Unilateral Hemilaminectomy for the Removal of the Spinal Space-Occupying Lesions

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In this study we have evaluated 40 patients with spinal lesions with respect to the value of unilateral hemilaminectomy. Our case study group included 29 intradural extramedullary, 6 intramedullary, and 5 extradural tumors. The thoracic spinal cord was involved in 17, the lumbar region in 13, and the cervical spinal cord in 10 cases. The mean age of the 20 males and 20 females was 35 (range 6–71). The rationale for choosing a unilateral approach is to preserve musculoligamentous attachments and bony posterior elements as much as possible. We did not observe any complication relating to unilateral hemilaminectomy. The patients were mobilized the following day after surgery or given rehabilitation therapy beginning on the second postoperative day without the use of any external support. At follow-up evaluation, a mean of 32 months postoperatively, none of the patients showed spinal deformity or spinal instability.

Key words: Hemilaminectomy – Spinal tumors

Introduction

It was shown clinically (1,2,3,4,5,6,7,8) and biomechanically (9) that iatrogenic destruction of posterior elements of the spinal column may cause spinal instability. When it is identified, stabilization of the affected segments should be performed. In order to reduce the risk of post laminectomy spinal instability and deformity, *Raimondi* (5) and *Parkinson* (4) recommended osteoplastic laminotomy which was originally described by *Bickham* (10) and *Hoffmann* (11). It is also recommended to fuse the spine primarily at the time of the initial decompressive laminectomy (12).

In lieu of these corrective or preventive procedures, a more limited approach, a unilateral hemilaminectomy is an alternative in most instances of intramedullary and extramedullary tumors of the spine. Unilateral hemilaminectomy was reported by *Taylor* (13, 14) in the beginning of spinal surgery and was popularized by *Eggert* et al. in the 1980's (15, 16). As damage to ligaments and intervertebral joints is much less significant with this technique, the chances of development of spinal instability and postlaminectomy kyphosis are greatly reduced (17). In this study, 40 patients suffering from spinal space-occupying lesions were studied with respect to the value of unilateral hemilaminectomy.

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Patients and Methods

Between the years 1988 and 1995, we operated on 40 patients with spinal space-occupying lesions by using the unilateral approach. The patient population consisted of 20 females and 20 males, ranging in age from 6 to 75 years. All patients suffered from local or radicular pain and sensory or motor disturbances of the extremities. Preoperative neurological examination revealed weakness of the extremities in 26 patients, sensory disturbances in 20 patients, and sphincter dysfunction in 10 patients. In all cases MRI was used to demonstrate the site and location of the tumor (Fig. **1a,b**). Three months post surgery, MRI's of all patients were obtained (Fig. **2a,b**). Preoperative, early postoperative, and late postoperative spinal X-rays were also obtained to evaluate spinal instability.

Intradural extramedullary tumors (72.5%, n = 29) accounted for most of the tumors (Table**1**). The thoracic spine was involved in 17 cases, the lumbar spine in 13, and the cervical spine in 10. Two of the lesions were seeding of medulloblastoma, 2 were haematogeneous spreading of tuberculosis, and the others were primary tumors.

Three patients with upper cervical lesions were operated on in a sitting position. The others were operated on in an prone position. A Mayfield headrest was used for patients with cervical lesions. All operations were performed under general anesthesia with orotracheal intubation and invasive blood pressure monitoring. Mean surgery time was 204 ± 68 minutes. Blood transfusion was needed in only four cases. There were no complications with respect to anesthesia and positioning. If level determination was needed, radiography was undertaken perioperatively. According to the size of the lesion, a longitudinal midline incision was performed. Fascia and paravertebral muscles were dissected subperiosteally from the spinous process unilaterally. By using an intraoperative microscope and high speed drill (7 mm and 3 mm osteotomy burr) hemilaminectomy was performed. The vertebral arch was drilled from medial to lateral and continued until the ipsilateral root or roots were seen. The ligamentum flavum was removed and the base of the spinous process was also drilled until the contralateral root or contralateral dural curve was seen (Fig. **3**). As necessary, parts of the articular process and the pedicle were removed and dural aspect of the contralateral lamina was minimally drilled. In intradural lesions the dura was opened longitudinally in the midline. After the tumor

Fig. 1a, b T1 weighted gadolinium enhanced sagittal and axial MRI demonstrates heterogeneously enhancing, broad-based meningioma of the cervical spine.

