Posterior Endoscopic Cervical Decompression in Metastatic Cervical Spine Tumors: An Alternative to Palliative Surgery

Vit Kotheeranurak, MD
Khanathip Jitpakdee, MD
Yodsawee Pornmeechai, MD
Yutthana Khanasuk, MD
Panyajarn Laohapornsvan, MD
Jin-Sung Kim, MD
Wongthawat Liawrungrueang, MD

ABSTRACT

Metastatic spinal cord compression of the cervical spine is a well-known consequence of cancer that generally manifests as an oncological emergency. This study presents and describes an alternative to the minimally invasive posterior full-endoscopic approach for direct decompression and tumor debulking from the metastasis of hepatocellular carcinoma (HCC) in the cervical spine. A 54-year-old man presented with progressive cervical radiculopathy that had persisted for 3 months. The underlying disease was HCC. Radiographic examination revealed evidence of metastatic spinal cord compression with an epidural mass at the C4-C5 levels, which compressed the C4-C5 spinal cord without bony destruction. The modified Tomita score was 6 to 8 points based on palliative surgery. A posterior full-endoscopic approach to remove the tumor from the metastasis of HCC in the cervical spine was done. A postoperative radiographic study revealed adequate tumor mass resection and spinal decompression. The patient was extremely satisfied with this alternative treatment and achieved complete neurologic recovery at 1 month and no recurrent symptoms at the 6-month follow-up. The technique of posterior full-endoscopic decompression of cervical metastasis causing unilateral radiculopathy, presented in this study, is feasible. This surgical intervention seems to be optional minimally invasive and acts as an alternative to palliative surgery.

The third most prevalent location of malignant neoplasm metastasis in the internal organs is the spine. The clinical presentation ranges from asymptomatic bony deposition to aggressive spinal cord compression. Up to 40% of patients with malignant neoplasms acquire spinal metastases during the course of their disease. Approximately 5% to 15% of these individuals suffer from metastatic spinal cord compression. The thoracic and lumbar spine are the most prevalent locations of vertebral metastases when compared with other parts of the vertebral column, and cervical spine metastasis is relatively infrequent, accounting for less than 10% of all spinal metastases.
Cervical Metastasis: Full-endoscopic Decompression

The primary areas of metastatic deposition are within the bony structure of the spine, with occasional extension into the epidural space, potentially compromising neural structures such as nerve roots or the dural sac. Intradural metastasis is relatively rare, accounting for less than 5% of all spinal metastases.6 Nerve compression is a result of physical compression or instability. This results in radiculopathy if the individual nerve roots are compromised. However, in the setting of spinal cord compression, the ensuing myelopathy can be devastating and potentially lethal. In such settings, timely diagnosis and treatment are key prognostic factors.6,7

It is difficult to predict the survival of patients with metastatic neoplastic malignancies of the spine. The utility of many grading systems for predicting long-term prognosis was investigated.8 The modified Tomita score system predicts patient survival and response to treatment. A modified Tomita score of 6 to 8 points suggests palliative surgery or palliative radiation therapy. The goals of palliative surgical treatment for spinal metastasis are to free the neural structure from ongoing compression by the tumor, stabilize the spinal column in cases of instability, reduce pain, and promote ambulation.9 Thus, careful decisions must be made regarding the use of surgical treatment since the open surgical techniques are associated with complication rates of up to 50%.10 Therefore, minimally invasive techniques that can adequately decompress the neural structure without affecting spinal stability are beneficial in this group of patients.

We report a case of cervical spine metastasis compressing the spinal nerve roots, causing radiculopathy and neurologic deficit. The patient was treated successfully using posterior endoscopic cervical decompression, a contemporary minimally invasive surgical technique.

