CASE REPORT

Dorsal root entry zone approach in ventral and eccentric intramedullary tumors: A report of 2 cases

Ashish Kumar, Chandrashekhar E. Deopujari, Vikram S. Karmarkar
Department of Neurosurgery, Bombay Hospital Institute of Medical Sciences, Mumbai, Maharashtra, India

ABSTRACT

Intramedullary tumors constitute 2–4% of all the tumors affecting the central nervous system. They include low-grade astrocytomas and ependymomas in majority. Earlier, only biopsy or decompression used to be the best available options for these tumors, but with the upcoming technology and newer techniques, gross total excision with the aim of achieving complete removal has been the preferred treatment for these tumors. Usually, nearly all intramedullary tumors are approached from posterior midline myelotomy as this is the safest corridor to approach under neurophysiologic monitoring. But sometimes, if the tumor is exophytic, eccentric, or ventral to the cord, other routes of access may also be useful. These approaches are less frequently used these days and actually may be found useful in certain cases. Hence, they should not be termed "obsolete" and must be kept in mind for tumors in specific location. We describe a similar less commonly used dorsal root entry zone approach for near total excision of ventral and eccentric cervical pilocytic astrocytomas in two patients.

Key words: Dorsal root entry zone, pilocytic astrocytoma, ventral intramedullary tumors

Introduction

Intramedullary tumors have been as intriguing in their surgical management as their pathology. They involve both children and adults and present with signs and symptoms of myelopathy with a gradual progressively worsening course. Most of them commonly involve the cervical and thoracic region in young patients, while lumbosacral cord is commonly involved in adults. Surgical approach has changed gradually over the past few years and now more aggressive resections have been carried out to achieve a gross total excision and offer a good long-term recurrence-free survival. Traditionally, these intramedullary lesions are approached from posterior midline myelotomy, and almost complete resections can be carried out with the help of intraoperative ultrasonography, cavitron ultrasonic surgical aspirator, and lasers under neurophysiologic monitoring. Sometimes, though the approach may have to be changed according to the tumor morphology and alternative approaches may have to be used. We report the use of dorsal root entry zone (DREZ) approach in two such patients where it helped us in achieving gross total excision.

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Address for correspondence:
Dr. Ashish Kumar, Bombay Hospital Institute of Medical Sciences, 12, New Marine Lines, Mumbai - 400 020, Maharashtra, India.
E-mail: drashishmch@hotmail.com

Case Reports

Case 1

This 17-year-old boy presented to us with intermittent and severe nocturnal nuchal pain and few episodes of vomiting for last 2 months. He also had occasional difficulty in swallowing and recent change in his voice. On examination, he had weakness (grade IV) and wasting in the left upper limb flexors, while power in the rest of the muscle groups was normal. The reflexes in the lower limbs were brisk and the gag reflex was depressed on the left side. There was some hypesthesia in the left C8 dermatome and the gait was normal with no other signs of myelopathy (McCormick grade I). The sagittal magnetic resonance imaging (MRI) revealed a cervicomedullary lesion with an exophytic portion in the lower half, lying ventral to the cord [Figure 1]. The axial images showed its eccentricity to the left [Figure 2]. There were cystic areas within and it showed patchy peripheral contrast enhancement. Although in the upper half, the lesion was completely intramedullary which could be accessed via the posterior midline myelotomy, the case proved to be technically demanding as the lower half of the tumor was completely ventral to the cord and significant neural tissue needed to be transgressed before reaching the tumor. We thus modified our approach and used the DREZ approach from the left side for this particular case. Midline durotomy was made and the cord was seen rotated to the opposite side which was further helped by cutting the

dentate ligaments and rotating it further. The tumor removal was started from below where the exophytic portion was tackled first between the roots [Figure 3], and as we moved up the cord the left DREZ [Figure 4] was incised to approach the upper intramedullary component. Piecemeal excision was done with the help of ultrasonic surgical aspirator and tumor forceps [Figure 5] and gross total excision was possible. The histopathology was pilocytic astrocytoma (grade I). The postoperative MRI revealed complete excision without any contrast-enhancing areas [Figure 6]. The patient had a good recovery with grade III power in the left upper limb which gradually improved with time.

