



Intramedullary spinal cord metastasis treated with prophylactic laminoplasty prior to radiation to the spinal cord: a case report

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Background: A cervical laminoplasty is a surgical procedure used to treat moderate-to-severe cervical stenosis resulting in cervical myelopathy. It is performed to widen the spinal canal and reduce compression on the spinal cord and surrounding nerves. Though often performed electively on patients presenting with varying degrees of neurologic dysfunction including weakness and imbalance, it may also be used prophylactically when spinal cord inflammation or edema is anticipated. Radiotherapy in the spinal cord is known to produce radiation-induced damage leading to radiation myelopathy.

Case Description: We present the case of a 62-year-old male diagnosed with both cervical stenosis and an intramedullary cervical spinal cord metastatic tumor. This patient presented with significant symptoms including limited mobility, numbness, lower back pain, paresthesia, and spasms in both legs as well as worsening sexual function. Given that the patient was to undergo radiotherapy, a cervical laminoplasty was performed to eliminate ongoing spinal cord compression as well to prevent future neurologic decline resulting from post-radiation inflammation and edema.

Conclusions: This case highlights that cervical laminoplasty can be performed safely and effectively with significant improvement in patients with metastatic disease. By treating the underlying symptomatic stenosis, and protect the patient from the potential for spinal cord edema from radiation to a spinal cord lesion in an already narrow spinal canal.

Keywords: Cervical laminoplasty; cervical myelopathy; intramedullary spinal cord metastasis (ISCM); radiotherapy; stenosis; case report

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Introduction

Cervical laminoplasty is a decompression procedure performed to treat cervical myelopathy resulting from degenerative or congenital stenosis of the cervical spinal canal. Developed as an alternative to laminectomy and fusion, this procedure preserves the laminae and spinous

process and typically avoids the need for spinal fusion. In the open-door laminoplasty, a hinge on one side of the lamina while the other side is held open with metal plates (1). This expands the effective diameter of the vertebral canal while preserving greater range of motion and incurring fewer postoperative complications compared to laminectomy and fusion (2).

Intramedullary spinal cord metastases (ISCMs) are a rare cause of myelopathy, occurring in fewer than 4% of spinal cord metastases and less than 1% of cancer patients (3). They generally result in significant neurological deterioration with decrease in motor function, paraparesis, and/or loss of bowel and bladder function (4). ISCMs tend to have a very poor prognosis, and are frequently impractical to resect surgically due to poorly defined tumor boundaries and the absence of a clear plane of dissection (3). Thus, radiosensitive metastases are typically treated with radiotherapy with the goal of preserving or restoring neurologic function (3).

However, the spinal cord is notoriously sensitive to radiation; one severe side effect of radiotherapy is radiation-induced damage leading to radiation myelopathy (5). Of particular concern is perilesional edema, which can lead to spinal cord expansion resulting in compression at the level of the lesion and worsening neurological dysfunction (6,7). Although high-dose corticosteroids may be used in an attempt to mitigate post-radiation inflammation, this carries a high risk of serious adverse side effects including hyperglycemia, immunosuppression, and thromboembolism (8,9). If patients do experience newfound or worsening symptoms of spinal myelopathy, radiotherapy may be ceased or the radiation dosage and fractionation may be altered, thereby affecting the efficacy of the treatment and the patient's long-term outcome (5). In patients with pre-existing cervical stenosis and cord compression, the risk of cord compression resulting from radiation-induced

myelopathy is especially heightened. In these cases, we suggest that a prophylactic expansion of the spinal canal may be appropriate.

This case report presents the use of a cervical laminoplasty to simultaneously relieve the symptoms of cervical myelopathy and prophylactically expand the vertebral canal in preparation for radiotherapy in a patient with a neuroendocrine ISCM. We present this article in accordance with the CARE reporting checklist (available at <https://jss.amegroups.com/article/view/10.21037/jss-23-27/rc>).