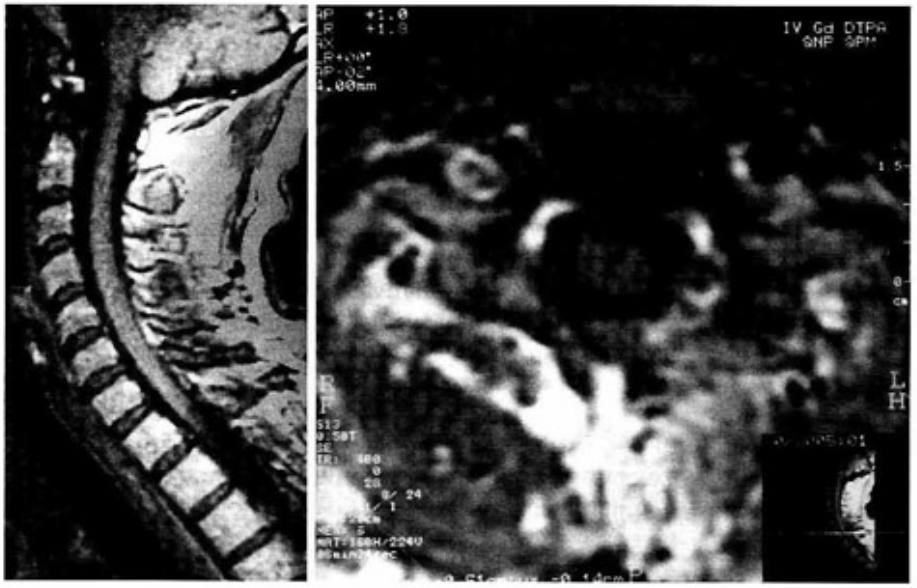

Fig. 2a, b An MRI (T1 W Gd-DTPA enhanced), done four months postoperatively demonstrates the tumor resection and normal spinal alignment.

	Intramedullary	Extramedullary	Extradural	Total
Cervical	Ependymoma (1)	Medulloblastoma (1) Neurinoma (5) Meningioma (2)	Sarcoma (1)	10
Thoracal	Tbc (1) Ependymoma (3) Cavermoma (1)	Neurinoma (6) Meningioma (3) Paragangioma	Tbc (1) Sarcoma (1)	17
Lumbar	Ø	Ependymoma (6) Neurinoma (2) Paragangioma (2) Medulloblastoma (1)	Sarcoma (1) Osteoblastoma (1)	13
Total	6	29	5	40

Table 1 Localization and nature of the lesions.

was exposed, it was first decompressed internally by removing piecemeal, if necessary using CUSA, then the tumor was pulled away from the spinal cord and by using cleavage was removed totally. By doing this any pressure on the spinal cord was avoided.

Tumor was removed totally in 37 cases and subtotally in 3 cases according to the assessment by the surgeon. In two patients with medulloblastoma seeding we could not find any cleavage due to infiltration of the spinal cord and tumors were excised subtotally. In a lumbar paraganglioma case, due to tight adherence of the tumor to the cauda

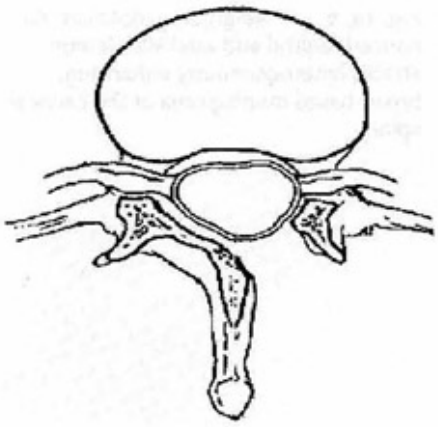

Fig. 3 A wide hemilaminectomy is performed then, using a high-speed drill, the spinous processes is undercut to gain access to the contralateral side.

