



## Unilateral Laminectomy Approach for the Removal of Spinal Meningiomas and Schwannomas: Impact on Pain, Spinal Stability, and Neurologic Results

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■ **BACKGROUND:** Spinal intradural tumors are usually removed with laminectomy/laminotomy with a midline dural incision. Pain, discomfort, postoperative kyphosis, and instability may be minimized with unilateral microsurgery.

■ **METHODS:** Seventy patients with schwannoma (73 tumors) and 27 patients with meningioma (29 tumors) were operated on with unilateral hemilaminectomy (June 2000 to March 2014). Surgery was generally kept to 1 or 2 levels, removing all the craniocaudal ligamentum flavum. Careful radioscopic identification is mandatory; in thoracolumbar schwannomas, the tumor may be mobile; in the prone position, it may move cranially than appears on magnetic resonance imaging. The dura was opened paramedially, and the tumor was dissected and removed either en bloc or piecemeal after ultrasonic debulking. Neurophysiologic monitoring was performed. The tumor was approached tangentially with no cord rotation or minimal manipulation. Average duration of surgery was 160 minutes (100–320 minutes). Removal was total in 72 of 73 schwannomas; Simpson grade was 1 in 10 meningiomas and 2 in 19.

■ **RESULTS:** Patients with no complications were discharged on day 5–7. Ten patients had orthostatic headaches; 2 had pseudomeningocele that required reoperation. Pain improvement (Dennis Scale) was significant either at discharge or at follow-up ( $P < 0.0001$  schwannomas,  $P < 0.001$  meningiomas). Neurologic results (McCormick Scale, Karnofsky Performance Score) were excellent/good: of 39 patients with preoperative neurologic impairment, 19 recovered completely, 17 had minor spasticity, and 3 had moderate spasticity but autonomous ambulation. Sphincters

recovered in 5 of 10 patients. At follow-up, average Karnofsky Performance Score improved from 60 to 90 ( $P < 0.0001$ ) and the McCormick score decreased from 121 to 55 ( $P < 0.0001$ ). No spinal instability was observed.

■ **CONCLUSIONS:** Neurologic and oncologic results were good and postoperative pain and discomfort were reduced. Stability was preserved with a unilateral technique. No bracing was necessary, permitting early rehabilitation.

### INTRODUCTION

Total single-level or multilevel laminectomy/laminotomy has been widely used in neurosurgery for the removal of spinal intradural/extramedullary tumors.<sup>1–4</sup> This approach has been advocated to widely expose cord, roots, and tumor, thus minimizing the risk of damage as a result of improper surgical manipulation.<sup>3</sup>

However, this approach causes destruction of posterior bony structures and the interspinous ligament and detaches the paraspinal muscles bilaterally.<sup>5,6</sup> This may result in at least temporary external bracing, severe and prolonged postoperative pain, and risk of late spine instability or kyphosis,<sup>7–10</sup> as well as persistent back pain.<sup>11</sup> For anteriorly placed tumors, the cord must be manipulated or rotated after section of the dentate ligament, with increased risk of neural damage.

Despite the use of microsurgery<sup>12,13</sup> and the development of minimally invasive techniques, the unilateral approach does not appear to be popular or the approach of choice. Few studies have been reported in the literature in recent years,<sup>14–22</sup> and neurosurgical textbooks mention its use only for small, laterally located

#### Key words

- Hemilaminectomy
- Minimally invasive neurosurgery
- Pain
- Spinal meningioma
- Spinal schwannoma
- Spinal surgery

#### Abbreviations and Acronyms

- KPS:** Karnofsky Performance Score  
**MRI:** Magnetic resonance imaging

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Citation: *World Neurosurg.* (2016) 85:282–291.  
<http://dx.doi.org/10.1016/j.wneu.2015.09.099>

Journal homepage: [www.WORLDNEUROSURGERY.org](http://www.WORLDNEUROSURGERY.org)

Available online: [www.sciencedirect.com](http://www.sciencedirect.com)

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tumors.<sup>4,23,24</sup> Only recently has it been suggested as a definite valuable surgical option.<sup>25</sup> There are no literature data on the length of hospital stay of these patients. With regard to postoperative pain, Tarantino et al.<sup>11</sup> recently reported 59.6% of residual back or wound pain after 1 year, having used the bilateral approach.

