

# Upper thoracic spine puncture and caudal advance of an epidural catheter for adequate analgesia in a patient with breast cancer with chest and upper back pain: A case report

SANCHUN YE<sup>1</sup>, YUBIN ZHONG<sup>1</sup>, QINGYAN YANG<sup>2</sup>, KEWU ZHENG<sup>2</sup> and YUENONG ZHANG<sup>1</sup>

Departments of <sup>1</sup>Surgery and Anesthesia and <sup>2</sup>Medical Oncology, The Third Affiliated Hospital of Sun Yat-sen University, Yuedong Hospital, Meizhou, Guangdong 514700, P.R. China

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**Abstract.** Patients with advanced cancer and metastasis frequently require analgesic treatments to relieve pain and maintain an acceptable quality of life. Continuous analgesic treatment with epidural drug infusion is one interventional approach to provide adequate pain relief. Most epidural analgesia procedures are performed with the catheter inserted in the lower thoracic or lumbar spine areas, which is then advanced in a cephalad direction to reach the level that requires analgesia. The present study reported on a patient with chest and upper back pain who failed oral oxycodone treatment. Epidural analgesia to target the T5 level was planned. However, a lower spinal puncture with cephalad advance of the catheter was not possible due to metastasis and compression in the T5-8 levels. Thoracic spine puncture was performed between the T1 and T2 vertebrae and the infusion catheter was advanced in a caudal direction to reach the T5 level. Successful pain relief and amelioration of clinical symptoms demonstrated that the method may be considered a feasible and safe approach to achieve adequate analgesia and improve the quality of life of patients with similar conditions.

## Introduction

Breast cancer is the most common cancer type worldwide (1). The treatment goal for breast cancer is not only to prolong survival but also to improve the quality of life of patients (2).

The quality of life of patients with cancer is closely associated with their experience of pain (3). Pain is the most common complaint from patients with cancer (4). High pain intensity is associated with a low quality of life. It was reported that >70% of patients with cancer experience severe pain despite various pain management approaches (5). The World Health Organization has recommended an analgesic ladder, which includes a three-step strategy from non-opioid analgesics to weak or strong opioid therapies (6). Certain researchers have suggested adding a fourth step to involve interventional treatments in order to provide adequate control for severe or sudden onset cancer pain (7). One of the interventional approaches is neuraxial analgesia with epidural or intrathecal injection of opioids. Neuraxial analgesia was proven to have good efficacy and safety for cancer pain management and provides adequate pain control and improvement of the quality of life (8). Neuraxial analgesia involves injection of anesthetic medication into the epidural space (epidural anesthesia) or the subarachnoid space (intrathecal anesthesia). Most epidural analgesia procedures are performed with the catheter inserted in the lower thoracic or lumbar spine areas and then advanced in a cephalad direction to reach a level that requires analgesia (9-12). However, this approach cannot always be successfully completed in patients with stenosis or compression in the epidural or subarachnoid spaces due to tumor metastasis or invasion into the spine, which may block the catheter advance. The present case study reports on a patient with breast cancer and spine metastasis, in whom adequate pain relief was successfully achieved by performing thoracic spine puncture and advancing the catheter in a caudal direction to reach the area of pain.

## Case report

A 59-year-old female patient was admitted to the Third Affiliated Hospital of Sun Yat-sen University, Yuedong Hospital (Meizhou, China) in September 2021 due to chest and upper back pain for >3 months after receiving the multi-line chemotherapy for postoperative recurrent left breast adenocarcinoma (T4aN3cM1, stage IV, Luminal B, Her2 negative). The patient denied a history of hypertension, diabetes or chronic obstructive pulmonary disease. In 2006, the patient had been diagnosed with left breast adenocarcinoma and

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*Correspondence to:* Professor Yuenong Zhang, Department of Surgery and Anesthesia, The Third Affiliated Hospital of Sun Yat-sen University, Yuedong Hospital, 124 Park North Road, Xinxian Town, Meizhou, Guangdong 514700, P.R. China  
E-mail: 36856665@qq.com

*Abbreviations:* VAS, visual analogue scale; MRI, magnetic resonance imaging; DSA, digital subtraction angiography

