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Tunneled Epidural Analgesia for Refractory Scrotal Cancer Pain: A Case-Based Evaluation of Therapeutic Efficacy

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Abstract

Background: Scrotal Squamous Cell Carcinoma (SCC) is a rare malignancy. Although SCC typically demonstrates slow progression, in advanced stages with significant size, it can cause considerable pain due to mass effect and local tissue invasion. The management of cancer-related pain encompasses a wide spectrum of approaches, ranging from pharmacologic to surgical interventions. In cases where patients become intolerant to the side effects of pharmacologic therapies and adequate pain relief cannot be achieved, while surgical options are either not feasible, interventional pain management may offer an effective alternative. Tunneled Epidural Analgesia represents one such interventional technique that can be considered for refractory pain. This case report aims to evaluate the efficacy of tunneled epidural analgesia administration in managing intractable pain associated with advanced scrotal SCC.
Materials and methods: This case report is structured according to the CARE (Case Report) guideline. The study was conducted at UGM Academic Hospital, where the patient received evaluation and treatment.
Case: A 65-year-old male diagnosed with SCC presented experiencing refractory cancer pain. Despite receiving conventional analgesic therapy, he experienced no significant pain relief and developed adverse effects. Pain management was subsequently escalated to an interventional approach using a bupivacaine 0.125% and fentanyl 25 mcg administered via a tunneled epidural drug delivery system. This intervention resulted in effective pain control, enabling him to do daily activities. With this modality, the pain remained well managed, although occasional breakthrough pain occurred, which was successfully managed with 1% lidocaine as a rescue analgesic.
Conclusion: Tunneled epidural analgesia using a combination of opioid and bupivacaine has demonstrated effectiveness in the management of refractory scrotal cancer pain.

Keywords: bupivacaine, epidural analgesia, opioid, refractory pain, scrotal cancer, squamous cell, tunnelled

1. INTRODUCTION

Cancer pain management remains a significant challenge, particularly in terminal-stage patients. A substantial number of cancer patients experience refractory cancer pain caused by factors such as mass effect, intra-tumoral hemorrhage, infection, nerve compression, or nerve irritation due to the release of inflammatory mediators. Pain may also result from treatment modalities, including chemotherapy (1,2). This type of pain often does not respond adequately to conventional therapy, and the patient's systemic condition frequently precludes operative intervention.

Scrotal squamous cell carcinoma (SCC) is a rare malignancy characterized by slow tumor progression. Despite its indolent nature, its malignant potential allows for continuous growth, resulting in mass effects, compression, and tissue infiltration. These pathological processes commonly lead to cancer-related pain. In advanced stages, the tumor may invade surrounding areas, including the genitalia, rendering surgical intervention unfeasible (3–5).

Interventional pain management offers an alternative approach for patients with refractory cancer pain. One such modality is the administration of tunneled epidural analgesia, which has been shown in previous studies to be effective in managing intractable cancer pain (6,7). The use of tunneled delivery systems allows for prolonged catheter placement and sustained analgesic administration (8). This case report aims to evaluate the efficacy of tunneled epidural analgesia in managing intractable pain associated with advanced scrotal squamous cell carcinoma.

2. MATERIALS AND METHODS

This case report has been structured in accordance with the CARE (Case Report) guidelines (9–11). The study was conducted at UGM Academic Hospital, where the patient received evaluation and treatment.

3. CASE

A 65-year-old male was referred by a surgical oncology department due to cancer-related pain involving the scrotum, with extension to the genitalia. The mass had been present for approximately one year and had progressively enlarged. Histopathological examination revealed skin tissue with epidermal proliferation forming an invasive tumor within the stroma, without evidence of vascular or perineural invasion. The invasive pattern consisted of solid nests, some angulated and others showing anastomosing structures. The tumor cells were pleomorphic, predominantly polygonal with some caudated forms, abundant eosinophilic cytoplasm, and round to oval nuclei, some bizarre in shape, with coarse chromatin and prominent nucleoli. A mitotic count of 7 per High-Power Field (HPF) was observed. These histopathological findings are consistent with a diagnosis of SCC.