Case 2

This 8-year-old boy presented with pain in the neck for 6 months. He had weakness in right-hand grip since 15–20 days along with difficulty in walking which was progressively worsening. On examination, he had grade I power at right shoulder joint while grade II in right elbow flexors. There was hypoesthesia in right upper limb with no sphincteric involvement. The MRI showed an intramedullary tumor enhancing sharply after contrast extending from C2 to D1 region [Figure 7]. The axial sections revealed the lesion to be eccentrically placed [Figure 8]. C2 to D2 laminotomy was done. Intraoperatively, the midline was difficult to identify and the tumor was seen surfacing near right DREZ. Hence, it was approached from the right DREZ and gross total excision was achieved [Figure 9]. The patient was electively ventilated for 48 hours and gradually weaned off later. He had no fresh postoperative deficits apart from increase in weakness of right hand. He recovered well later and was ambulatory at the time of discharge.

Figure 1: T1 weighted, T2 weighted and post contrast sagittal MRI showing cervico-medullary intramedullary tumour with lower ventral exophytic component

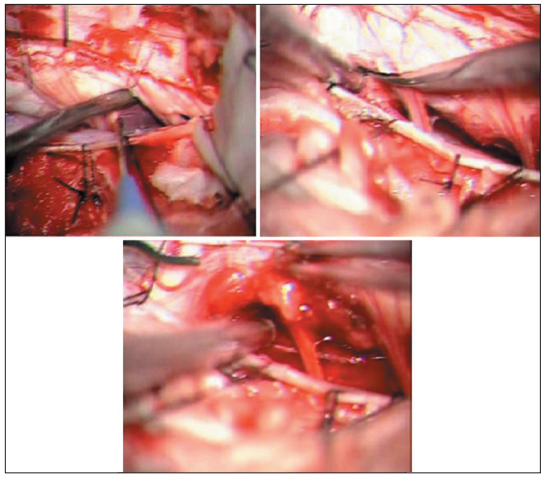

Figure 3: The ventral exophytic component incised with an arachnoid knife and Dorsal root entry zone incision was given to access the upper intramedullary tumour with piecemeal excision being carried out with tumour forceps

Discussion

The intramedullary tumors form 2% to 4% of all the central nervous system neoplasms and 20–25% of all intraspinal tumors.[1-3] The DREZ approach has been used sparingly in the past for surgeries of intramedullary tumors. Currently, most of the series in the literature favor the posterior midline

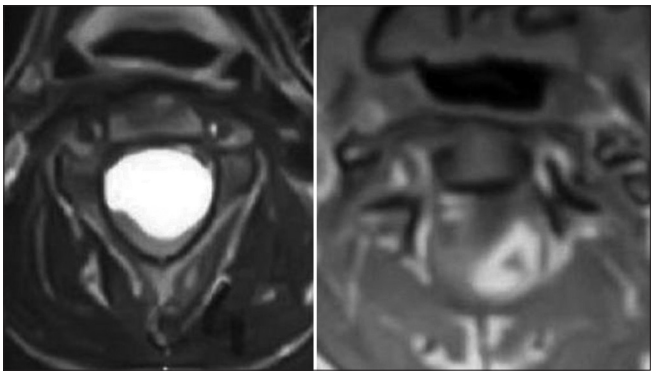

Figure 2: Axial T2 weighted showing the ventral portion and post contrast images showing eccentricity to the left

