Intercostal cryoneurolysis for the management of chronic intercostal neuralgia after vertebral column fracture – a case report

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Abstract:

Cryoneurolysis is a minimally invasive, non-surgical, non-pharmacological method used to treat acute and chronic pain. This technique involves the application of low temperatures to reversibly interrupt the conduction of sensory nerves, thereby blocking the sensation of pain. Cryoneurolysis is commonly used in the treatment of neuropathic pain, postoperative pain, chronic pain syndromes, and injury-related pain. This technique is safe and highly effective, and the procedure is typically performed under fluoroscopic or ultrasound guidance, allowing for precise placement of the cryoapplicator on the affected nerve. However, it is important to carefully assess the indications and contraindications to ensure maximum effectiveness and safety of the procedure. We report a case of a 22-year-old patient who suffered from a traumatic vertical fracture of T8 at the junction of the pedicle and the transverse process on the right side, confirmed by an MRI. He experienced severe pain for nearly four years. Despite physical therapy and extensive use of NSAIDs, the pain persisted. Two years later, the patient was diagnosed with Thoracic Syndrome, and continued pain management with opioids, which was ineffective. Four years after injury, a diagnostic intercostal nerve block (T7-T9) with ropivacaine and dexamethasone provided temporary pain relief. After exhibiting the positive response, the patient underwent cryoneurolysis of the intercostal nerves. The procedure was performed under ultrasound guidance, involved freezing the nerves at T7- T9, and effectively blocking pain transmission. Following the procedure, the patient experienced immediate relief, with no pain reported during a 2-week follow-up, leading to the discontinuation of analgesic medications.

Keywords: cryoneurolysis, intercostal nerves, pain management, intercostal neuralgia

Sažetak

Krioneuroliza međurebrenih živaca u liječenju kronične interkostalne neuralgije nakon prijeloma kralježaka- prikaz slučaja

Krioneuroliza je minimalno invazivna, nekirurška, nefarmakološka metoda koja se koristi za liječenje akutne i kronične boli. Ova tehnika uključuje primjenu niskih temperatura kako bi se reverzibilno prekinulo provođenje signala osjetnih živaca, čime se blokira osjet boli. Krioneuroliza se često koristi u liječenju neuropatske boli, postoperativne boli, kroničnih bolnih sindorma te boli povezane s ozljedama. Ova tehnika je sigurna i vrlo učinkovita, a postupak se obično izvodi pod fluoroskopskom ili ultrazvučnom kontrolom, što omogućava precizno postavljanje krioaplikatora na zahvaćeni živac.

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Međutim, važno je pažljivo procijeniti indikacije i kontraindikacije kako bi se osigurala maksimalna učinkovitost i sigurnost postupka. Ovo je prikaz slučaja 22-godišnjeg bolesnika koji je pretrpio traumatski vertikalni prijelom karlješka Th8 na spoju pedikula i poprečnog nastavka s desne strane, što je potvrđeno magnetnom rezonancom. Bolesnik je patio od jake boli gotovo četiri godine. Unatoč fizikalnoj terapiji i širokoj primjeni nesteroidinih protuupalnih lijekova, bol je ostala prisutna. Dvije godine kasnije, bolesniku je dijagnosticiran torakalni sindrom i nastavljeno je liječenje boli opioidima, što se pokazalo neučinkovitim. Četiri godine nakon ozljede, provedena je dijagnostička blokada interkostalnih živaca (Th7-Th9) s ropivokainom i deksametazonom koja je donijela privremeno olakšanje boli. Nakon pozitivnog odgovora, pacijent je podvrgnut krioneurolizi interkostalnih živaca. Postupak je izveden pod ultrazvučnom kontrolom, a uključivao je zamrzavanje živaca na Th7-Th9 i učinkovito blokiranje prijenosa boli. Nakon postupka, bolesnik je odmah osjetio olakšanje, a tijekom 2-tjednog praćenja nije prijavio bol, što je omogućilo prestanak primjene analgetske terapije.

Ključne riječi: krioneuroliza, međurebreni živci, liječenje boli, interkostalna neuralgija

Introduction:

Cryoneurolysis is a minimally invasive procedure where cold temperatures are applied to specific nerves using a cryoprobe. The process involves the rapid freezing of the nerve, which causes a temporary or permanent disruption in the nerve's ability to transmit pain signals (1). The procedure is centered around an "ice ball" on the tip of a probe that creates temperatures of -60°C or lower. When applied to an affected nerve, this leads to interruption of nerve conduction and Wallerian degeneration. The nerve structures remain intact after the procedure, allowing for eventual nerve regeneration. This approach is most commonly used in pain management, in particular for patients with chronic pain syndromes, or those who cannot tolerate traditional treatments. Major indications include chronic pain syndromes (e.g., facet joint pain, cervical and lumbar radiculopathy, post-surgical pain), peripheral neuropathies (like diabetic neuropathy or postherpetic neuralgia), and upper extremity pain (e.g., suprascapular neuritis, peripheral neuritis) (2). Though considered as generally safe, cryoneurolysis carries some risks and complications, including bleeding, bruising, numbness, and, very rarely, infection at the injection or treatment site (1, 2). Furthermore, contraindications to cryoneurolysis are similar to contraindications for peripheral nerve blocks, including infection (local or systemic), anticoagulation, bleeding disorders, cryoglobulinemia, cold urticaria, and Raynaud's syndrome (3). Cryoneurolysis can also be used for treating chest wall pain, which affects many patients with malignancies, or those undergoing chest surgery. Almost 50% of patients following thoracotomy report chest wall pain (4). Besides cryoneurolysis, there are various treatment options available for managing intercostal neuralgia, including conservative approaches like oral medications, topical treatments, and nerve blocks (such as thoracic paravertebral, erector spinae plane blocks, and intercostal nerve blocks) (5,6). Cryotherapy, however, has the potential to deliver sustained pain relief over the long term, compared to conventional treatment options.

