicians) therefore become involved to provide support and alleviate Ms. Doe's distress.

Discussion: levels of palliative care

A palliative approach of care can be integrated at any time in a patient's illness trajectory, including in the existing care that patients and their families are receiving.^{6,25} This approach reinforces a patient's autonomy and right to receive medical care that is aligned with their values and goals of care. Therapeutic interventions are provided to manage pain, other physical symptoms, and psychosocial distress. The ultimate goal is to improve a patient's self-defined quality of life.^{5,26}

Palliative care can be provided by primary-level healthcare professionals (e.g., oncology physicians and nurses).²⁷ Nevertheless, there may be instances where the primary team will consult with palliative care professionals in outpatient or inpatient settings to manage complex symptoms, and assist with goals of care discussions and end-of-life planning.^{25,28,29} Typically, a shared model of care is used where palliative care involvement is initiated at the request of the primary team and recommendations are then provided.³⁰ As a patient's disease progresses and associated symptoms worsen, palliative care teams may assume the role of the primary care team.²⁷

Palliative care can be provided in all care settings including home, hospitals, long-term care facilities, specialized palliative care units (PCU), and hospices.^{28,31,32} Within some hospitals, there may be an APCU where patients with complex symptom management needs can be addressed.³¹ Novel and potentially medically active interventions (e.g., interventional analgesia procedures) can be performed on patients admitted to these inpatient units. Lengths of stay are often short (less than two weeks), and patients may have multiple admissions over the course of their illness.^{31,33} These APCUs differ from other end-of-life PCUs located in tertiary hospitals, complex continuing care facilities, long-term care homes, and hospices. Traditionally, PCUs and hospices provide comfort-focused care to support patients and their families as their disease progresses towards end-of-life. Active medical investigations and interventions (e.g., regular blood work, imaging) are not typically provided in these facilities.³⁴

Case: Ms. Jane Doe's initial pain management

When Ms. Doe arrives on the APCU, a comprehensive physical examination reveals that she has tenderness with palpation of her bilateral lower abdominal quadrants. There are adequate bowel sounds, and no evidence of abdominal distension, palpable masses, rebound tenderness, or guarding.

Based on the location of her disease, pain description, and physical examination findings, the APCU team diagnoses her with primarily visceral nociceptive pain secondary to her pelvic mass. Prior to the APCU admission, Ms. Doe was receiving immediate-release hydromorphone on an as-needed basis, which usually reduced her pain from 10/10 to 8/10 within 30 min. Based on her morphine equivalent daily dose (MEDD), the attending physician changes her opioid regimen to a long-acting formulation of hydromorphone and increases her breakthrough hydromorphone dose. Despite these changes, however, Ms. Doe continues to report her pain is not well controlled with an average 24-hr rating of 6/10.

The anesthesia service is subsequently consulted to explore potential interventional pain management strategy options. Based on her medical history, and physical examination and imaging findings, a decision is made to provide a superior hypogastric plexus block. Ms. Doe undergoes a diagnostic fluoroscopic-guided superior hypogastric plexus block with local anesthetic that produces a favourable response; accordingly, she receives a neurolytic procedure with alcohol. Her pain is reduced by 50% to 3/10; and her breakthrough hydromorphone use decreases. She is discharged home with a prescription for immediate-release hydromorphone to be used if she has episodes of pain, and is also provided with community nursing and personal care support.

Discussion: Peripheral nervous system interventional analgesic procedures

One target for cancer pain interventions is the peripheral nervous system (somatic and visceral [autonomic] nervous systems),³⁵ which is involved in pain transmission through afferent pathways. A review of a patient's goals of care is crucial before proceeding as, although pain can be distressing, the serious adverse effects that could result from an interventional analgesia procedure may similarly be unbearable to a patient. Trial procedures using local anesthetics can allow patients to temporarily experience the effects of the block and assist with decision-making before embarking on a more permanent pain solution.³⁶ If adequate pain relief is achieved and adverse effects are

acceptable to a patient, therapeutic procedures can then be performed to provide more sustained analgesia.