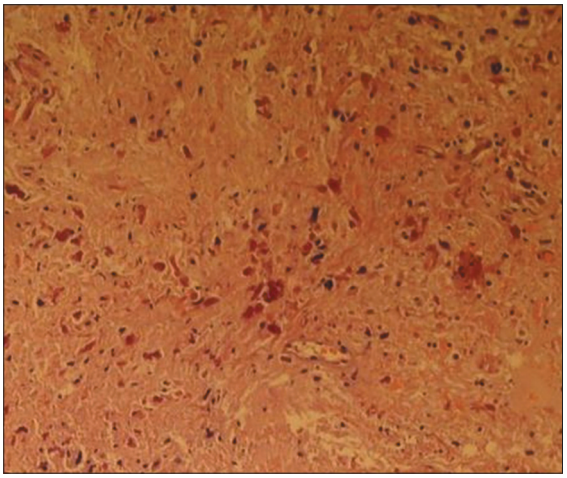

Figure 4: The histopathology confirming the diagnosis of pilocytic astrocytoma (Rosenthal fibres along with typical biphasic appearance)

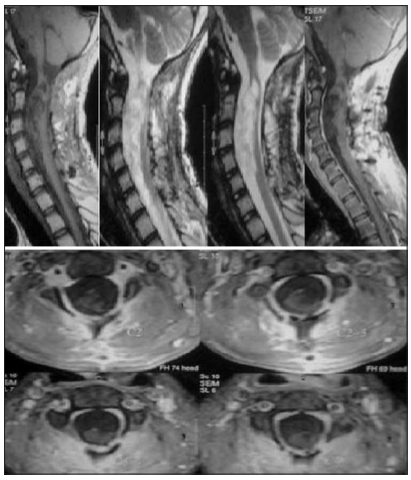

Figure 5: Immediate post-operative contrast MRI showing adequate excision and no residual contrast enhancing regions

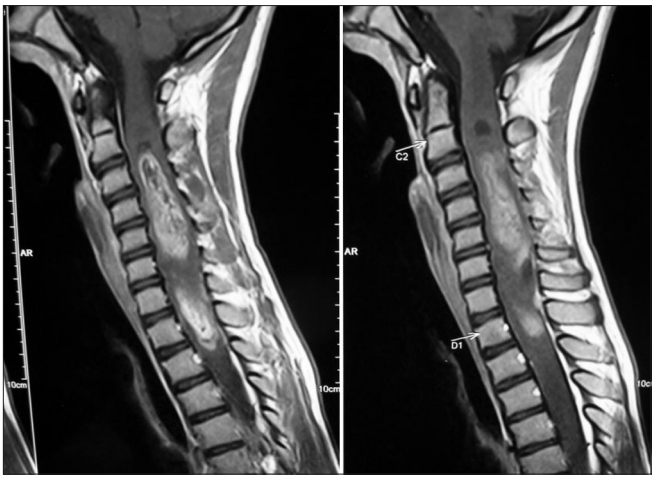

Figure 6: Contrast enhancing intramedullary tumour extending from C2 to D2 levels

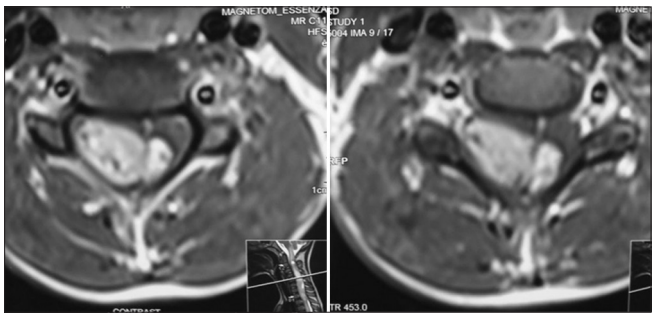

Figure 7: Axial sections showing eccentricity to right side of spinal cord

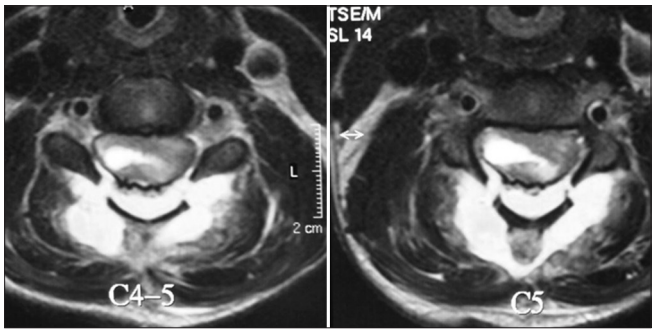

Figure 9: Axial sections showing the gross total excision of the lesion and residual cavity with preservation of posterior cord substance