Case presentation

We present a 62-year-old male patient with a history of neuroendocrine carcinoma diagnosed 8 years prior to presentation. At the time of diagnosis, the patient was found to have neuroendocrine tumors in the jejunum, liver, and intramedullary cervical spinal cord. He subsequently underwent resection of the intestinal tumor followed by steroid and radiation therapy, including to the cervical spinal cord lesion. At the conclusion of treatment, the patient was incontinent and wheelchair bound due to bilateral leg weakness.

Eight years later, the patient presented to the corresponding author with ongoing incontinence, limited mobility in his left leg and no mobility in his right leg with bilateral numbness and tingling. Moreover, he complained of 5.5/10 lower back pain, paresthesia, and spasms in both legs as well as worsening sexual function. An magnetic resonance imaging (MRI) of his cervical spine revealed that there was a slight increase in size and enhancement of intramedullary lesion at C6–C7 with a dorsal intramedullary versus leptomeningeal component spanning from mid C6 to mid T1 level when compared to prior studies. The tumor was irregular in appearance and measured 3.3 mm in rostral-caudal diameter (*Figure 1*). Additionally, the MRI revealed severe stenosis from C2 to T1 with a 13 mm osseous canal (*Figure 2A*).

Given his protracted and worsening neurologic dysfunction and severe stenosis, he was recommended for and underwent a cervical laminoplasty prior to undertaking his planned therapy for the ISCM. Since the patient planned to undergo radiotherapy for his spinal lesion, the laminoplasty was intended to expand the spinal canal to prophylactically mitigate the compressive effects of the growing lesion and possible swelling as a result of radiotherapy, as well as to treat any direct spinal stenosis symptoms (*Figure 2B*).

One month post-laminoplasty, the patient endorsed

Highlight box

Key findings

- Cervical laminoplasty surgery can be used prophylactically to treat spinal cord compression caused by cervical stenosis which can be worse by radiotherapy.

What is known and what is new?

- It is known that cervical laminoplasty is used to alleviate cervical myelopathy from cervical stenosis. Also it is known that radiotherapy for treatment of intramedullary spinal cord metastases (ISCMs) can cause cervical myelopathy. What is new is using cervical laminoplasty surgery prior to radiotherapy to prevent cervical myelopathy caused by radiation.

What is the implication, and what should change now?

- This case report illustrates that use of a prophylactic cervical laminoplasty can be used for patients with ISCMs to prevent radiation-induced myelopathy. Surgeons can now use this information to better prevent cervical myelopathy.