Prolonged therapeutic relief can be achieved by several means, including perineural steroid deposition, thermal coagulation with radiofrequency ablation, cryoablation, or chemical neurolysis (with alcohol or phenol).³⁷ When possible, catheters can be left in place with a continuous infusion of local anesthetic for short-term palliation of pain. Of these interventions, chemical neurolysis typically has the greatest potential for serious, irreversible adverse effects. Perineural administration of alcohol or phenol results in protein denaturation and subsequent neurolysis.³⁸ Chemical neurolysis can produce long-lasting effects with a duration of three to six months. Nevertheless, these chemicals may spread unpredictably and damage unintended structures, resulting in serious and irreversible adverse effects (e.g., loss of motor function).^{39,40} Furthermore, access to these neurolytic medications can be challenging in certain regions because of availability and cost.

The following is an overview of common peripheral and sympathetic nerve blocks that can be performed to relieve complex cancer-related pain:

Peripheral nerves: somatic pain

Peripheral nerves can be directly compromised by extension, compression, or invasion by the primary tumour or metastatic lesions. Peripheral nerve blocks can be used when somatic pain is limited to the distribution of a specific nerve(s) or plexi. Common interventional procedure targets are brachial and lumbosacral plexuses (and distal branches thereof), intercostal nerves, trigeminal nerve branches, and ilioinguinal and iliohypogastric nerves.³⁵ Patients should be made aware of the limitations and potential risks associated with neuroablative procedures of the peripheral structures, including ensuing motor deficits, deafferentation pain, incomplete pain relief, and duration of effect.⁴¹ A prognostic local anesthetic block can be performed prior to the ablative procedure.⁴² This allows the patient and the practitioner to understand the implications of permanent interruption of neural function.

Sympathetic nerves: visceral pain

Stretch, compression, and invasion of visceral structures in the head and neck, thorax, abdomen, pelvis, or perineal regions can result in pain that is often poorly localized.³⁹ Sympathetic nerve blocks can be provided to manage visceral pain; however, pain relief is often incomplete as pain syndromes are typically mixed (nociceptive and neuropathic).³⁷ The goal for these interventions should be

to minimize pain and related symptoms (e.g., nausea), as well as to maximize the effect and minimize the dose of oral analgesics.⁴³ Sympathetic nerve blocks are best viewed as adjuncts to pharmacologic therapy as although they provide some pain relief, they rarely eliminate opioid consumption.³⁷

Regional blocks of the celiac plexus and thoracic splanchnic nerve, superior hypogastric plexus, and ganglion impar can treat sympathetically mediated and visceral pain. Less common techniques not discussed in this review include the stellate ganglion and lumbar sympathetic blocks.

Celiac plexus and thoracic splanchnic nerve blocks

The blockade or ablation of the celiac plexus and thoracic splanchnic nerves can play a significant role in the management of upper gastrointestinal malignancies, most commonly pancreatic, gastric, or biliary cancer.⁴⁴ The celiac plexus is composed of two paired ganglia and lies in the retroperitoneal space anterior to the aorta and first lumbar vertebral body.⁴⁵ It receives sympathetic fibres from the thoracic splanchnic nerves (greater, lesser, and least splanchnic nerves), and parasympathetic fibres from the vagus nerve to innervate many gastrointestinal organs (including the liver, pancreas, gallbladder, kidneys, adrenals, small intestine, and part of the large bowel).³⁷

Both the celiac plexus and thoracic splanchnic nerves are possible targets for interventional analgesic procedures. A variety of techniques exist for accessing the nerves and can be performed using posterior or anterior approaches. Posterior approaches are the most common, and involve placing needles percutaneously under fluoroscopic or CT guidance to target the celiac plexus or thoracic splanchnic nerves.⁴⁴ Anterior approaches include endoscopic ultrasound-guided approaches, ultrasound- or CT-guided trans-abdominal approaches, and direct open surgical neurolysis.⁴⁶

Of all cancers, neurolysis of the celiac plexus with alcohol or phenol has been the most extensively studied in patients with pancreatic cancer. A 2011 Cochrane systematic review evaluated the role of the celiac plexus block compared with standard analgesic therapy in adults with pancreatic cancer and found significantly improved pain control at eight weeks as well as lower opioid consumption and opioid-related side effects.⁴⁴ Complications of these procedures include transient sequelae of sympathetic blockade (orthostatic hypotension and diarrhea), pneumothorax, intravascular injection, and nerve root injury.⁴⁷