Magnetic Resonance Imaging (MRI) was performed to assess the extent of metastasis and local invasion of the scrotal SCC. The MRI revealed a tumor mass occupying the entire scrotum and displacing the testes. The lesion also extended to and infiltrated the penis, prostate, pre-anal and pre-rectal fat, perineum, and the skin of the pubic and suprapubic regions (Figure 1).

The cancer progressively enlarged and extended, exerting pressure on the surrounding areas, including the genital organs, resulting in severe and refractory pain. Systemic conditions that may contribute to pain exacerbation or render pain difficult to control—such as sepsis—were investigated and ruled out. Laboratory examinations yielded normal results and did not support the presence of sepsis (Table 1). Surgical resection of the tumor was recommended; however, the patient declined operative intervention. Consequently, chemotherapy with cisplatin was planned as an alternative treatment approach.

The patient is currently experiencing severe pain localized to the scrotal and genital regions, with a pain intensity rated at 9 out of 10 on the numeric rating scale. Due to the severity of the pain, the patient is bedridden and unable to perform daily activities. He was admitted for inpatient care as a result of the uncontrolled pain and had been receiving tramadol 50 mg every 8 hours and morphine sulphate 10 mg every 12 hours. Despite this regimen, pain control remained inadequate, and the patient began experiencing gastrointestinal side effects,

including nausea and vomiting. A referral was subsequently made to the pain service for further management.

Table 1. Laboratory Findings

Parameters	Result	Normal range
Leucocyte	10.5	3.8-10.6x10^3/µl
Erythrocyte	4.0	4.4-5.9 x10^6/µl
Hemoglobin	10.9	13.2-17.3g/dL
Hematocrit	32.9	40-52%
Thrombocyte	357	150-44010^3/µl
Neutrophile	86.6	50-70%
Lymphocyte	9.3	25-40%
Blood Urea Nitrogen	68.5	10.7-42.8
Creatinine	1.28	0.6-1.2mg/dL
Sodium	133	135-145mmol/L
Potassium	2.6	3.5-5.1mmol/L
Chloride	93	95-115mmol/L
GDS	349	60-199mg/dL

Physical examination revealed a mass on the scrotum extending to the penis. Vital signs were within normal limits, and the pain score before pain intervention was 9 out of 10. The patient weighed 60 kg. An interventional pain management procedure was planned in the form of epidural analgesia using a combination of bupivacaine 0.125% and fentanyl 25 mcg, administered via the tunneling technique.

The procedure was performed in the catheterization laboratory under general anesthesia to facilitate the intervention. The steps of the procedure were as follows:

1. The patient was positioned in the left lateral decubitus position, and standard monitoring devices were applied to continuously assess hemodynamic parameters throughout the procedure.
2. The procedural area was prepared using strict aseptic technique, and a sterile drape was applied.
3. A radiologic technologist positioned the C-arm fluoroscopy unit, with the X-ray generator placed inferiorly and the image intensifier superiorly, to guide the procedure and ensure accurate needle placement at the L4–L5 level.
4. Epidural catheter placement was performed at the L4–L5 interspace using an 18-gauge Tuohy spinal needle with the loss-of-resistance technique utilizing 0.9% sodium chloride (NaCl).
5. The epidural catheter was inserted with 5 cm of the catheter tip advanced into the epidural space.
6. A 2 mL injection of iohexol contrast agent was administered through the epidural catheter reservoir. The catheter position was confirmed using anteroposterior (Figure 2A) and lateral (Figure 2B) fluoroscopic views with the C-arm to ensure proper placement within the epidural space and to exclude malposition.
7. A test dose of lidocaine 20 mg combined with epinephrine 0.0125 mg/mL was administered to exclude inadvertent intravascular placement.
8. Following a negative test dose, the catheter was tunneled subcutaneously toward the anterior aspect to reduce the risk of dislodgement and improve patient comfort.
9. Maintenance analgesia was provided using a combination of bupivacaine 0.125% and fentanyl 25 mcg, with a total volume of 10 mL administered every 8 hours.
10. Pain monitoring was conducted to assess the reduction in the patient's pain score and to detect any occurrence of breakthrough pain.
11. In the event of breakthrough pain, rescue analgesia was administered with 10 mL of 1% lidocaine.