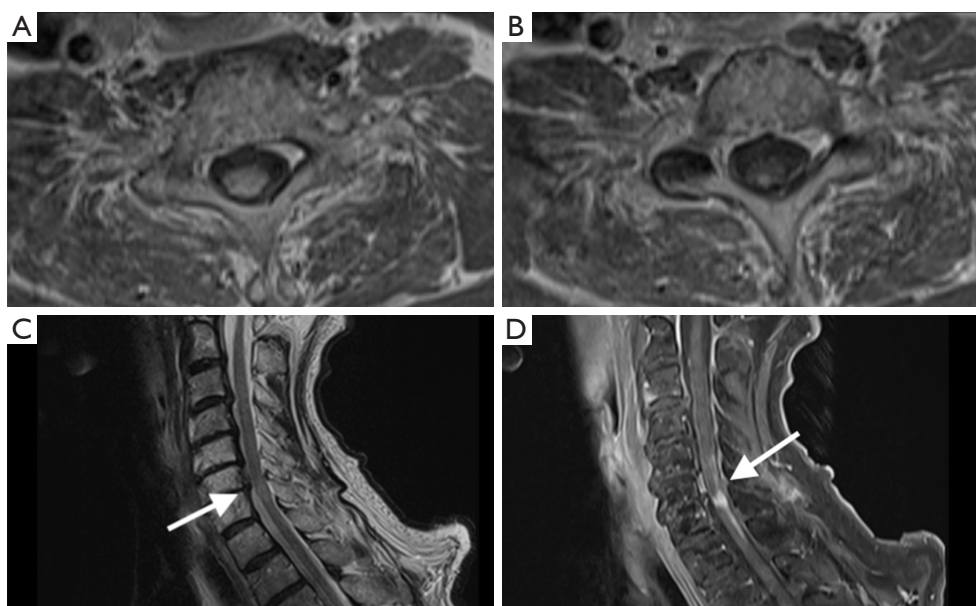


Figure 1 Original image of pre-treatment MRI with and without contrast. (A) Axial T1-weighted image with contrast at the upper body of C7. (B) Axial T1-weighted image with contrast, through the mid body of C7, demonstrating a small focal area of increased contrast enhancement in the posterior spinal cord region. (C) T2-sagittal image where the white arrow is pointing to increased signal within the spinal cord in the upper 2nd/3rd of the C7 vertebral body level with some increased width of spinal cord focally. (D) Sagittal T1-post contrast image where the white arrow is pointing to the focal increased signal uptake within the spinal cord at the upper 2nd/3rd of the level of the vertebral body of C7. MRI, magnetic resonance imaging.

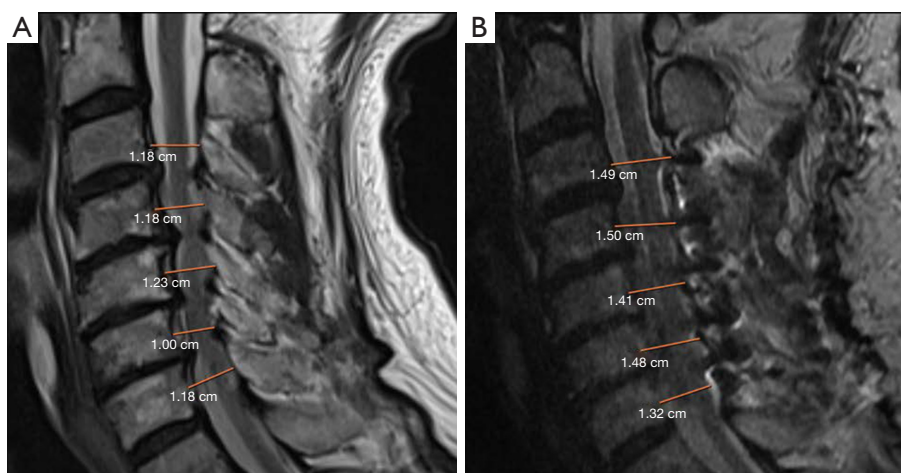


Figure 2 Original image of preoperative MRI (A) demonstrating congenital cervical stenosis and in-between critical degenerative spinal stenosis that extended from C3–C7. An MRI performed immediately postoperative (B) shows a significantly wider canal. MRI, magnetic resonance imaging.

improved bilateral leg sensation, sexual function, and bladder control. At 1.5 months post-laminoplasty, the patient was started on a treatment regimen of peptide receptor radiotherapy (PRRT) with Lutathera[®]

(lutetium Lu 177 dotatate) lasting 10 months. The risk of pseudoprogression of the lesion following PRRT with resulting increase of spinal cord pressure was noted and was addressed with dexamethasone as needed. Within 3 months

of the operation and 1 month after beginning radiotherapy, the patient demonstrated marked additional improvement in leg mobility, regaining the ability to move his right toes.

At his 9-month follow-up appointment, the patient showed further neurologic improvement with heightened sensation in his lower extremities with 3/10 pain and renewed sensation to urinate and intermittent erections which were not present prior to surgery or radiotherapy. Additionally, at this time, the patient denied his previous lower back pain. Overall, the patient demonstrated no sign of worsening myelopathy and has continued to be pleased with his continued progress as well as ability to undergo radiotherapy without major neurologic complication.

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Publication of this case report and accompanying images was waived from patient consent according to the Advara ethics committee/institutional review board.