There is growing interest in targeting the splanchnic nerves as an alternative to celiac plexus chemical neurolysis. Unlike the celiac plexus, the thoracic

TABLE Common medications for intrathecal use

Drug class	Medication	Recommended starting dose*	Maximum concentrations*	Maximum daily dose*
Opioid	Morphine	0.1–0.5 mg·day ⁻¹	20 mg·mL ⁻¹	15 mg
	Hydromorphone	0.01–0.15 mg·day ⁻¹	15 mg·mL ⁻¹	10 mg
	Fentanyl	25–75 µg·day ⁻¹	10 mg·mL ⁻¹	1000 µg
	Sufentanil	10–20 µg·day ⁻¹	5 mg·mL ⁻¹	500 µg
Conotoxin: N-type calcium channel blocker	Ziconotide	0.5–1.2 µg·day ⁻¹	100 µg·mL ⁻¹	19.2 µg
Amide anesthetic	Bupivacaine	0.01–4 mg·day ⁻¹	30 mg·mL ⁻¹	15–20 mg**
Alpha 2 adrenergic agonist	Clonidine	20–100 µg·day ⁻¹	1000 µg·mL ⁻¹	600 µg

*Recommended starting dose, maximum concentrations, and daily doses are recommended by the Polyanalgesic Consensus Conference 2012 and 2016.

**Bupivacaine dose may be higher in end-of-life care and complex pain management cases

splanchnic nerves exist in a well-defined region that is amenable to thermocoagulation using radiofrequency ablation.^{45,48} Although evidence is limited, potential advantages of thermocoagulation include a more reliable analgesic response due to the predictable location of the splanchnic nerves.⁴⁸ This intervention also avoids the risks associated with the unpredictable spread of neurolytic solution.⁴⁸

Superior hypogastric plexus

The superior hypogastric plexus block is a technique for managing pelvic visceral pain.³⁷ These nerve fibres are located bilaterally in the retroperitoneum, travelling over the ventral surface of the lower third of the fifth lumbar vertebral body to the upper third of the first sacral vertebral body.³⁷ The plexus provides innervation to many pelvic organs, including the descending colon, rectum, bladder, prostate, uterus, and internal genitalia.⁴⁹ Various approaches for this technique have been described, but the most common technique is a fluoroscopic-guided classic posterior or transdiscal approach (one- or two-needle).^{50–53} If significant improvement is achieved following a diagnostic block with local anesthetic, neurolysis with alcohol or phenol can be performed. In addition to pelvic pain, this technique has also been used to manage tenesmus in the palliative patient.^{38,54} Depending on the technique used, complications may include retroperitoneal hematoma, discitis (if utilizing a transdiscal approach), visceral injury, and damage to nerve roots.⁴⁷ Evidence regarding the efficacy of a superior hypogastric plexus block is limited, but it has been reported to provide effective pain relief and significantly reduce opioid requirements in more than 50% of patients.^{52,53}

Ganglion impar

The ganglion impar (also known as the ganglion of Walther) is located anterior to the sacrococcygeal junction.⁵⁵ It is the solitary, distal termination of the bilateral sympathetic chains. This ganglion innervates the distal rectum, anus, and perineum.⁵⁶ This block is typically performed under fluoroscopic guidance with a posterior approach.⁵⁶ Similar to the other blocks, diagnostic and subsequent neurolytic blocks with alcohol and phenol can be performed.⁵⁶ The primary indications are refractory anal and perineal pain in the context of pelvic cancer. Although evidence for this technique is limited, case reports documenting its efficacy have been published.^{37,52} Future high-quality research is needed to assess the role of neurolytic sympathetic nerve blocks in refractory or complex cancer pain management.