Case Presentation

A 54-year-old man with a history of hepatocellular carcinoma (HCC) presented with complaints of progressive severe radicular pain and weakness for 1 month. The patient had undergone chemotherapy for the treatment of HCC. A physical examination revealed a normal mental status and vital signs. The patient had limited neck motion and severe right radicular pain down to the shoulder, with right C5 weakness (motor power grade II). According to clinical measurement scores, the neck disability index was 47, the arm’s visual analog scale (VAS) was 7, and the neck’s VAS was 3. Special examinations revealed abnormalities in the Spurling test. A rectal examination revealed a normal sphincter tone. Radiographic examination using the CT scan showed the osteolytic lesion right transverse process and right pedicle at the C5 level (Figure 1), and MRI showed an infiltrative enhancing marrow lesion involving the C5 vertebral body, right transverse process, right pedicle, and right lamina without bony destruction. Abnormal soft tissue involving the paravertebral region, right C4/C5 neural foramina with epidural extension along the lateral aspect of the spinal canal at C4-C5 levels, causing compression/involvement of the right C5 root and mild pressure effect on the right-sided spinal cord with a normal spinal cord signal, was noted (Figure 2). MRI results suggested a metastatic epidural mass, as well as a likely diagnosis of a metastatic neoplastic tumor from HCC. His modified Tomita score was between 6 and 8 points, suggesting palliative surgery. C4-C5 was chosen for the full-endoscopic decompression of the cervical metastasis for resection of the epidural mass.

Surgical Technique

The patient was placed in the prone position on a radiolucent table with a stabilization head for cervical flexion using a Mayfield holder (Figure 3A). The surgical access was found using anatomic landmarks, and the skin incision was marked with the guidance of posteroanterior fluoroscopy. The skin entry point was determined from the lateral to midline, 1 cm at the C4-C5 level, and a stab incision was created (Figure 3B). The dilator was placed under posteroanterior and lateral fluoroscopic guidance (Figure 3C). A dilator was used to advance the working sleeve with a bevelled opening to the C5-C6 level, after which the dilator was removed. The working sleeve was then passed through a cervical endoscope (Richard Wolf GmbH). Between C4 and C5, the interlaminar space (interlaminar V-point) was identified and visible (Figure 4A). An endoscopic diamond burr and a Kerrison rongeur were also used to perform a laminotomy over the right

Dr. Kim or an immediate family member serves as a paid consultant to RwoSpine, GmbH, and Elliquence. Neither of the following authors nor any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Kotheeranurak, Dr. Jitpakdee, Dr. Pommeechai, Dr. Khanasuk, Dr. Laohapornsan, and Dr. Liawrungrueang.

The patient provided written informed consent to share the case details and any accompanying images published. Queen Savang Vadhana Memorial Hospital Institutional Review Board, Queen Savang Vadhana Memorial Hospital, provided their approval to publish the case details. The patient’s personal information remains confidential. There was no cost incurred or payment made or harm done to the patient as a result of this study.
inferior lamina of C4 and the right superior lamina of C5 (Figure 4, B and C). Endoscopic cautery was used to control bleeding after the ligamentum flavum was resected (Figure 4D), and an abnormal epidural tumor was eradicated from the spinal cord and nerve root (Figure 4E). The abnormal epidural mass was removed and sent for pathologic examination. The nerve root tension was measured and evaluated using a nerve hook for adequate spinal decompression (Figure 4F). Active bleeding was monitored and stopped. No drain was placed. The stab incision was closed using absorbable suture 3-0 with interrupted subcutaneous suturing.

Results
No intraoperative or postoperative complications were noted. A pathologic study reported mixed inflammatory cells, predominantly lymphocytes, on a bloody background (Figure 5A). Atypical cells displayed enlarged irregular nuclei and hyperchromatin (Figure 5B), which favored metastasis from HCC. The patient received multidisciplinary postoperative care, a rehabilitation program, and proper postoperative concurrent radiation therapy and chemotherapy. Immediate postoperatively, the neck disability index was decreased to 22, arm’s and the neck’s VAS was 1. The patient’s radicular symptoms improved satisfactorily compared with the preoperative symptoms. The patient had near-complete neurologic recovery at 1 month and no recurrent symptoms at the 6-month follow-up, after which he died.

Discussion
To the best of our knowledge, there have been no previous reports on the detailed surgical technique of the full-endoscopic method to decompress cervical spine metastasis through the posterior approach. A posterior approach was used to decompress the neurologic structures owing to the compressive pathology on the dorsal aspect of the
Figure 2

A, Mid-sagittal T2-weighted MRI shows no vertebral destruction. B, Right parasagittal T2-weighted MRI and (C) T1-weighted MRI with fat saturation and contrast demonstrate the located epidural mass posterior to the spinal cord and compression nerve root at the level of C4-C5 (Red arrows). D, Axial T2-weighted MRI and (E) T1-weighted with fat saturation and contrast MRI show the lesion located in the right posterior epidural space at the C4-C5 level.

