Case Report

Efficacy of an Intrathecal Drug Delivery System in Controlling Pain Caused by Skin Defect in Fournier’s Gangrene

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ABSTRACT

Intrathecal drug delivery systems are widely used to treat intractable cancer and chronic pain. However, they are rarely used in cases that require pain control in the acute phase, such as Fournier’s gangrene. Here, we report a case, in collaboration with our pain management department, in which an intrathecal drug delivery system was effective in controlling pain in an individual with a skin defect caused by Fournier’s gangrene. A 71-year-old man with diabetes and alcoholic cirrhosis presented with fever in our emergency department and was diagnosed with a urinary tract infection. However, the subsequent development of Fournier’s gangrene due to infection with preexisting hidradenitis suppurativa necessitated pain management. This was successfully achieved by injecting bupivacaine following the placement of an intrathecal drug delivery system via a port on the lateral chest wall. The resulting pain relief permitted adequate debridement, wound care, and skin grafting. The patient was rehabilitated and discharged on the 89th day of hospitalization with an independent gait. The favorable outcome of this case demonstrates that intrathecal drug delivery systems may be instrumental in providing pain relief, even in the acute phase, and facilitating enhanced patient care.

Key words: acute pain, Fournier’s gangrene, intrathecal drug delivery system, pain management, wound care

Introduction

The intrathecal drug delivery system, a means of spinal analgesia used in pain clinics, is widely used for intractable cancer pain and chronic pain. However, to the best of our knowledge, there have been no reports on the management of pain by this type of system in the acute phase, such as that in Fournier’s gangrene. Fournier’s gangrene is a necrotizing fasciitis involving the perineum. Surgical debridement is required to control the infection, which results in extensive soft tissue defects. The wound remains open and requires daily care with irrigation until the infection is controlled. Then, the wound bed is prepared, and the wound is often closed with secondary skin grafting. However, good wound bed preparation takes several weeks, and daily wound care is thus required. This procedure is extremely painful and stressful for patients.

Herein, we report a case in which an intrathecal drug delivery system was used to control pain and relieve stress, as much as possible, in a patient until skin grafting was performed.

Material and methods

A 71-year-old man with diabetes and alcoholic cirrhosis presented to the emergency department of our hospital with fever. He was diagnosed with a urinary tract infection and admitted to our urology department. On the 5th day of hospitalization, redness and pain in the perineum led to a suspicion of cellulitis, and a dermatologist was consulted. Incision and drainage were performed with the diagnosis of Fournier’s gangrene triggered by infected hidradenitis suppurativa. Although antibiotics (2 g/d ceftriaxone) were administered thereafter, the wound healing was poor. Additional drainage was performed on the 12th and 21st days of...
hospitalization. A colostomy was performed during the second drainage. Subsequently, although wound care was attempted, it could not be performed adequately because of severe pain. On the 23rd day of hospitalization, the doctors in the pain management department performed the placement of an intrathecal drug delivery system. This procedure was performed under intravenous anesthesia in the left-lateral position using fluoroscopy. An initial spinal puncture was performed at L4–L5 using the paramedian approach. Thereafter, an intrathecal catheter was inserted cranially and placed at the caudal edge of the L1 body. The catheter was fixed to the fascia using absorbable sutures. The catheter was extended through the subcutaneous tunnel into a subcutaneous pocket created in the right chest wall and connected to an embedded-type port. The port was used on the following day. For pain management at rest, a drug solution consisting of 1 mL of 1% morphine and 16 mL of 0.5% bupivacaine dissolved in 83 mL of saline was administered at 1.0 mL/hr. This improved the pain at rest from 8 to 2 on the visual analog scale (VAS) without the use of other pain killers. In addition, 20 minutes before wound care, 3 mL of high-density 0.5% bupivacaine was injected via the port, and irrigation wound care was performed. Because of the analgesic anesthesia from the intrathecal port, the pain during wound care significantly improved, resulting in a VAS score of 0. Although daily wound care was provided, wound healing was unfavorable; therefore, our plastic surgery department was consulted. Considering the insufficient debridement, we performed additional debridement on the 41st day of hospitalization (Fig. 1a, b). The soft tissue defect was 23 ×16 cm in size and ranged from the pubic region to the sacral region. On the 47th day of hospitalization (6 days after treatment), negative pressure wound therapy (NPWT) was started, which smoothly enabled care without the complaint of severe pain due to the intrathecal drug delivery system. On the 56th day of hospitalization, the wound was closed by mesh skin grafting using portions of the bilateral thighs as donors (Fig. 2a, b). Furthermore, the third debridement and last skin grafting procedure were performed using the intrathecal drug delivery system without intubation. During skin grafting, a slight residual sensation was observed in the right thigh after additional bupivacaine administration; therefore, fentanyl and local anesthesia were combined as precautionary procedures.
With these minimal anesthetics, the operation was successful with 80% graft survival. The dose of continuous administration was reduced on the 10th day after skin grafting, and after confirming that there was no pain, even without administration, it was removed 3 weeks after surgery. There were no complications associated with this system. The patient was sufficiently rehabilitated and discharged from our hospital with an independent gait on the 89th day of hospitalization.

Discussion

Fournier’s gangrene is a form of necrotizing fasciitis involving the perineum, and it has a high mortality rate of 20–30%1-3. A history of diabetes, HIV, or alcoholism is a risk factor for its onset3-9. In this case, pre-existing diabetes and alcoholic cirrhosis triggered Fournier’s gangrene, and a rapid increase in the prevalence of pre-existing hidradenitis suppurativa subsequently followed. In cases of controlled hidradenitis suppurativa, debridement and reused skin grafting are performed simultaneously4-7. However, as the infection was not adequately controlled in this case, we had to first perform sufficient debridement while controlling the infection in the open wound and then perform skin grafting. Care of open wounds after debridement is particularly painful. The management of acute pain includes the administration of medications, such as acetaminophen and NSAIDs, via an oral or intravenous route6-7. These medications are less invasive but often do not provide sufficient pain relief. Other pain management techniques include peripheral nerve block and epidural anesthesia. Although these can sufficiently relieve the pain, patients experience stress from these techniques during each procedure.