equine fibers it was impossible to remove the tumor totally. In most of the cases, tumors were exposed with 2 or 3 levels hemilaminectomy, in one case 7 levels (C_2-T_1) hemilaminectomy was necessitated. We have never used corticosteroids, pre- or postoperatively. Postoperative pain was relieved by narcotic analgesics for the first day and then by nonsteroidal anti-inflammatory drugs. External orthotics were not used. Regarding their neurological status, the patients were mobilized at the latest one day postoperatively or were given rehabilitation therapy beginning on the second postoperative day.

Neurological status did not change in 20 cases, 18 patients have shown full neurological recovery and 2 cases were complicated with sphincter disturbances in the early postoperative period. We did not observe any wound infections. We have treated CSF leakage by lumbar external CSF drainage in one case. At follow-up evaluation, a mean of 32 months post surgical intervention none of the patients showed kyphosis or scoliosis.

Discussion

In this study we have evaluated surgical results of 40 cases of spinal tumors which were removed by using microsurgical hemilaminectomy and we suggest that the unilateral approach is the optimal way for most of the spinal tumors in respect to exposition and resection of the lesion and preserving the spinal stability. Post-laminectomy kyphoscoliosis is the major problem which may occur within weeks to years after laminectomies for tumor or trauma (1,2,4,5, 6,7,18). Kyphosis is commonly associated with instability and results in an anterior compression of the spinal cord or nerve roots (18,19,20,21,22). In order to reduce the risk of postlaminectomy kyphosis, *Raimondi* (5) and *Parkinson* (4) recommended osteoplastic laminotomy, *Herman* and *Sonntag* (23) recommended anterior decompression and fusion using cervical plating in patients presenting with progressive kyphosis and instability after laminectomy for either cervical spondylosis or spinal tumors. It was proven that laminectomy may cause postoperative spinal instability due to damage to ligaments and intervertebral joints (1,2,3,4,5,6,9,24). The rationale for more limited approaches to the vertebral canal than laminectomy is to preserve the structures important in spinal stability. If hemilaminectomy is sufficient to expose and remove the lesion then why laminectomy? It is also possible to extend hemilaminectomy into laminectomy at any stage of the procedure. *Chiou* and *Eggert* (16) reported their experience in 256 spinal tumors which were removed by using unilateral or bilateral hemilaminectomy. They compared these two approaches and concluded that the unilateral approach can be applied to extradural tumors without disadvantage and in intradural, extramedullary tumors it was seen to be even superior to bilateral laminectomy. With development of MRI, it is possible to demonstrate shape, size, and relations to the cord of spinal tumors precisely. MRI and microsurgical techniques allows us to reach and remove spinal tumors by a minimal invasive approach. In the surgery of the spinal tumors our goals were to obtain adequate exposure of the lesion, to remove the lesion totally without injury to the spinal cord, nerve roots or vascular structures, and to protect the structures important for stability as much as possible. Here we have reviewed our results relating to microsurgical unilateral approaches to spinal tumors. In all cases but 3, it was possible to remove the lesion totally. In these 3 subtotally resected tumors, the problem was the invasiveness of the tumors, not the chosen surgical approach. We did not observe any disadvantage of hemilaminectomy in our series. The only complication was CSF leakage which was treated by lumbar external drainage. The follow-up period is relatively short to evaluate long-term stability; however, the value of hemilaminectomy in exposing and removing the lesion and in preserving the spinal stability is satisfactory.

In conclusion, it is possible to remove all spinal tumors except bilaterally extensive invading extradural tumors by hemilaminectomy with the aid of microneurosurgical techniques.

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