Case report:

A 22-year-old patient presents to the pain management office with complaints of pain in the thoracic region of the spine at the level of T8 on the right, radiating in a band-like manner along the intercostal nerves. The pain appeared as continuous, present both during day and night. The patient has been experiencing the above described pain for almost 4 years. Prior to this condition, the patient was a professional athlete, training in rugby. During training, a fall caused a vertical fracture of T8 at the junction of the pedicle and transverse process on the right side, confirmed by an MRI. There were no erectile, ejaculatory, urinary, or defecation issues. A few months later, the patient presented to the emergency department, where a CT scan from T6 to T10 was performed, ruling out thoracic vertebral fractures. The CT has shown a small Schmorl's nodes on the endplates of T6, T7 and T8, with normal width of the spinal canal. The need for urgent surgical treatment was excluded, and a diagnosis of paravertebral muscle strain was made. Seven months later, a follow-up MRI revealed marked bone edema of the transverse process and subtle changes in the right pedicle and lamina of T8. After 2 years, the patient was scheduled for an exam in the pain clinic by a physiatrist due to persistent pain, and a diagnosis of Thoracic Syndrome (Sy Thoracale) was made. Physical therapy recommended as a treatment plan for the above-mentioned syndrome. The patient has been continuously taking large amounts of NSAID medications (e.g., Ibuprofen) and paracetamol. Opioid analgesics were also prescribed, but they provided no relief. Four years after the injury, the patient returned to the pain management office at the Anesthesia department, where an analgesic block was performed on the intercostal nerves T7-T9 (0.325% ropivacaine + dexamethasone), resulting in a reduction of pain for several days. Due to the good response to the diagnostic block, the patient was scheduled for cryoneurolysis of the intercostal nerves. The procedure was performed with the patient in the prone position after the spinal segments were marked. The

procedure was conducted under strict sterile conditions. After sterile cleansing and draping, a local anesthetic (0.2% lidocaine) was applied subcutaneously at the planned insertion site. Under ultrasound guidance, a cannula was directed to the intercostal nerve, and a cryo probe was inserted through the cannula. The procedure was executed using a cryoneurolysis device (Cryo-S Painless, Metrum Cryoflex, Poland (EU)), with standard Single-use cryoprobe A-13, which is 1.3 mm thick. Using a neurostimulator, sensory stimulation was confirmed, and motor stimulation was excluded. Two freezing and thawing cycles were carried out, and at the end of the procedure, local anesthetic (0.2% lidocaine) was applied to the freezing site. The procedure was repeated identically for all three nerves (T7-T9). Immediately after the procedure, the patient reported the complete disappearance of pain in the area of innervation of the intercostal nerves. The next day, the patient noted some pain at the injection sites, but the radiating pain along the intercostal spaces had disappeared. At the follow-up visit 2 weeks later, the patient had no pain and discontinued analgesic use.

Discussion:

Traditional site-specific regional anesthesia, using a variety of local anesthetics, often offers effective pain relief, but its duration may be limited. Emerging evidence suggests that cryoanalgesia is potentially superior, demonstrating prolonged analgesia with fewer side effects. The results of multiple studies have shown that cryoanalgesia is, among other benefits, a good method for postoperative pain reduction (7). In a double-blind, randomized study that included 55 patients, cryoanalgesia provided superior postoperative pain relief for patients with intercostal neuralgia compared with standard care (8). Another randomized controlled trial that included 100 patients has shown similar results, together with improved pulmonary function after video-assisted thoracic surgery (9). Also, results of an observational study that included 50 post-thoracotomy patients found similar improvements in pain, forced expiratory volume in one second, forced vital capacity, reduced opioid consumption, and reduced nausea and vomiting (10).

In contrast, research has shown that long-term postoperative pain scores may worsen with intraoperative cryoanalgesia. A double-blind, randomized study that included 42 patients after posterolateral thoracotomy found increased pain scores in the cryoanalgesia arm at 8 weeks, and statistically more neuropathic-type pain; this was resolved after 6 months, with the difference between groups disappearing (11).

