INTRODUCTION

Intradural spinal cord tumors are uncommon though mostly benign lesions and fortunately affect only a minority of the population. However, their growths result in compression of the spinal cord, ultimately causing limb dysfunction, motor and sensation loss, and, even death. Despite their rarity, these lesions can pose a challenge for resection. Numerous factors affect the resectability and ultimately the outcome of these lesions.¹ Since Gower and Horsley reported satisfactory results for the first time by removing a tumor located at the T6-7 level in a 42-year-old male in 1887, more aggressive treatment approaches, aimed at preserving and further enhancing the neurological function, have been developed over the past 30 years.²

More than 50% of these tumors are found in the thoracic spine, and they occur in the cervical and lumbosacral spine at a similar rate, 22% and 18%, respectively.³ Intradural extramedullary (IDEM) tumors that are anteriorly located in the upper thoracic spine were found to have the highest rate of surgery-related complications and postoperative neurological deficits.² This finding may be associated with a higher cord-to-canal ratio and a tenuous vascular supply in this region. These tumors are usually treated primarily with an aggressive surgical excision due to improvements of diagnostic and surgical instrumentation as well as microsurgical and neuroanesthesia techniques.⁴,⁵ In addition, great strides have been made recently in the prognosis of surgery due to the development of diagnostic tools, an understanding of the precise anatomical structures, and the advancement of surgical techniques. Nevertheless, early-stage IDEM are difficult to detect. They are not easily differentiated from lower lumbar degenerative disc diseases. These tumors lack obvious clinical symptoms until compression or neurological deficit occurs. However, a delay in surgical removal and treatment can lead to permanent neurological deficits.

This study was, therefore, done to assess the outcome of excision through posterior approach in terms of...
functional recovery in patients with IDEM after surgery, thus it can be taken as standard in such patients with benign but difficult to approach tumors.

**METHODOLOGY**

This interventional study included 38 patients treated surgically for IDEM at Department of Neurosurgery, Jinnah Postgraduate Medical Centre, Karachi, from March 2011 to February 2014; who showed clinical, radiological and histopathological evidence of IDEM on MRI, and were available for a more than 6 months follow-up were enrolled in this study. Those with bleeding disorders, diabetes mellitus, previously operated and with no histopathological evidence of tumor on biopsy were excluded from this study. These patients were admitted through OPD in ward. The clinical signs, symptoms and location of the tumor were noted. These patients were then operated after taking prior written consent and by the same surgical team headed by a consultant. The patients were placed in the prone position under general anesthesia. A laminectomy was performed regardless of the location or type of tumor through the posterior approach alone. A longitudinal incision was made in the dura mater and the tumor was detached from the dura mater and removed. Careful dissection was done when tumor was adherent to nerves with removal of tumor as much as possible. Transpedicular screw was fixed in two cases where the tumor was so large, as to cause posterior instability.

The postoperative evaluations involved an assessment of the neurological findings and were graded according to the MRC classification preoperatively and at the last follow-up at 6 months postoperatively on the prescribed Performa. Grade 5 was muscle contracting against full resistance. Grade 4 was strength reduced, but contraction could still move the joint against resistance. Grade 3 was strength further reduced, such that joint could be moved only against gravity with examiner's resistance completely removed. Grade 2 was muscle could only move if resistance of gravity was removed. Grade 1 had only a flicker of movement seen or felt; and Grade 0 was no movement at all. Good outcome was marked if the patient improves from a lower grade to higher grade, according to improvement in muscle strength assessed on follow-up after 6 months of surgery.

Data was analyzed using SPSS Version 18.0. Categorical variables, such as gender, tumor types, clinical features, tumor location, MRC grading, and post-operative complications were expressed in frequency and percentage, whereas continuous / quantitative variables such as patient's age was expressed in mean with range.

**RESULTS**

The mean age of the patients was 42.6 ±10 years. There were 26 (68.42%) females and 12 (31.57%) males. Meningioma was the commonest tumor (63.15%), followed by neurofibroma (21.05%) and schwannoma (15.78%) as shown in Table I. The commonest location was thoracic as present in 28 (73.68%) patients. Others were cervical (13.15%) and lumbar (13.15%) in 5 patients each. Backache was present in all (100%) patients, motor weakness in 30 (78.92%) patients, sensory disturbance in 5 (13.5%) patients, sphincter disturbance in 7 (18.42%) patients, and shortness of breath in 1 (2.63%) patient. Preoperatively, there were 10 patients (26.31%) in grade 3, 9 (23.68%) patients in grade 0, 8 (21.05%) in grade 1, and 7 (18.42%) patients in grade 2. Postoperatively, after 6 months, there were 23 (60.52%) patients in grade 5, 5 (13.15%) patients in grade 3, 5 (13.15%) patients in grade 2, and 2 (5.26%) patients in grade 1. Regarding postoperative complications, cerebrospinal fluid leakage was observed in 5 (13.15%) patients, deterioration of shortness of breath in 1 patient (2.63%), wound infection in 6 (15.78%) patients, and incontinence in 1 (2.63%) patient. Cerebrospinal fluid leakage was managed non-operatively. Incontinence occurred
in 1 patient with lumbar area tumor and persisted in the follow-up.