*Key words:* breast cancer, metastasis, thoracic spine puncture, epidural analgesia

received modified radical mastectomy. Postoperatively, the patient received chemotherapy (cyclophosphamide, doxorubicin and fluorouracil, followed by long-term tamoxifen therapy) and was followed up in the clinic. In 2014, the patient was found to have cancer recurrence. Epidermal growth factor receptor-2 was negative. The patient received a total of 35 rounds of chemotherapy, including fluorouracil, cyclophosphamide, doxorubicin, platinum, vinorelbine, lobaplatin and paclitaxel, as well as endocrine therapy with exemestane, with poor responses. Additional endocrine therapy with cyclin-dependent kinase 4 and -6 inhibitor was recommended but was refused by the patient due to its high cost. During the current hospital admission, the patient complained of intermittent severe pain with an intensity of up to 10 on the visual analogue scale (VAS) in the left chest and up her back (the body surface is projected between the ribs T5 and T6) several times a day. Oral 80 mg oxycodone was prescribed, which was able to decrease the pain intensity to 5. However, the patient experienced severe side effects, including nausea, vomiting, poor appetite, insomnia and dizziness. Physical examination showed normal vital signs. Magnetic resonance imaging examination revealed multiple bony metastases in the T5, T7 and T8 vertebral bodies and bilateral pedicles, as well as in the left 7th and 8th posterior ribs. T5 and T8 spinal stenoses and spinal cord compressions were also present. The epidural space at the T5 level was narrowed to 0.55 mm (Fig. 1). The spinal cord at the T8 level was severely compressed, with the narrowest subarachnoid space at 1.24 mm (Fig. 2), a narrow epidural space of 0.55 mm (Fig. 3) and a right shift of the spinal cord. Other parts of the spinal cord were unremarkable. The admission diagnoses included the following: i) Postoperative recurrence of invasive ductal adenocarcinoma of the left breast (T4aN3cM1, stage IV, Luminal B, Her2 negative); ii) spinal metastases; and iii) cancer pain.

The patient received oral oxycodone but was unable to tolerate it and was unable to maintain her routine daily life activities. Oxycodone caused severe side effects in this patient. After the hospital admission and necessary tests, it was determined that there was no contraindication for epidural analgesia. Therefore, a decision was made for epidural catheter placement to reach the T5 level and provide analgesic infusion to relieve the pain and improve the quality of life. The traditional approach of epidural analgesia is to perform a lower thoracic or lumbar spine puncture first and then insert the epidural catheter in a cephalad direction to reach the epidural space at the T5 level. However, considering that the patient had spinal stenosis and compression at the T8 level but the area of pain was at the T5 level, an epidural catheter entered through the lumbar area and directed cephalad would not have been able to pass the T8 level and reach the T5 level; it was thus decided to perform the thoracic spine puncture at the T1-2 level and direct the epidural catheter caudally to reach the T5 level.

The procedure was explained to the patient and the patient's family and written informed consent was obtained from them. In the operating room, the patient was placed in the left lateral decubital position. Routine disinfection was performed and surgical drapes were applied. The spinous processes of the T1 and T2 were identified under digital subtraction angiography (DSA). A hollow spine puncture needle was connected to a

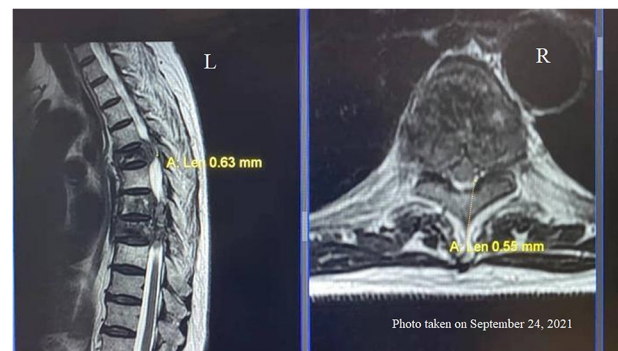


Figure 1. Narrow epidural space at the T5 level in MRI images (Len, epidural space; L, sagittal view; R, transverse view).



Figure 2. Narrow subarachnoid space at the T8 level in MRI images (Len, subarachnoid space; L, sagittal view; R, transverse view; green axis, Midline of the transverse axis of the T8 vertebral body).

glass syringe with negative pressure and entered into the skin at 2 cm lateral to the spinous process. The bevel of the needle formed a 30-degree angle to the coronal plane. After the needle was inserted by ~5.5 cm, a 'pop' sensation occurred and the negative pressure in the glass syringe disappeared, suggesting that the needle had reached the epidural space. The glass syringe was removed and a soft catheter was inserted through the spine puncture needle and advanced caudally with its tip, finally reaching the level of the T5 vertebral body. The spine puncture needle was removed. The other end of the soft catheter was connected to an infusion port for drug delivery. Both the catheter and the port were sutured in a subcutaneous pocket above the right shoulder and lateral to the right side of the neck. The skin was sutured and covered by sterile gauze (Fig. 4). The vital signs of the patient were stable throughout the procedure.

After a successful thoracic spine puncture and caudally directed epidural catheter placement (Fig. 5), the drug delivery port was connected to an analgesic pump, which contained 30 mg morphine, 200 mg ropivacaine and 30 mg dexamethasone in 250 ml normal saline. The first bolus was given at 5 ml. The infusion rate was at 1 ml/h. The patient could increase the dose by himself, and each demand dose was set at 2 ml with a lockout interval of 20 min.

