Intrathecal Pain Pumps
Indications, Patient Selection, Techniques, and Outcomes

Robert Bolash, MD[a], Nagy Mekhail, MD, PhD[b,*]

KEYWORDS

• Intrathecal pain pumps • Intrathecal drug delivery • Chronic pain • Intractable spasticity

KEY POINTS

- Intrathecal drug delivery allows continual administration of analgesics directly to their site of action within the cerebrospinal fluid (CSF), providing pain relief to patients who are intolerant or refractory to other routes of administration.
- Success with intrathecal therapy requires careful patient selection, an understanding of the pain mechanisms, and reasonable patient expectations.
- A trial of intrathecal drug therapy often precedes implant of the intrathecal drug delivery system. The trialing period enables both patient and physician to assess efficacy and immediate side effects of the intrathecal analgesia.
- Sustained improvement in both pain score and functional measures have been demonstrated when intrathecal drug delivery is used for both neuropathic and nociceptive pain.

INTRODUCTION

Intrathecal drug delivery systems represent an important therapeutic strategy for a subset of refractory chronic pain patients. Only morphine and the N-type calcium channel blocker ziconotide are Food and Drug Administration (FDA) approved for intrathecal administration, although a much wider variety of agents are currently in use for both nociceptive or neuropathic pain conditions.[1]

The continuous administration of analgesics via the intrathecal route results in higher subarachnoid drug concentrations and can achieve improved pain scores while mitigating many of the side effects seen with systemic administration of these same medications. Quality-of-life measures and overall health care utilization costs are decreased in select patients when intrathecal drug delivery is compared with conventional medical management alone, underscoring the importance of this route of delivery in an increasingly cost-conscious health care arena.[2–11]

INDICATIONS

Although intrathecal drug delivery systems have been widely used for treating intractable pain due to various malignancies, the delivery of neuraxial opiates for chronic nonmalignant pain states continues to gain favor in parallel with a growing body of evidence supporting their use.[12] By delivering opiates in close proximity to their site of action on the dorsal horn of the spinal cord, analgesia is achieved at doses much lower than when these same medications are administered systemically. Additionally, adverse effects are often mitigated and concerns about opiate diversion and analgesic compliance are attenuated when medications are administered via an

[a] Department of Pain Management, Cleveland Clinic, 9500 Euclid Avenue/C25, Cleveland, OH 44195, USA; [b] Evidence Based Pain Medicine Research, Department of Pain Management, Cleveland Clinic, 9500 Euclid Avenue/C25, Cleveland, OH 44195, USA
* Corresponding author.
E-mail address: mekhain@ccf.org

Neurosurg Clin N Am 25 (2014) 735–742
http://dx.doi.org/10.1016/j.nec.2014.06.006

implanted drug delivery system. Newer intrathecal delivery systems are capable of providing patient-controlled analgesia on demand via a personal therapy manager.[13]

Although opiates have multiple established routes of delivery, the recent discovery of the non-opiate analgesic ziconotide necessitates direct administration into the CSF and has efficacy exclusively via the intrathecal route. As ziconotide use increases so will the number of patients with intrathecal drug delivery systems. Although outside of the scope of this discussion, intrathecal drug delivery systems are also widely used in the treatment of spasticity in both pediatric and adult populations.[14,15]

Consideration of the administration of intrathecal analgesics is typically reserved for those patients who fail, or are unable to tolerate, conservative treatment modalities, including opiate and nonopiate pharmacotherapy, as well as nonpharmacological adjuncts, such as interventional procedures or physical modalities. A pain diagnosis should be well established, classifying the pain as either nociceptive or neuropathic, and serve to guide the selection of intrathecal agents. Additionally, the pain should be chronic and present throughout most of the day, necessitating round-the-clock analgesic dosing. The source of the pain should not be easily correctable via an alternative intervention or any alternative surgical treatment should be deemed to pose a greater risk than treatment of the condition with intrathecal analgesics.

The development of intolerable side effects precluding the use of oral opiates represents a subset of patients who may achieve analgesic benefit from these same agents when administered directly into the CSF. This includes patients who achieve substantial pain relief from oral opiates but develop intolerable sedation, constipation, and other adverse effects. On administration of these same agents into the intrathecal space, many patients achieve analgesia while avoiding the adverse cognitive and gastrointestinal side effects (**Box 1**).

Box 1
Indications for consideration of intrathecal drug delivery

- An established pain diagnosis has been made classifying the symptoms as neuropathic, nociceptive, or mixed.
- The pain complaint should be chronic or both chronic and progressive in nature owing to either a malignant or nonmalignant cause.
- Pain should be present throughout nearly the entire day.
- Patients have failed to achieve analgesia with conservative nonpharmacologic modalities
- Patients who are refractory or intolerant to orally administered analgesics
- Corrective treatment addressing the pain generator is not warranted.
- Surgical contraindications to implanting prosthetic hardware and accessing the intrathecal space are absent (eg, bacteremia or anticoagulation).

PATIENT SELECTION

Judicious patient selection is perhaps the most important strategy for achieving lasting success with continuous intrathecal drug therapy and involves multidisciplinary decision making with the input of interventionalists, mental health professionals, patients and their caregivers. Several stepwise algorithms to identify candidates for consideration of intrathecal drug delivery have been suggested, all with a focus on evaluating and optimizing the multiple comorbidities on which chronic pain has an impact.[12,16]

First, pain practitioners identify patients, establish a pain diagnosis, and determine that more conservative options have been exhausted. Second, intrathecal drug delivery is presented to patients and expectations, comprehension, and support networks are assessed. Because administration of analgesics via the intrathecal route offers pain control, rather than pain elimination, realistic expectations should be set by practitioners and anticipated outcomes quantified among patients. Third, patients are evaluated and treated for psychological comorbidities that may be barriers to success with the therapy. The psychological evaluation is particularly important when considering the use of ziconotide because worsening mood disorders, cognitive impairment, and suicidal ideation have been observed with its use.[1,17,18] Although not demonstrated prospectively, preexisting psychopathology is thought to predispose patients to new adverse psychiatric events after initiation of ziconotide therapy, and many physicians consider psychosis a contraindication to the use of ziconotide.[1]

The multidisciplinary team should focus on how best to optimize patient success with intrathecal therapy rather than accepting intrathecal analgesia as a strategy of last resort. Patient dissatisfaction with intrathecal therapy remains a significant reason for premature revision or removal of intrathecal drug delivery systems, with only 51% of patients reporting satisfaction