Case: Return and worsening of Ms. Jane Doe's pain

After Ms. Jane Doe is discharged home, she continues to receive palliative care through her cancer centre's outpatient palliative care clinic. After one month, Ms. Doe reports to her team that her pelvic pain has returned. She also now reports a burning, stabbing pain in her left anterior thigh. Her pain score is 9/10 on average in the last 24 hr. This pain and severe fatigue are severely affecting her functional status, so she is now mainly confined to her bed. A physical examination reveals left hip flexion and thigh adduction weakness. There is allodynia (pain with light touch) to her left anterior thigh. A subsequent diagnosis of mixed nociceptive and neuropathic pain is made. She is started on a controlled-release preparation of hydromorphone based on her average daily use of immediate-release hydromorphone and, given the

neuropathic features of her pain, she is also started on gabapentin.

Unfortunately, her pain continues to be severe despite titration of the hydromorphone and gabapentin over the next two weeks. An admission is organized to the APCU for investigation and management of her pain. Re-staging CT scans show significant disease progression with the tumour now measuring 10 x 8 cm with additional distant metastases to her lungs and liver. Bloodwork shows no evidence of hematologic, liver, or renal function impairment. Her life expectancy is now estimated to be months.

Ms. Doe's goals of care are reviewed given the changes in her disease and prognosis. She expresses that she is suffering from her pain and is open to any intervention that will reduce it. Therefore, the APCU team makes the decision to change her opioids to methadone. This opioid rotation provides some relief with her average daily pain rating decreasing to 5/10, but her persistent pain continues to be distressing. The interventional analgesia service is consulted and recommends a magnetic resonance imaging of the lumbar spine to investigate the neuropathic pain. The imaging clearly shows involvement of the lumbosacral plexus. There is no evidence of metastatic disease involving the spinal cord or brain. The APCU and interventional analgesia teams review pain management options with Ms. Doe, including ketamine and lidocaine bolus infusions. Ms. Doe reiterates that her priority is to be at home for as long as possible. Her preference is to receive pain management that can be continued and adjusted if needed in the community. Given her estimated prognosis is limited to several months, a decision is made with Ms. Doe to insert a percutaneous intrathecal catheter that will be connected to an external analgesia pump.

Discussion: neuraxial analgesia infusions

Neuraxial analgesia infusions involve medication administration into either the epidural or intrathecal space to manage refractory pain in patients with focal disease below the neck.⁵⁷ Comprehensive assessments and interdisciplinary collaboration are required to successfully provide this procedure.^{36,58} The site of analgesia delivery, infusion strategy, and medication choice depend on several important factors, including cancer type and stage, prognosis, and pain location and mechanism.⁵⁹ Absolute contraindications for this procedure include untreated sepsis, coagulopathy, impending spinal cord compression, epidural metastases, and elevated intracranial pressure.^{57,60} Specialty education, training, and resources (e.g., intrathecal catheter port-access needle) in the inpatient and community settings are needed to ensure that the teams

are competent and equipped to provide the necessary associated patient care.^{58,59} Centres with limited resources and access to palliative care and anesthesia services can encounter challenges with providing neuraxial analgesia infusions. Furthermore, given these procedures' invasive nature and potential for serious adverse effects, a review of all possible pain management options and the patient's goals of care are of utmost importance before considering this procedure.^{37,59,61} See Appendix A for training and resource recommendations and Appendix B for pre-procedure patient assessment recommendations.

There are three options for neuraxial analgesia infusions that can be delivered as continuous infusions with the option for patient-administered doses for breakthrough pain:

- 1) Percutaneous short-term catheter (epidural or intrathecal) connected to an external pump—*recommended for patients near the end of their life:*

Short-term catheters can be placed percutaneously into the epidural or intrathecal space, and tunnelled subcutaneously away from the insertion site to minimize the risk of infection.⁶² The external catheter is then connected to an ambulatory infusion pump for medication delivery. Advantages of this technique include ease of catheter placement, inexpensive equipment, and familiarity among healthcare providers who routinely manage percutaneous catheters for perioperative care. Disadvantages of this technique are that these catheters are prone to infection, migration, dislodgement, and that an external pump is required that will likely limit the patient's mobility.⁴⁷

Though these catheters can be inserted into the epidural space, intrathecal placement is usually preferred as there are fewer catheter-related issues (e.g., migration, catheter tip granulation), technical problems associated with epidural fibrosis,⁶³ and lower medication dose requirements.^{62,63} Nevertheless, both options carry the risk of infection in the central nervous system. Although there are data showing a similar rate of central nervous system infection with epidural and intrathecal catheters, an epidural catheter has the theoretical advantage of having the dura as a natural barrier to prevent spread to the spinal cord.^{62,63} Regardless of the catheter location, this technique is typically reserved for patients near the end of their life who require analgesia for a short period of time.