During the pain intervention, the patient experienced only one episode of pain exacerbation, which responded effectively to the administration of 10 mL of 1% lidocaine. Analgesia was monitored over three days, during which the optimal dosing frequency of the combined analgesics, bupivacaine 0.125% and fentanyl 25 mcg, was determined to be every 6 hours. A limitation of this method is that the prepared drug mixture remains stable at room temperature for only 24 hours after preparation.

After one day of home care analgesia, the patient reported no severe pain and was able to stand, walk, sit, and carry out daily activities

independently. The side effects of catheter insertion were evaluated during hospitalization and up to 10 days post-insertion during home care. No adverse effects, such as signs of infection or inflammation at the insertion site, were observed. Additionally, potential side effects related to the therapy were monitored, and no instances of nausea, vomiting, pruritus, sedation, delirium, or more serious complications such as addiction or respiratory depression were identified. Ten days after catheter placement and cessation of continuous analgesic therapy, no severe pain recurred. Therefore, it was decided to administer 2% lidocaine diluted in 8 mL of normal saline only as needed for breakthrough pain, while maintaining the catheter in situ.

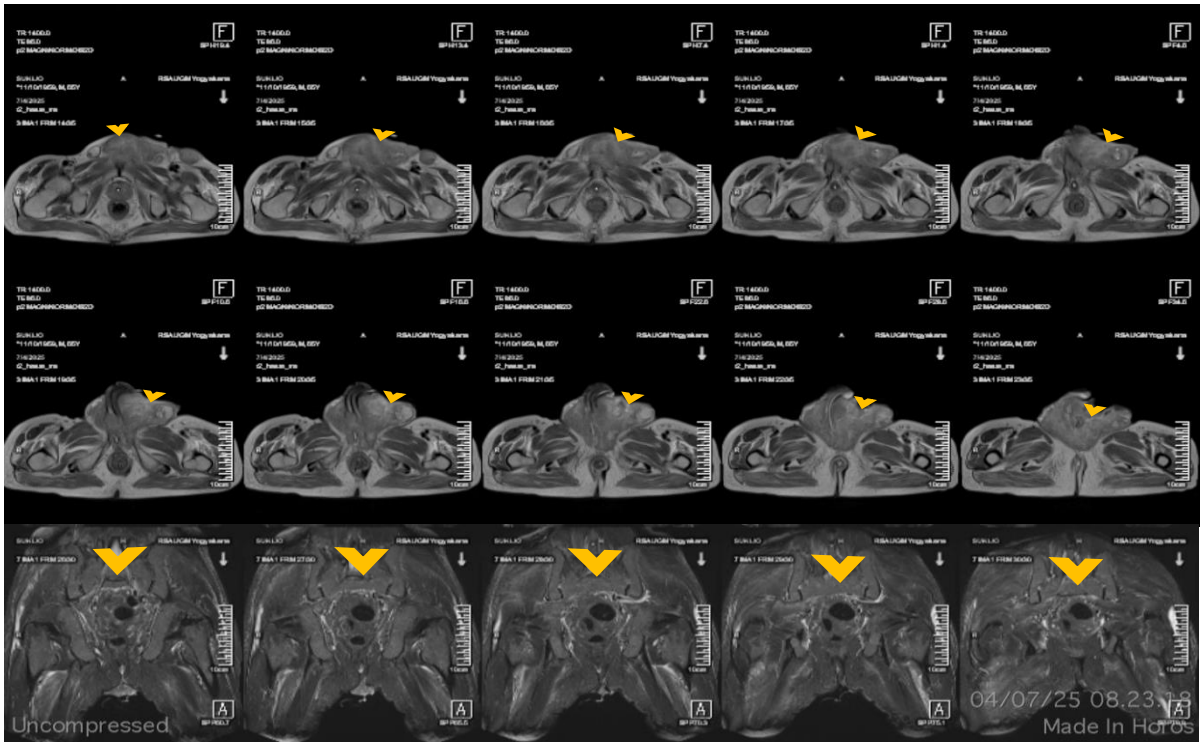

Figure 1. The MRI revealed a tumor mass (yellow arrows) occupying the entire scrotum and displacing the testes. The lesion also extended to and infiltrated the penis, prostate, pre-anal and pre-rectal fat, perineum, and the skin of the pubic and suprapubic regions.