Discussion

Observations

Cervical spinal cord compression can have global effects throughout the body including pain, paresthesia, and weakness of the extremities as well as imbalance. If left untreated, continued cord compression may lead to further neurological deterioration and result in permanent cord and nerve damage (8). Surgical treatments for cervical myelopathy include anterior discectomy and fusion, laminectomy and fusion, and laminoplasty. Non-fusion procedures may be preferred over fusion procedures if their benefit is equivalent in patients in need of radiation and chemotherapy, or for those who have already had radiation therapy to the surgical field, which may result in impaired bone healing. In patients anticipating radiotherapy and/or chemotherapy, fusion procedures may be less desirable, due to an increased risk of pseudarthrosis and instability following radio- or chemotherapy (9,10). A laminoplasty is able to achieve cord decompression without the need for fusion and may therefore be preferred over laminectomy and fusion in these patients.

When cervical stenosis is coupled with an expanding intramedullary lesion, patients may be at an even greater risk for worsening cervical myelopathy due to the combined effects of bone deterioration and lesion

advancement. While radiotherapy is the first-line treatment in many instances of ISCM, it also carries the risk of further neurologic dysfunction due to radiation-induced progressive perilesional edema and inflammation (11). This inflammation may not only hinder diagnostic efforts but also further compress the spinal cord and exacerbate neurological symptoms. By prophylactically expanding the vertebral canal, a cervical laminoplasty may serve to prevent additional compression of an already narrow spinal canal undergoing tumor infiltration.

A prior study has noted the importance of prophylactic expansion of the space available to the spinal cord in order to prevent radiation-induced myelopathy. Fiss *et al.* described the prophylactic use of duraplasty in patients with unresectable malignant intramedullary lesions or metastases prior to radiotherapy (12). The authors utilized a spinal expansion duraplasty to enlarge the intrathecal volume in order to preemptively mitigate spinal cord edema and associated neurologic decline resulting from radiotherapy.

Although this treatment was effective in maintaining intraspinal pressure and cord perfusion that may be compromised by radiotherapy, duraplasty would require a full laminectomy to be performed. This would require a spinal fusion in the cervical spine to avoid subsequent kyphoscoliosis (13). Therefore, in patients for whom a bony cervical decompression is needed but stabilization is not required, a laminoplasty may be more appropriate as a first-line choice for managing patients with pre-existing cervical stenosis. With this procedure, if the patient subsequently develops problems suggesting a need for additional decompression, the laminoplasty can at any time later be converted to a laminectomy and fusion with expansile duraplasty.

This patient serves as an example of the protective and therapeutic effects of a decompressive cervical laminoplasty for patient with spinal tumors. After treatment of his cervical stenosis, the patient experienced immediate postoperative neurologic and quality-of-life improvements, likely associated with improvement of myelopathy from the increased diameter of the spinal canal. These improvements subsequently withstood multiple radiotherapy sessions. Despite the side effects of his ongoing cancer treatments, he reported notable improvement in his mobility, pain, and participation in activities of daily living, without having to undergo a much more extensive or painful procedure such as a laminectomy and fusion with expansile duraplasty, and without the risks of radiation-induced wound or fusion healing problems that come with duraplasty and fusion in

the setting of radiation.

Conclusions

Although this patient was not initially offered surgical treatment for his cervical stenosis, likely due to his oncological diagnosis of intramedullary tumor. We present this case to demonstrate that cervical laminoplasty can be performed safely and effectively, even in patients with metastatic disease, to treat the underlying symptomatic stenosis and protect the patient from the potential for spinal cord edema from radiation to a spinal cord lesion in an already narrow spinal canal. Cervical laminoplasty achieves these goals while avoiding potential fusion-related pseudoarthrosis complications that may be exacerbated by radiotherapy, or possible CSF leak complications associated with poor dural healing from expansive duraplasty.

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Footnote

Reporting Checklist: The authors have completed the CARE reporting checklist. Available at <https://jss.amegroups.com/article/view/10.21037/jss-23-27/rc>

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Publication of this case report and accompanying images was waived from patient consent according to the Advara ethics committee/institutional review board.

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