- 2) Subcutaneous intrathecal catheter and injection port connected to an external pump—*recommended for patients with a life expectancy of one to six months:*

Subcutaneous intrathecal catheters are placed percutaneously and tunnelled subcutaneously away from the insertion site. The catheter tip is then connected to an

access port that is placed in a subcutaneous pocket, commonly overlying the lower ribs. A special safety needle attached to an external pump is connected percutaneously into the port.⁵⁷ Advantages of this technique include lower incidence of skin and subcutaneous tissue infections, catheter dislodgement, and kinking.⁶³ Disadvantages of this technique include the expertise required to place the subcutaneous port, less familiarity with accessing ports, and a higher risk of infection compared with fully implanted systems.⁴³ Therefore, this option is typically reserved for patients with a life expectancy of approximately one to six months.⁵⁶

- 3) Subcutaneous intrathecal catheter with a fully implanted programmable infusion pump (also known as an “intrathecal drug delivery system” [IDDS])—*recommended for patients with a life expectancy of \geq six months:*

If patients have a life expectancy of more than six months, IDDS can be considered.⁶⁴ Commonly, a trial of intraspinal analgesia using a temporary intrathecal catheter or a single shot bolus is administered to determine efficacy before IDDS implantation.⁴³ The IDDS involves connecting a subcutaneous catheter to a pump and drug reservoir, which are also inserted subcutaneously in the abdominal wall.⁵⁷ The reservoir is accessed percutaneously through a port to change and refill medications. These reservoirs are refilled with medication monthly.⁶⁵ Although the initial cost of placement is high, maintenance costs are lower and can save costs compared with the hospital, pharmacy, and healthcare provider fees associated with oral and intravenous medication and related adverse effects.^{64,66,67} Despite the potential for an overall cost-saving when implanted in appropriate patients, availability is an ongoing challenge in many centres. In 2016, Health Quality Ontario recommended against the expansion of public funding for intrathecal drug delivery systems for those patients with refractory cancer-related pain.⁶⁸ Using IDDS is associated with a lower risk of infection, but the procedure is more invasive compared with percutaneous options, and specialized expertise are needed for placement and device management.⁴³

The main medications used for neuraxial analgesia infusions are preservative-free local anesthetics and opioids.^{57,59} Access to community pharmacies that are familiar with compounding sterile medications for neuraxial administration is critical. See the Table for information on common medications and dosages that can be delivered for intrathecal therapy.

Aside from analgesia infusions, other less common neuraxial procedures can be performed for pain management including intrathecal neurolysis,⁶⁹ vertebral

augmentation,⁷⁰ percutaneous cordotomy,⁷¹ and spinal cord and dorsal ganglion stimulation.⁷²

Case: Ms. Jane Doe’s neuraxial analgesia infusion procedure

The APCU and anesthesia team review Ms. Doe’s understanding of the procedure and overall goals of care. She is aware that the neuraxial analgesia infusion procedure is being offered to manage her severe pain and will not change her cancer disease trajectory. Prior to admission, Ms. Doe expressed a wish to not receive resuscitation or aggressive medical interventions if her clinical condition deteriorates. Nevertheless, given that acute, serious complications (e.g., catheter migration) may result from the procedure itself, and not her underlying disease, Ms. Doe agrees to temporarily reverse her code status to full resuscitation in case immediate post-procedure complications occur. Nevertheless, she is clear that her ultimate wish is to be comfortable and receive end-of-life care at home.

The interdisciplinary APCU team collaborates with Ms. Doe’s community team to develop a plan that will meet her care needs when she is discharged home. Team members that are involved in the discussion include Ms. Doe and her caregivers, anesthesiologist, outpatient palliative care physician, home visiting care coordinator and nurses, and community pharmacy. Education and training about the neuraxial analgesia infusion are provided and contingency plans in case complications arise are developed.