Postoperatively, the patient stopped taking oral analgesics and only used the epidural drug infusion system.



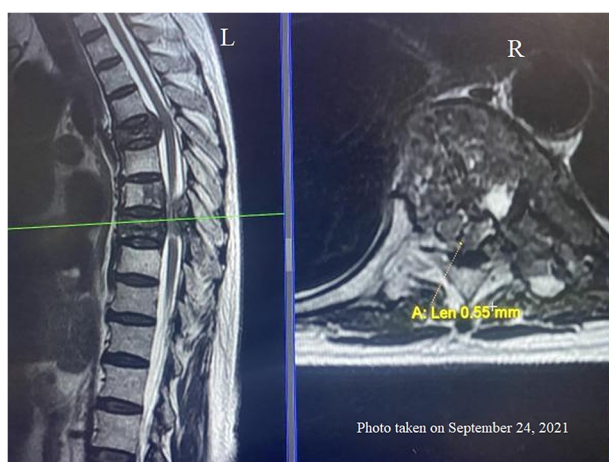


Figure 3. Narrow epidural space at the T8 level in MRI images (Len, epidural space; L, sagittal view; R, transverse view; green axis, Midline of the sagittal plane of the T8 vertebral body).



Figure 4. Image of the implantable port in the recessed area where the right trapezius muscle intersects the clavicle.

The pain was successfully controlled at a VAS of 2, with a small number of episodes of sudden onset of severe pain. The symptoms of nausea, vomiting, reduced appetite and dizziness were also improved in the patient. The patient was satisfied with the pain control and discharged three days after the procedure. During the two-month follow-up period, the patient did not exhibit any signs of infection or gastrointestinal discomfort. The pain intensity was 2. Both appetite and body weight were improved, and BMI increased from 20.8 to 21.0 kg/m<sup>2</sup>.

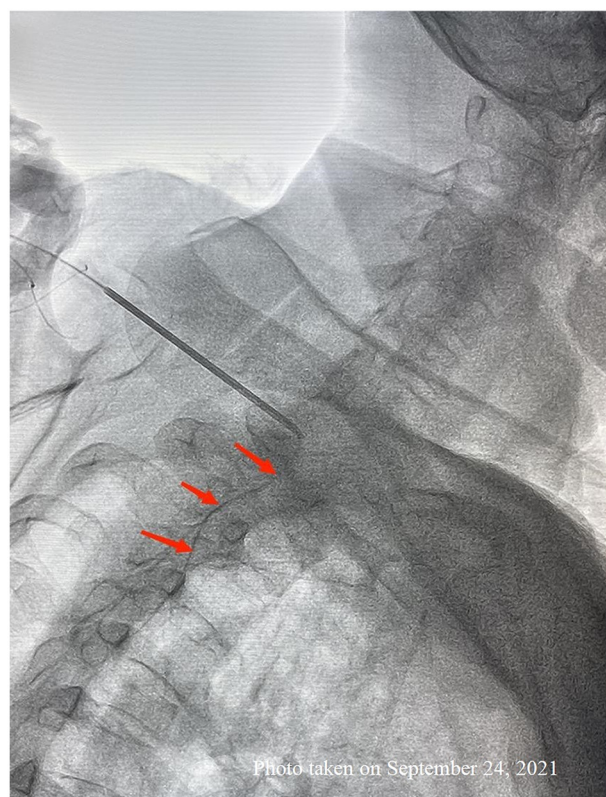


Figure 5. Epidural catheter (arrows) visualized by digital subtraction angiography.

## Discussion

Cancer pain has a marked impact on the quality of life of patients. The World Health Organization has recommended an analgesic ladder, which includes a three-step strategy from non-opioid analgesics to weak or strong opioid therapies (6). However, certain patients still have severe pain after conventional analgesic treatments. Epidural drug infusion therapy is one interventional approach. Most epidural analgesia procedures are performed with a catheter inserted in the lower thoracic or lumbar spine areas and then advanced in the cephalad direction (13). A previous case report described a patient with metastatic spinal cord compression who received cervical epidural analgesia due to neck pain (14). Furthermore, thoracic epidural analgesia was performed in patients during chest or abdominal surgeries or with rib fractures (15). All the above were successful. The present study reported on a patient with chest and upper back pain due to metastatic breast cancer. The upper thoracic spine puncture was successfully performed between the T1 and T2 vertebrae and the epidural catheter was advanced in a caudal direction to reach the T5 level, which provided adequate analgesia.