The duration of the block after cryoneurolysis is influenced by several factors, including the distance from the ablation site to the terminal nerve ending, the surrounding tissue temperature, and the nerve's diameter. As a result, the duration of analgesia can be highly variable and difficult to predict, though it is typically measured in weeks or months (7). The patient in our case report had no pain for several weeks. The primary limitations of cryoneurolysis for postoperative pain management are the complete sensory and motor block it induces, as well as the prolonged and often unpredictable duration of this block. However, specific acute or chronic pain conditions may be particularly amenable to cryoneurolysis, including total shoulder or knee arthroplasty, procedures like amputations and burn treatments, rib and spinal fractures and thoracotomies (5). As with any therapeutic approach, it is important to exercise caution when introducing a novel technique. Intercostal nerve blocks using local anesthetics have been associated with a pneumothorax incidence rate exceeding 1% (12). Therefore, it is reasonable to expect that intercostal cryoneurolysis may carry a similar risk. However, since cryoneurolysis typically involves a more blunt probe compared to the sharper needle used in traditional nerve blocks, this may reduce the risk of pneumothorax. Our patient had no side effects after treatment. To fully assess the risk-benefit profile of intercostal cryoneurolysis for treating acute and chronic pain after injuries, large-scale randomized trials will be necessary.

Conclusion:

Intercostal neuralgia is a significant problem, and an effective treatment method is cryoneurolysis. It is not highly invasive, has good results, and the analgesic effect lasts for a long time. We consider it the treatment of choice for such issues.

Ethical approval

For every elective and urgent procedure in our Hospital, it is required to obtain an
informed consent form. The patient had signed the informed consent form and
therefore gave the Hospital permission to perform procedures as well as use the data for scientific purposes with strong protection of personal information.

Conflicts of interest:

The cryoneurolysis device and probes used in these case reports were provided by the manufacturer (Cryo-S Painless, Metrum Cryoflex, Poland (EU)). This company had no input into any aspect of this case or manuscript preparation. The content of this article is only the responsibility of the authors and does not necessarily represent the official views of this company.

References:

1. Biel E, Aroke EN, Maye J, Zhang SJ. The applications of cryoneurolysis for acute and chronic pain management. Pain Pract. 2023; 23: 204–215. https://doi.org/10.1111/papr.13182
2. Law L, Rayi A, Hendrix JM, et al. Cryoanalgesia. [Updated 2024 Feb 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK482123/
3. Ilfeld B, Gabriel R, Trescot A. Ultrasound-guided percutaneous cryoneurolysis for treatment of acute pain: could cryoanalge-sia replace continuous peripheral nerve blocks? Br J Anaesth.2017;119:709–12.
4. Ilfeld BM, Gabriel RA, Trescot AM. Ultrasound-guided percu-taneous cryoneurolysis providing postoperative analgesia last-ing many weeks following a single administration: a replacement for continuous peripheral nerve blocks?: a case report. Korean JAnesthesiol. 2017;70(5):567–70.
5. Huang J, Delijani K, El Khudari H, Gunn AJ. Intercostal Cryoneurolysis. Semin Intervent Radiol. 2022 Jun 30;39(2):167-171. doi: 10.1055/s-0042-1745763. PMID: 35781990; PMCID: PMC9246488
6. Vairamuthu, Ramesh; Das, Gautam; Das, Suspa; Gotur, Aparna. Ultrasound-Guided Cryoneurolysis of Intercostal Nerves for Intercostal Neuralgia. Journal on Musculoskeletal Ultrasound in Pain Medicine 8(1):p 29-31, May–Aug 2023. | DOI: 10.4103/jmupm.jmupm_4_23
7. Ilfeld BM, Gabriel RA, Trescot AM. Ultrasound-guided percutaneous cryoneurolysis for treatment of acute pain: could cryoanalgesia replace continuous peripheral nerve blocks? Br J Anaesth. 2017 Oct 01;119(4):703-706. [PubMed] [Reference list]
8. Pastor J, Morales P, Cases E, Cordero P, Piqueras A, Galán G, París F. Evaluation of intercostal cryoanalgesia versus conventional analgesia in postthoracotomy pain. Respiration. 1996;63(4):241-5.
9. Pastor J, Morales P, Cases E, Cordero P, Piqueras A, Galán G, París F. Evaluation of intercostal cryoanalgesia versus conventional analgesia in postthoracotomy pain. Respiration. 1996;63(4):241-5.
10. Sepsas E, Misthos P, Anagnostopulu M, Toparlaki O, Voyagis G, Kakaris S. The role of intercostal cryoanalgesia in post-thoracotomy analgesia. Interact Cardiovasc Thorac Surg. 2013 Jun;16(6):814-8.
11. Mustola ST, Lempinen J, Saimanen E, Vilkko P. Efficacy of thoracic epidural analgesia with or without intercostal nerve cryoanalgesia for postthoracotomy pain. Ann Thorac Surg. 2011 Mar;91(3):869-73.
12. Shanti C, Carlin A, Tyburski J. Incidence of pneumothorax from intercostal nerve block for analgesia in rib fractures. J Trauma. 2001; 51:536–9.