Once a satisfactory discharge plan has been developed, Ms. Doe receives the neuraxial analgesia infusion procedure. The catheter is inserted in the operating room under fluoroscopic guidance and tunneled subcutaneously away from the insertion site. The catheter tip is connected to an access port placed in a subcutaneous pocket under her left 12th rib. The external infusion pump is connected to the access port with the use of a non-coring safety needle. Ms. Doe recovers on the APCU for the next several days with monitoring of her vital signs, sensory and motor functions, pain, port site, bowel and bladder functions, tubing connection, and infusion pump settings and function. Fortunately, she does not have any complications, and her pain is reduced to 2–3/10. The team carefully titrate down her opioids under close observation by the clinical team of nurses and physicians. Ms. Doe is successfully discharged home with transfer of care to the community palliative and anesthesia colleagues.

Discussion: Interdisciplinary collaboration and pragmatic considerations for neuraxial analgesia infusions

Neuraxial analgesia infusions are useful procedures that can provide significant pain relief for patients with life-threatening illnesses. Before the procedure is offered, an exploration of a patient's goals of care is strongly recommended to confirm that interventional procedures and potential adverse effects are acceptable.⁶⁵ Patients should be aware that serious iatrogenic complications, such as catheter migration, can occur. Therefore, decisions about resuscitation (or code) status should be discussed in this context. Detailed and informed consent to proceed with the intervention is necessary and the patient's substitute decision makers and caregivers should ideally be involved. Though these interventional procedures are often considered "last resort options", patients need to be well enough to provide consent and undergo the procedure. Delirium is common on admission and during APCU admissions with prevalence reported at 43% and 70%, respectively.⁷³ We suggest considering interventional pain management strategies in conjunction with conventional pharmacologic strategies to manage complex cancer-related pain.

A large proportion of prescribed opioids are used for symptom management during palliative care.⁷⁴ A cohort study of Ontarians found 6.5% of 653,993 individuals were started on opioids for cancer and palliative care clinical indications in 2015–2016. The median starting daily dose was 38 mg and 30 mg MEDD for cancer and palliative care, respectively.⁷⁵ As patients deteriorate and approach their end-of-life, their mean opioid dose can be more than 300 mg MEDD, sometimes even greater than 1800 mg MEDD.⁷⁶ If an interventional procedure is successful, excessive sedation from the previously prescribed opioids may occur. Re-assessment and careful weaning of the opioids should be considered to managed opioid-related adverse effects and prevent withdrawal.

Neuraxial analgesia can address physical pain but will not relieve psychosocial distress. An interdisciplinary, collaborative team approach can help alleviate suffering and improve quality of life.⁷⁷ Typically, specialist palliative care teams contain psychologists, social workers, and chaplains in addition to physicians and nurses.⁷⁸ Furthermore, before neuraxial analgesia is provided, pre-emptive discharge planning, staff education, and assessment of available community resources should be performed. Patients and teams should be aware that end-of-life disposition options may be limited as most PCU and community palliative care teams will not be familiar with management of neuraxial infusions.^{58,65} Specialized training is required to ensure palliative care teams are competent and have the technical expertise to safely care for patients.^{58,59}

Maintaining this expertise can be challenging given the low percentage of patients who are candidates for the procedure.^{79,80} Access to necessary equipment and supplies, such as IDDS and medications, can also be limited and are a barrier to providing these procedures.

Ongoing collaboration between interventional anesthesia and palliative care are necessary to address the complex pain and other symptoms that patients may be facing. See the appendices for the training and resource recommendations, and for pre-procedure patient assessment recommendations. An interdisciplinary approach to contingency planning is especially important to ensure patients are well supported if complications arise.^{58,59} Reports of critical incidents have been published, including the accidental use of a patient's intrathecal access port for a central venous access line.⁸¹ Medical alert bracelets or necklaces about the neuraxis infusion line are recommended to inform first responders of the intervention.⁸¹

Conclusions

The concept of "total pain" was first described by Dame Cicely Saunders, the founder of the modern hospice movement; the distress that patients experience when faced with life-threatening illness is influenced by physical, emotional, social, and spiritual dimensions.⁸² Understanding patients' experiences, goals, values, and expectations of their medical care is the core of palliative care. Collaboration between anesthesia and palliative care can successfully address the complex pain that patients with advanced cancer face. Interventional pain management strategies can effectively manage physical pain, while the interdisciplinary care that palliative teams provide can address patient's psychosocial distress. Novel and innovative strategies are needed to achieve the best quality of life possible for patients with life-threatening illnesses.