**DISCUSSION**

More than 50% of these tumors are found in the thoracic spine, and they occur in the cervical and lumbosacral spine at a similar rate, 22% and 18%, respectively. IDEM are rare and are mostly associated with neurological deficits and radicular and nocturnal pain. Back pain is not commonly described as a concomitant symptom, such that in patients having a tumor and degenerative spine disease, any back pain is typically attributed to the degeneration rather than the tumor. According to Shin et al., abdominal pain is the first subjective symptom, most patients complain of paresthesia and motor abnormalities at the time of admission.

Remarkable relationships were found between the symptoms and locations of a tumor. Cervical spine tumors were associated with pain in the neck and motor weakness in the upper limbs. Thoracic spine tumors were related to severe pain in the thoracic spine due to spinal cord compression by the tumor. Paresis of both lower limbs was also more related to thoracic tumors than to the lumbar. The chief complaints of the patients with conus medullaris and cauda equina tumors included bladder and bowel dysfunction and saddle anesthesia. In particular, pain in the lesions of the conus medullaris tend to precede a sphincter disturbance occurring in the later stage. This was attributed to the difficulty in making an early diagnosis because the tumors grow slowly, produce vague symptoms in the early stages, and present with pain and radiating pain, similar to those found in degenerative lumbar disc diseases. Therefore, it is believed that spinal cord tumors should also be taken into consideration as a possible diagnosis when a patient complains of symptoms that are usually found in lower lumbar disc diseases, such as intervertebral disc herniation and spinal stenosis. Regardless of the treatment, diagnosis and treatment before the development of significant neurologic and functional deficits improve outcomes.

It was reported that pedicle and/or vertebral body erosion, foraminal widening, neural foramen widening, and scoliosis were found on plain radiographs in approximately 38 - 56% of patients with an IDEM. MRI is regarded as being a helpful tool with regard to tumors and assessing its size, shape, and anatomical relations with the adjacent structures, as well as in determining the basic treatment guidelines and surgical approaches by allowing early detection of a metatstatic tumor. Spinal cord tumors have usually been removed through total laminectomy, and this method is still used widely. However, this procedure may end up in spinal instability and kyphosis due to the damage to the musculoligamentous structures and posterior bony elements, thus also resulting in spinal and nerve compression. Recently, modified approaches are used which are minimally invasive and may be routinely used to remove IDEM.

Mostly, these tumors are treated primarily with an aggressive surgical excision due to the developments of diagnostic and surgical instrumentation as well as microsurgical and neuroanesthesia techniques. Majority of tumors were with well defined capsule so were easily separated. However, difficulty was encountered in 4 patients, including one with ependymoma, this patient developed incontinence after surgery. Lower preoperative grade yielded better results, while the higher the preoperative grade, the more likely tumor was insufficiently removed. During the procedure, posterior lumbar interbody fusion and instrumentation were also performed in two cases, where the tumors were so large as to cause posterior instability. During this resection, care was taken to remove the sensory nerve branch without damaging the motor nerve branch, using the nerve excitability test. However, the sensation of the removed branch was not easily restored. Early recognition of the signs and symptoms of primary spinal cord tumors facilitates early treatment, potentially minimizes neurologic morbidity, and improves outcome.

Marked improvement was seen in all patients after laminectomy and tumor resection. However 2 (7.69%) patients, 1 with cervical tumor and 1 with Schwannoma, showed no improvement. Patient with cervical IDEM already had respiratory problem, which deteriorated after surgery, however later on improved on conservative management. Different studies have also shown good results after surgery of such lesions in terms of functional outcome in these benign tumors. However, locations of tumor, preoperative grade, duration of symptoms and extent of surgical resection along with histopathological diagnosis have an impact on tumor outcome.

**CONCLUSION**

IDEM, which are detected by MRI and tend to be histopathologically benign, can be separated completely from the spinal cord by surgery without any difficulty. In addition, good treatment outcomes and prognoses can be expected after surgical removal of such tumors. Therefore, aggressive surgical approaches for the treatment of IDEM are recommended.

**REFERENCES**