An intrathecal drug delivery system can be placed by an experienced surgeon for approximately 1 hour. Under fluoroscopy, a catheter is inserted and placed at the desired vertebral level. Next, a subcutaneous tunnel is made towards the lateral chest wall, and a port is placed in the chest wall (Fig. 3). It is relatively resistant to infection and can be expected to be used for a long period of time because it is used via a long-distance subcutaneous tunnel; however, cleanliness needs to be maintained for the injection of medical solutions. Contraindications of the intrathecal drug delivery system are the same as those of peripheral nerve blocks, such as bleeding tendency, hemostatic coagulation disorders, and infection at the site of device placement. In this case, although the patient had cirrhosis, there was no prolongation of the prothrombin time or activated partial thromboplastin time, and the platelet count was nearly 400,000/μL. No hidradenitis suppurativa lesions were present near the lumbar puncture site (L4/5), and the system could be safely inserted. Complications of this system include opioid side effects, infection, urinary retention, and postdural puncture headache. The side effects of opioids include nausea, vomiting, constipation, and respiratory depression5-9. One of the features of the intrathecal drug delivery system via a port is that once the port is placed, the pain can be repeatedly relieved by simple medications. Therefore, there is no stress on the patients during drug administration. Pain control is more effective than acetaminophen and NSAIDs and does not require repetitive procedures, such as peripheral nerve block and epidural anesthesia. It has been shown that this system improves cancer pain according to the VAS by approximately 50%9. In this case, the VAS score during wound care decreased from 8 to 2 after anesthesia was implemented, demonstrating the efficacy of the system for pain control. We consider that it is significant not only for cancer pain but also for acute pain, such as that in Fournier’s gangrene.

Resting pain can be controlled by the continuous administration of low doses of drugs. A mixture of morphine and bupivacaine was used in this case. Bupivacaine (0.5% high-density) was used for analgesia prior to wound care. In this case, 3 mL of bupivacaine was administered 20–30 minutes before wound care was performed. The effective analgesic range was uneven after approximately 20 minutes; however, a sufficient range of analgesic effects was obtained after 30 minutes. As there are individual differences in drug dose and waiting time, adjustments should be made according to the patient’s symptoms. As the effect lasts for approximately 2 hours, the patient can take a shower before the procedure if sufficient pain relief is obtained. In this case, we considered the analgesic effect to be sufficient and performed debridement and skin grafting with the intrathecal drug delivery system using the catheter placed before debridement. It was shown that the analgesic effect was sufficient not only for daily wound care but also for invasive situations, such as surgery. This analgesic method may be widely used for procedures for cases in the

![Fig. 3. A port was placed on the right chest wall (green color), followed by the insertion of a catheter toward the subarachnoid space.](image-url)
adequate phase, such as debridement, treatment, and skin grafting, which often require analgesia. For example, its application in chronic limb-threatening ischemia (CLTI), which is a concern in plastic surgery, has been suggested to enhance its adaptation. Further studies on similar cases are required to better understand the applications of this system.

Conclusion

We encountered a case in which an intrathecal drug delivery system was useful for pain control in a patient with soft tissue defect after Fournier’s gangrene. This case also demonstrates that surgical treatment can be performed using this system if analgesia is maintained. In addition, it may be possible to seek adaptation to burns and CLTI, such as in cases of diabetic foot gangrene.

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Patient consent

The patient provided written informed consent for the publication and use of their images.

Conflicts of interest

None.

References

1) Hahn HM, Jeong KS, Park DH, Park MC, Lee JI: Analysis of prognostic factors affecting poor outcomes in 41 cases of Fournier gangrene. Ann Surg Treat Res 2018; 95: 324-32.
2) Singh A, Ahmed K, Aydin A, Khan MS, Dasgupta P: Fournier’s gangrene: a clinical review. Arch Ital Urol Androl 2016; 88: 157-64.
3) Insua-Pereira I, Ferreira PC, Teixeira S, Barreiro D, Silva Â: Fournier’s gangrene: a review of reconstructive options. Cent Eur J Urol 2020; 73: 74-9.
4) Chen YE, Gerstle T, Verma K, Treiser MD, Kimball AB, Orgill DP: Management of hidradenitis suppurativa wounds with an internal vacuum-assisted closure device. Plast Reconstr Surg 2014; 133: 370e-7e.
5) Maeda T, Kimura C, Murao N, Takahashi K: Promising long-term outcomes of the reused skin-graft technique for chronic gluteal hidradenitis suppurativa. J Plast Reconstr Aesthet Surg 2015; 68: 1268-75.
6) Li JW, Ma YS, Xiao LK: Postoperative pain management in total knee arthroplasty. Orthop Surg 2019; 11: 755-61.
7) Blondell RD, Azadfard M, Wisniewski AM: Pharmacologic therapy for acute pain. Am Fam Physician 2013; 87: 766-72.
8) Kamran S, Wright BD: Complications of intrathecal drug delivery systems. Neuromodulation 2001; 4: 111-5.
9) Follett KA, Naumann CP: A prospective study of catheter-related complications of intrathecal drug delivery systems. J Pain Symptom Manage 2000; 19: 209-15.
10) Deer TR, Smith HS, Burton AW, et al: Comprehensive consensus based guidelines on intrathecal drug delivery systems in the treatment of pain caused by cancer pain. Pain Physician 2011; 14: E283-312.