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APPENDIX A Training and resource recommendations for neuraxial analgesia infusions

Training of palliative care unit and community teams, especially nurses, pharmacists, and physicians, in the following:

- Basic understanding of neuraxial procedures, indications and contraindications, and potential complications
- Typical medications prescribed and their doses and potential adverse effects
- Ambulatory infusion pump programming and troubleshooting (if applicable)
- Access to community compounding pharmacy for off-label intrathecal medications
- Specific nursing tasks include how to:**
 - Change the infusion tubing, cassette, medical bag, filter
 - Access the implanted port (if applicable)
 - Connection site (e.g., needle *in situ*, dressing, monitor for infection, leaking)
 - Document medication orders and patient use
 - Evaluate and document baseline and post-procedure patient vital signs, pain rating, sedation level, sensory and motor function, and any side effects (e.g., urinary retention)
 - Programming and troubleshooting the ambulatory infusion pump

Contingency planning

- Alternative analgesia plan if neuraxial analgesia fails or needs to be discontinued abruptly
- On call access to palliative care team to assist with pain and other symptom management in inpatient and community settings
- On call access to interventional anesthesia team in inpatient and community settings to assist with procedure-related issues
- Consider having a medical alert bracelet or necklace for patient to wear at all times to clearly indicate that the patient has an intrathecal catheter access port^A
- Collaboration with intensive care unit when patients are admitted to acute care
- Collaboration with first responders and emergency department when patients are in the community^A
- Documentation about device, medication orders, and team contact information in case patients need to seek acute medical attention

^A Incidents have occurred where intrathecal catheter access ports have been mistaken for central venous lines in emergency department: <https://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2005-08Intrathecal.pdf>

APPENDIX B Pre-neuraxial analgesia infusion procedure patient assessment recommendations

Establish patient's goals of care^A including resuscitation status, pain management goals, and end-of-life location preference

Admit patient to an acute care unit before planned procedure day to complete assessments

Baseline interdisciplinary assessments:

- Comorbidities and central nervous system active medications that increase risk of respiratory depression (e.g., obstructive sleep apnea, benzodiazepines)
- Psychological assessment to identify psychosocial distress, support, and history of psychosis
- Identification of possible contraindications:
 - Untreated sepsis or local infection^B
 - Bleeding risk that increases risk of epidural or spinal hematoma formation (e.g., thrombocytopenia^B)
 - Unstable central nervous system disorders including raised intracranial pressure
 - Epidural and brain metastases
 - Spinal pathology including impending spinal cord compression
 - Medication reconciliation (pharmacist)
 - Functional assessment (occupational therapist and physiotherapist)
 - Exploration of expectations, psychosocial wellbeing, and concerns including support system (nursing, physicians, social worker)

Perform the following investigations:

- Bloodwork: complete blood count, creatinine, liver enzymes, coagulation studies (INR/PTT)
- Magnetic resonance imaging of spine, if not performed recently
- Notify the intensive care unit about plans to perform procedure^A

Discharge planning before initiation of the neuraxis analgesia procedure that includes:

- Contact details and service availability of palliative care and anesthesia healthcare professionals involved in patient's care
- Necessary equipment (e.g., tubing, catheter access port needle, analgesia pump) is available in the community
- Compounding pharmacy can prepare sterile medications for neuraxial administration
- Education for healthcare professionals (including home care staff), patients, and caregivers

^A A common admission criterion for palliative care units is for patients to have a "do not resuscitate" code status. Nevertheless, rare but life-threatening iatrogenic adverse effects may occur from neuraxial procedures (e.g., intrathecal catheter migration). We, therefore, recommend full active medical management including resuscitation if needed for patients for at least 24 hr after the procedure is performed or as recommended by anesthesia.

^B If infections and coagulopathy can be reversed prior to the procedure, they are no longer contraindications to the procedure. Adherence to current regional anesthesia guidelines for patients receiving antithrombotic or thrombolytic therapy is important.

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