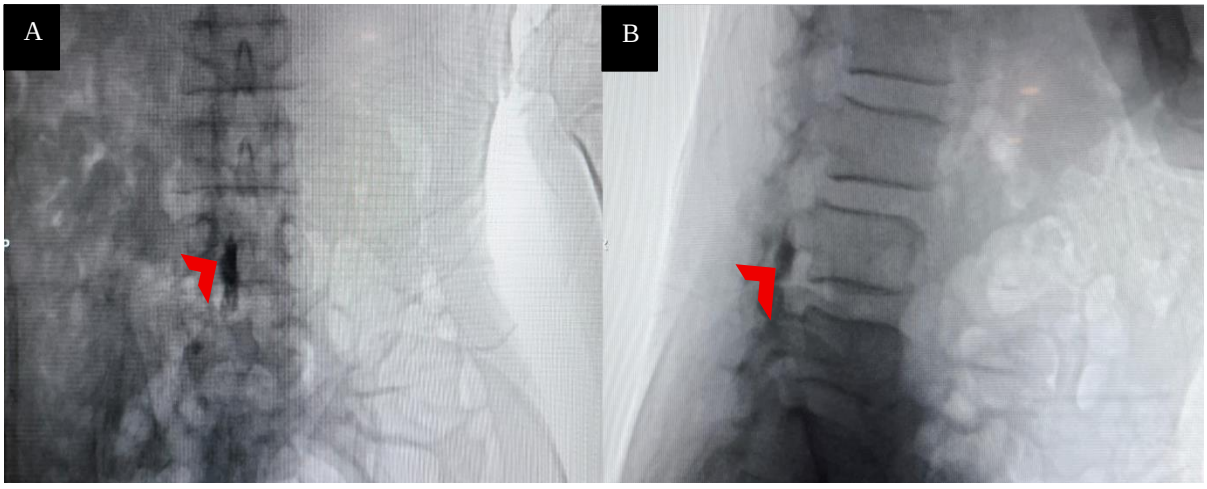

Figure 2. The catheter position was confirmed (red arrows) using antero-posterior (A) and lateral (B) fluoroscopic views with the C-arm to ensure proper placement within the epidural space and to exclude malposition.

4. DISCUSSION

Patients with scrotal cancer may experience cancer-related pain. A significant proportion of patients with cancer pain develop intractable pain. In cases of scrotal cancer, pain may arise due to tumor mass effect, nerve compression, intra-tumoral bleeding, or the release of pro-inflammatory cytokines by the tumor, which can irritate innervating nerves (1,2). Approximately 0.01–10% of patients with scrotal cancer experience severe cancer pain (12).

The therapeutic approach to scrotal cancer is highly variable, ranging from pharmacological management to surgical intervention. Pharmacological therapies may include oral opioids, intranasal, buccal, or sublingual fentanyl, as well as adjuvant medications such as gabapentinoids and tricyclic antidepressants to address neuropathic pain (13). However, these treatments may be associated with side effects ranging from mild, such as nausea, vomiting, pruritus, sedation, and delirium, to more serious complications, including addiction and respiratory depression (14,15). Conventional therapy fails in approximately 10–30% of patients with scrotal cancer who suffer from cancer pain (7). The same condition was observed in this case, where the patient began to experience opioid-related side effects, yet pain relief remained inadequate.

Consequently, alternative approaches must be considered for managing pain in cancer patients. Interventional pain management has emerged as a viable option for patients with intractable cancer pain, including those with scrotal cancer. One such approach is neurolytic therapy, which offers the advantage of being a single, potentially definitive procedure. However, it also carries limitations, such as the use of neurolytic agents that may induce severe neuritis at the injection site, difficulty in application, and side effects, including diarrhea and unpleasant numbness due to nerve damage. Additionally, advanced techniques such as Radiofrequency Ablation (RFA), cryoablation, and neurosurgical procedures are not widely available in all healthcare settings (7).