Figure 3

A, Photograph showing patient’s prone position and stabilization head with the Mayfield holder. B, Skin entry point at the lateral to midline 1 cm at the C4-C5 level. C, The dilator and working sleeve were placed under fluoroscopic guidance.
cervical vertebra. Cervical spine metastases with compression of the spinal cord is a serious disorder that can have fatal or life-threatening effects if treatment and diagnosis are neglected. Less than 10% of all spinal metastases involving the cervical spine can cause severe neurologic dysfunction. Therefore, early surgical decompression is typically advised to prevent major consequences.\(^{11}\)

Surgical intervention and management have considerable morbidity; thus, surgeons frequently have to balance the benefits and risks while treating patients with spinal metastases. Surgical decompression has a risk of complications in individuals with bleeding, prolonged surgery, cervical instability, postoperative wound problem, and other systemic problems.\(^{12}\) However, the previous study on minimally invasive spinal decompression procedures has been established in the literature.

Limited open decompressive procedures and direct lateral approaches are generally recognized as minimally

**Figure 4**

A. Diagram showing interlaminar V-point of C4-C5. B, A diamond burr and (C) Kerrison rongeur were used to perform a laminotomy on the right inferior lamina of C4 and right superior lamina of C5. D, Ligamentum flavum resection, (E) epidural mass removal, and (F) final decompression.

**Figure 5**

A. Photomicrograph (H&E stain ×400) showing the smears show mixed inflammatory cells and predominantly lymphocytes in a bloody background. B. A typical cells display enlarged irregular nuclei and hyperchromatin. H&E = hematoxylin-eosin
invasive techniques for spinal metastases. When compared with open surgery, minimally invasive surgery is known for having lower risks, blood loss, transfusion rates, and hospital stays, as well as a similar rate of neurologic recovery.

In 2001, McLain reported a case series of thoracic spinal metastases treated with endoscopic decompression. Gao et al also reported a case of metastasis at the lumbar level that was successfully decompressed with endoscopy by the transfemoral approach. Although percutaneous endoscopy has been used for posterior cervical decompression, we are not aware of any previous reports on the use of this technique for the treatment of cervical metastasis.

Open laminectomy may cause postoperative instability requiring instrumentation, leading to increased operating time, more extensive muscle dissection, and limited cervical motion. However, the endoscopic decompression technique preserved cervical motion while minimizing blood loss, shortening the surgical operation, and allowed early postoperative ambulation. The adequacy of decompression is also an important factor. As per the single-level decompression, we were able to visualize the posterior elements clearly with endoscopic instruments, thus leading to successful decompression. Moreover, the continuous fluid irrigation of endoscopic system can help improve the visualization field when compared with limited open decompressive or tubular surgery.

Early recovery is another key advantage of using an endoscope for surgical decompression of cervical metastases. Many patients with cancer are frail and may have a poor prognosis because of the disease process. These patients are unable to tolerate prolonged surgery including corpectomy, open laminectomy, and instrumentation. As such, minimally invasive endoscopic procedures represent the smallest possible surgical footprint available at present.

This case of metastatic spinal cord compression of the cervical spine is an aggressive neoplastic disease that involves challenging preoperative surgical treatment. In this case, the treatment resulted in a successful outcome. The use of posterior full-endoscopic decompression of cervical metastases in conjunction with tumor debulking has been linked to good results and outcomes.

Conclusions

The technique of posterior full-endoscopic decompression of cervical metastasis causing unilateral radiculopathy, presented in this study, is feasible. It yields satisfactory results and outcomes and represents the smallest surgical footprint available at present.

Acknowledgments

The authors would also like to express our thanks to the Department of Orthopedics, Queen Savang Vadhana Memorial Hospital, for their support.