The patient of the present study had breast cancer recurrence and metastases after the initial surgery and chemotherapy. The patient had complaints of severe chest and upper back pain due to cancer metastases, as well as spinal stenosis in the thoracic spine area. Oral oxycodone therapy did not relieve the patient's pain but had severe side effects. All of these factors had markedly decreased the patient's quality of life. Epidural drug infusion therapy was

selected. Adequate pain relief by the epidural drug infusion in the patient necessitated placing the tip of the infusion catheter at the level of pain. A traditional method is to perform the lumbar puncture first (16) and then the infusion catheter was inserted in a cephalad direction to reach the thoracic T5 level in the present patient. However, for the present case, this traditional approach to place the infusion catheter may have been difficult, since the patient had severe spinal compression with stenosis in both the subarachnoid and epidural spaces at the T8 level. The stenosis and compression at T8 may have blocked a cephalad advanced epidural catheter from reaching the T5 level. It was also considered that the insertion of the epidural catheter at the T4-5 level may have had a risk of catheter dislodgement due to the short distance of implantation in the epidural space. If the catheter had been left too long in the epidural space, it may have passed the T5 level and resulted in incomplete analgesia in the T5 area. In addition, it may have been inappropriate to insert the infusion catheter at the T5, T7 and T8 levels, since it may have caused spinal cord injury and paraplegia from subarachnoid puncture and spinal ependymoma (17). Therefore, it was concluded that the best approach was to perform the thoracic puncture at the T1-2 level and advance the infusion catheter in a caudal direction in the epidural space to reach the T5 level. During the DSA-guided procedure, the head of the patient was placed in a forward-flexed position. Successful placement of the infusion catheter was achieved after multiple fine adjustments of the direction and angle of the catheter.

Most previous studies reported on the implantation of the injection port in the waist or the lower abdominal areas (18,19). In the patient of the present study, the infusion port was implanted in the depression where the right trapezius meets the clavicle, which is easier to secure to the skin due to its proximity to the site of pleural puncture. It also facilitated postoperative care. Compared to implantation in the waist (19), based on previous experience and literature (20), this location made the patient feel more comfortable and the infusion port was not as easy to contaminate in the shower. There is no consensus on the analgesic drugs used for cancer pain control among clinicians involved in patient care. Opioids have been the mainstay analgesics. In the present case, a small dose of dexamethasone (~3 mg/day) was also included to prevent nausea and vomiting, which were the main side effects of the opioid treatment. Simultaneously, dexamethasone may also reduce cancer pain scores and decrease the amount of opioids required to obtain adequate pain relief.

Contraindications to intrathecal drug infusion include local skin infection and coagulation dysfunctions. During the thoracic puncture and advance of the infusion catheter in the epidural space, care should be taken to avoid catheter knotting or misalignment. Postoperatively, patients should be monitored for cerebrospinal fluid leakage, infection and spinal hematoma formation (19,21).

As a single case report, the present study had the limitations of single patient description, retrospective review of the clinical information and short-term follow-up. The procedure used in the present study also had a high medical expense, with potential side effects, including infection and cerebrospinal fluid leakage. Patients under this treatment also require frequent hospital visits to ensure adequate analgesia and safety.

Currently, this patient is being followed up in the clinic to observe opioid consumption and pain control. In the future, this analgesic approach will be applied to further suitable candidates. The present case study aimed to introduce this analgesic approach to clinicians. Once additional cases are reported, further experience and clinical evidence may be accumulated to refine this treatment method to benefit more patients.

In conclusion, epidural analgesic infusion may be suitable for certain patients with cancer metastasis for adequate pain relief. In patients with chest and upper back pain, the traditional approach of lower thoracic or lumbar spine puncture and cephalad advance of infusion catheter may not be possible due to thoracic spinal metastasis and stenosis. In the current case report, thoracic spine puncture was performed at the T1-2 level and the infusion catheter was advanced in a caudal direction to reach the T5 level. Successful pain control in this patient indicated that this may be a feasible and safe approach to achieve adequate analgesia and improve the quality of life of patients with similar conditions. Future prospective studies are warranted to confirm the present results.

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### Availability of data and materials

All data generated or analyzed during this study are included in this published article.

### Authors' contributions

SY, QY and YZha conceived and designed the study. SY, QY, YZho and KZ performed the literature search. KZ acquired data and drafted the manuscript. SY, YZha and YZho established the clinical diagnosis and assisted in revising the manuscript. SY, KZ and QY wrote the original draft. SY, QY and YZha wrote, reviewed and edited the manuscript. SY, YZ and QY confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

### Ethics approval and consent to participate

This study was approved by the Ethics Committee and Institutional Review Board of the Third Affiliated Hospital of Sun Yat-sen University-Yuedong Hospital (approval no. 2021-18; Meizhou, China).

### Patient consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

### Competing interests

The authors declare that they have no competing interests.

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