Another alternative within interventional pain management is the use of intrathecal or epidural analgesia. Opioids administered via the intrathecal or epidural route act by binding to pre- and post-synaptic receptors in the spinal cord, thereby blocking or modulating nociceptive signal transmission. Their hydrophilic nature allows for prolonged analgesic effects (7).

Epidural opioid administration, however, can lead to similar side effects as parenteral administration. Therefore, several studies have explored the use of combination therapy, incorporating low-dose local anesthetics such as bupivacaine with opioids like fentanyl. This combination not only enhances analgesic efficacy through synergistic potentiation but also reduces the risk of opioid-related side effects and local anesthetic toxicity associated with higher monotherapy doses (7).

Fentanyl is often selected for its rapid onset and lipophilic properties, although it has a relatively short duration of action, making it suitable for continuous infusion (7). Bupivacaine was used in this case due to its efficacy in epidural analgesia, with a duration of action ranging from 120 to 300 minutes. A concentration of 0.125% was chosen, which provides sufficient analgesia for cancer pain with minimal motor blockade. The use of a tunneled epidural drug delivery system allows for flexible titration of fentanyl and bupivacaine doses according to patient needs (16). In addition, the use of tunneled catheters allows for long-term administration and can be utilized in daily clinical practice (8).

The use of epidural infusion analgesia is being increasingly explored; however, one limitation is the requirement for a larger drug volume compared to intermittent dosing. Previous studies have compared analgesia via a tunneled Intrathecal Drug Delivery System (IDDS) with conventional pharmacological therapy. Use of the analgesia pump demonstrated significant pain score reduction without opioid toxicity. Furthermore, administration via an epidural catheter can be performed either independently by the patient or by trained home care personnel (6,7). A similar outcome was observed in this case, where intermittent epidural injections every six hours effectively managed the patient's cancer pain.

The selection of appropriate analgesia for patients experiencing advanced cancer pain

presents a distinct challenge. A palliative condition does not negate the patient's right to be free from pain. Non-invasive management strategies, including the administration of systemic opioids, have been implemented in this case. While systemic opioid therapy remains a cornerstone in the management of cancer-related pain, advanced disease often necessitates higher dosages to achieve adequate analgesia. However, increasing the opioid dose frequently results in adverse effects, as observed in this patient, who began to experience nausea and delirium (17,18). An alternative option for managing cancer pain is the use of transdermal fentanyl. However, this modality was considered suboptimal due to its delayed onset of action, limited flexibility in dose titration, and inadequate efficacy in the context of rapidly escalating cancer pain (19,20).

Therefore, epidural analgesic administration may serve as a viable alternative. Epidural delivery enables effective pain control with reduced systemic side effects, which is particularly important in palliative care settings involving patients with frail physiological conditions. The use of a tunneled catheter facilitates continued home-based care, helping to preserve quality of life while minimizing the need for hospitalization (21). A comparison of the various benefits and side effects of different analgesic modalities in cancer patients is presented in Table 2. While transdermal fentanyl was not trialed in this case, the decision to proceed with tunneled epidural analgesia was made based on the patient's rapidly escalating pain, suboptimal response to systemic opioids, and the need for effective and sustained symptom control in a palliative home-care setting These considerations formed the basis for selecting tunneled epidural catheter administration of opioids as the preferred method of pain management in this case.