References

1. Molina CA, Gokaslan ZL, Scibubba DM: Diagnosis and management of metastatic cervical spine tumors. Orthop Clin North Am 2012;43:75-87, vii-ix.
2. White AP, Kwon BK, Linskealde GE, Grauer JN: Metastatic disease of the spine. J Am Acad Orthop Surg 2006;14:587-598.
3. Alamanda VK, Robinson MM, Kneist JS, Patt JC: Functional and survival outcomes in patients undergoing surgical treatment for metastatic disease of the spine. J Spine Surg 2019;4:28-36.
4. Laufer I, Scibubba DM, Madera M, et al: Surgical management of metastatic spinal tumors. Cancer Control 2012;19:122-128.
5. Agarawal JP, Swangsilpa T, van der Linden Y, Rades D, Jeremic B, Hoskin PJ: The role of external beam radiotherapy in the management of bone metastases. Clin Oncol (R Coll Radiol) 2006;18:747-760.
6. Lawton AJ, Lee KA, Cheville AL, et al: Assessment and management of patients with metastatic spinal cord compression: A multidisciplinary review. J Clin Oncol 2019;37:61-71.
7. Patnaik S, Turner J, Inaparthi P, Kieffer WK: Metastatic spinal cord compression. Br J Hosp Med (Lond) 2020;81:1-10.
8. Afsar A, Qadeer M, Sharif S: Surgically treated spinal metastases: Do prognostic scores have a role? Surg Neurol Int 2017;8:158.
9. Nathan SS, Healey JH, Mellano D, et al: Survival in patients operated on for pathologic fracture: Implications for end-of-life orthopedic care. J Clin Oncol 2005;23:6072-6082.
10. Paulino Pereira NR, Janssen SJ, van Dijk E, et al: Development of a prognostic survival algorithm for patients with metastatic spine disease. J Bone Joint Surg Am 2016;98:1767-1776.
11. Telteian AE, Ceyelese A, Fridley J, Doberstein C, Gokaslan ZL: Endoscopic surgical treatment for symptomatic spinal metastases in long-term cancer survivors. J Spine Surg 2020;6:372-382.
12. Lau D, Chou D: Posterior thoracic corpectomy with cage reconstruction for metastatic spinal tumors: Comparing the mini-open approach to the open approach. J Neurosurg Spine 2015;23:217-227.
13. Li J, Wei W, Xu F, Wang Y, Liu Y, Fu C: Clinical therapy of metastatic spinal tumors. Front Surg 2021;8:626873.
14. Miscusi M, Polli FM, Forcato S, et al: Comparison of minimally invasive surgery with standard open surgery for vertebral thoracic metastases causing acute myelopathy in patients with short- or mid-term life expectancy: Surgical technique and early clinical results. J Neurosurg Spine 2015;22:518-525.
15. McLain RF: Spinal cord decompression: An endoscopically assisted approach for metastatic tumors. Spinal Cord 2001;39:482-487.
16. Gao Z, Wu Z, Lin Y, Zhang P: Percutaneous transforaminal endoscopic decompression in the treatment of spinal metastases: A case report. *Medicine (Baltimore)* 2019;98:e14819.

17. Zhang C, Wu J, Zheng W, Li C, Zhou Y: Posterior endoscopic cervical decompression: Review and technical note. *Neurospine* 2020;17(suppl 1): S74-S80.

18. Wu P-F, Li Y-W, Wang B, Jiang B, Tu Z-M, Lv G-H: Posterior cervical foraminotomy via full-endoscopic versus microendoscopic approach for radiculopathy: A systematic review and meta-analysis. *Pain Physician* 2019;22:41-52.

19. Molina CA, Gokaslan ZL, Sciubba DM: A systematic review of the current role of minimally invasive spine surgery in the management of metastatic spine disease. *Int J Surg Oncol* 2011;2011:598148.

20. Lin Y, Rao S, Li Y, Zhao S, Chen B: Posterior percutaneous full-endoscopic cervical laminectomy and decompression for cervical stenosis with myelopathy: A technical note. *World Neurosurg* 2019;124: 350-357.

21. Rose PS, Clarke MJ, Dekutoski MB: Minimally invasive treatment of spinal metastases: Techniques. *Int J Surg Oncol* 2011;2011:494381.