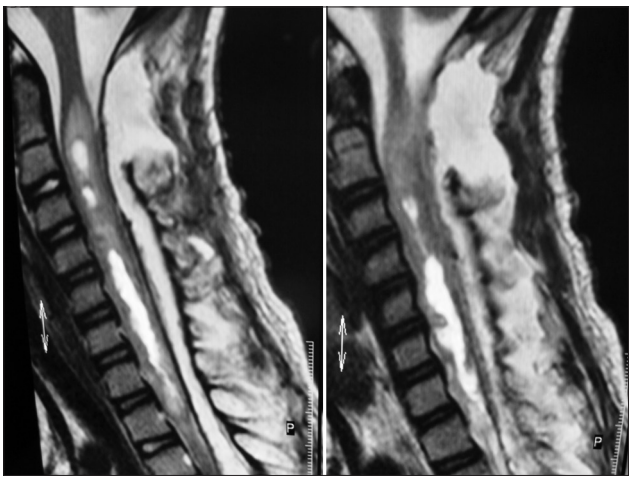

Figure 8: Immediate post-operative T2 weighted images showing gross total excision of tumour with residual cavity

approach as it gives the least invasive and minimally morbid exposure to the centrally placed tumors like ependymomas and astrocytomas. The only drawback of this approach is the involvement of the posterior column tracts and postoperative loss of joint position sense in the lower limbs. In comparison, DREZ approach can be used to reach out to the lesions which are more ventrally placed without transgressing much neural tissue. This approach is not used frequently owing to its limited access and difficult contralateral visualization. The other limitation being the strong disturbing dysesthesia.[4] It has been found useful in patients with asymmetric damage to the central cord where the posterior columns are intact. The posterior midline approach becomes more feasible if the posterior column tracts are already damaged preoperatively.[5] Neurophysiologic monitoring helps to identify the posterior column tracts and prevent their inadvertent damage. Somatosensory evoked potentials (SSEPs) and motor evoke potentials (MEPs) are very useful although SSEPs may disappear once the myelotomy is done. Thus, in this situation the MEPs remain the mainstay guide throughout the surgery and any loss of the recordings or reduction in the D wave amplitude can alarm the surgeon of an impending damage. Usually after DREZ lesioning the spinal cord potentials do not get affected by the ascending volleys while segmental and descending volleys may result in reduced amplitude of the potentials.[6] Although use of anterior approaches has been fairly acknowledged in the past for various intradural extramedullary pathologies like meningiomas,[7] schwannomas,[8] and hemangioblastomas,[9] Ogden *et al*. described a novel anterior approach for a ventral intramedullary tumor which precluded the damage to posterior column tracts.[10] This patient had a ventrally placed pilocytic

astrocytoma which was approached after C7 corpectomy. The chief disadvantage of this approach, however, is the damage to the radiculomedullary arteries and anterior spinothalmaic and corticospinal tracts. Also, anterior approaches cannot be used in tumors extending more than two to three levels. Correctly performed DREZ myelotomy may achieve optimal goals without giving additional deficits to the patient. Any major catastrophe can be avoided by accessing this safe corridor for ventral intramedullary tumors. Our patients were appropriate candidates for DREZ approach due to the eccentricity of the tumor to one side and direct access to the exophytic part. The tumor was readily accessible throughout its length. Also, if required the C1-C2 nerve roots could have been cut for better visualization. However, this was not deemed necessary by us and gross total excision could be achieved.

Conclusions

Posterior midline myelotomy is the standard and most commonly used corridor for approaching intramedullary tumors. However, in certain situations, the approach may have to be tailor made for a given patient and DREZ approach may be found useful in these select cases. Keeping all the available approaches in mind with careful analysis of the imaging morphology preoperatively may help the neurosurgeon select the best approach for each case.

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