Table 2. Comparison of Interventional and Conventional Pain Management Techniques

Approach	Advantages	Disadvantages / Limitations
Oral Opioids (e.g., morphine, oxycodone) (17,18)	- Easy administration - Widely available - Effective for many cancer pain cases	- Gastrointestinal side effects (nausea, constipation) - Tolerance and dose escalation - Systemic side effects
Transdermal Fentanyl (19,20)	- Non-invasive - Provides continuous pain control - Better compliance in some patients	- Delayed onset and offset - May be insufficient in rapidly escalating pain - Skin reactions are possible
Peripheral Nerve Blocks (22)	- Targeted analgesia - Minimally invasive - Useful for localized pain	- Short duration - Not practical for diffuse or central pain - Requires repeat procedures
Celiac Plexus Block / Neurolysis (23)	- Effective for upper abdominal cancer pain (e.g., pancreatic)	- Short-to-medium duration relief - Risk of hypotension, diarrhea - Requires a skilled interventionist
Epidural Catheter Analgesia (21)	- Provides regional pain control - Can deliver multiple drugs	- Risk of infection, dislodgment - Requires inpatient care or skilled home support - Short-term use
Tunneled Intrathecal / Epidural Drug Delivery System (21)	- Delivers small doses directly to the CNS - Effective for refractory pain - Fewer systemic effects - Suitable for home care when tunneled	- Invasive procedure - Risk of infection, granuloma, and catheter complications - Requires trained personnel
Spinal Cord Stimulation (SCS) (24)	- Effective for neuropathic pain - Reversible and adjustable	- High cost - Not suitable for visceral cancer pain - Limited availability in palliative settings

Other studies have also shown the efficacy of tunneled IDDS analgesia in managing chronic pain. This interventional approach allows for superior pain relief, lower opioid requirements, minimized toxicity, improved cost-effectiveness compared to conventional therapies, and enhanced patient satisfaction and quality of life (QOL) (25). The same was observed in this patient, who was previously bedridden due to severe pain. After initiation of intermittent tunneled epidural analgesia, the patient was able to ambulate and perform daily activities independently.

Moreover, the placement level of the tunneled epidural analgesia catheter significantly influences the success of the therapy. Park et al. (2024) demonstrated that the site of catheter insertion is closely associated with the effectiveness of tunneled epidural analgesia (26). The perineal region receives innervation from motor neurons located in the nucleus of Onuf, a branch of the pudendal nerve (27). The pudendal nerve carries both motor and sensory modalities originating from the ventral rami of the spinal nerves S2 to S4 (28). Inserting the catheter at the L4–L5 level enables blockade of the lumbosacral trunk, which consists of nerve fibers from the ventral rami of L4 and L5 and contributes to the lumbosacral plexus (29). Clinical observations have shown that catheter placement at the L4–L5 level effectively alleviates pain symptoms in patients.

Tunneled Intrathecal / Epidural Drug Delivery System analgesia offers advantages in managing cancer pain in palliative conditions (30). Nonetheless, the technique requires skilled healthcare professionals for catheter placement, whether intrathecal or epidural. Being a semi-invasive procedure, it carries risks including spinal cord or nerve injury, cerebrospinal fluid leakage, granuloma formation, and both local and systemic infections. In some cases, catheter kinking or fracture may occur, leading to sudden analgesia failure and the potential onset of withdrawal symptoms (8,31). Therefore, patient and caregiver education, along with the availability of skilled medical personnel capable of recognizing early signs of complications or adverse effects, is essential to ensure therapeutic success and minimize risks. Moreover, during the follow-up period, none of these signs were observed in this case.

It is worth noting that the follow-up for this case was only conducted over a short period. Further research involving larger sample sizes and extended follow-up durations is necessary to assess the long-term effectiveness of epidural analgesia delivery using a tunnelling epidural drug delivery system in managing chronic refractory cancer pain.

5. CONCLUSION

Tunneled epidural analgesia using a combination of opioid and bupivacaine has demonstrated effectiveness in the management of refractory scrotal cancer pain. This intervention may serve as an alternative treatment option, potentially improving patients' QOL and reducing the socioeconomic burden. However, these findings should be interpreted with caution, and further large-scale, multicenter studies are warranted to validate their clinical utility and generalizability.

6. ABBREVIATIONS

a. CARE: Case Report
b. HPF: High-Power Field
c. IDDS: Intrathecal Drug Delivery System
d. MRI: Magnetic Resonance Imaging
e. NaCl: Sodium Chloride
f. RFA: Radiofrequency Ablation
g. SCC: Squamous Cell Carcinoma
h. SCS: Spinal Cord Stimulation
i. QOL: Quality of Life

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