In 2008, one of the largest series of spinal schwannomas was reported.<sup>26</sup> Conventional laminotomy or hemilaminotomy was used to remove most of the lesions. Pain was recognized as the most common presenting symptom irrespective of tumor level or location. Even if the Karnofsky Performance Score (KPS) was reported to be significantly higher at the follow-up than preoperatively, no details specifically addressing pain management and results were given.

In 2004, we published our first experience with a small series of 10 patients with thoracolumbar schwannomas who were operated on using the unilateral approach.<sup>17</sup> In this article, the results that we obtained in a larger series of patients with both spinal schwannomas and meningiomas are reported.

## METHODS

Ninety-seven patients diagnosed with intradural extramedullary tumor were operated on at our institution using the hemilaminectomy approach between June 2000 and March 2014: 70 had schwannomas (73 tumors) and 27 had meningiomas (29 tumors). Other intradural extramedullary tumors were excluded, as well as 5 more patients with posterior meningiomas and bilateral dural involvement, who were operated on with a bilateral laminotomy. Four patients had multiple tumors: one had 3, the second had 2 distinct lumbar schwannomas, the third and fourth had 2 distinct dorsal meningiomas.

### Surgical Technique

The surgical technique was similar to that was pioneered by Yasargil et al. in 1991<sup>13</sup> and that we described with fewer details in previous studies.<sup>17,27</sup>

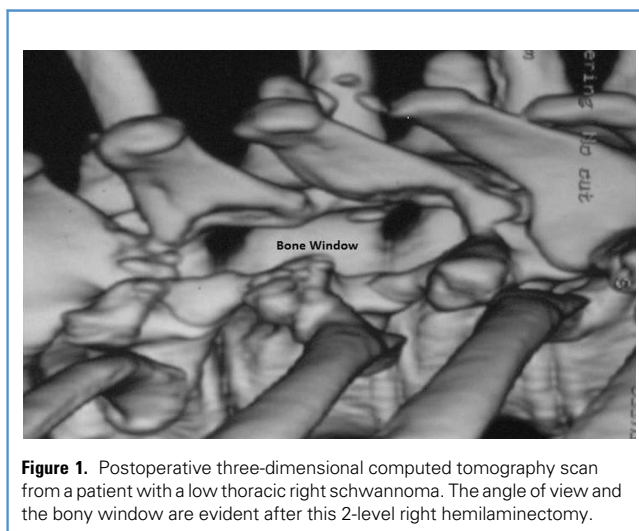
The genupectoral position was used for small lumbar tumors in young patients. For all others, the prone position was used to avoid venous stasis in the lower limbs. For dorsal and cervical tumors, the patient was placed in the prone position with the head fixed in the cranial 3-pin headrest to avoid prolonged neck rotation or facial decubitus. Combined motor and somatosensory evoked potentials were routinely monitored in thoracic and cervical tumors. Somatosensory evoked potentials and motor evoked potentials did not significantly change during surgery from the baseline recorded after patient positioning on the operating table. Stimulation was used to identify the unaffected rootlets in lumbar and cervical lesions. This allowed safer dissection of the tumor from the main root.

After careful radioscopic identification, the skin was incised medially for the required length (5–10 cm). A paramedial incision was used for fascial opening and the paraspinal muscles were detached on that site and retracted. Flavectomy of the nearest interlaminar space to the tumor was performed under microscopy. Then, a single-level hemilaminectomy was performed with bone forceps or a high-speed drill. Lateral extension to the joint is generally unnecessary, but partial facetectomy may be sporadically

required in patients with bone hypertrophy. Hemilaminectomy should also be extended to the cranial or caudal interlaminar space, and, if necessary, also to a second lamina (Figure 1). Additional space may be gained by removing the deepest portion of the interspinous ligament for 2–3 mm with Kerrison bone forceps. However, given the patient's prone position (contrary to the supine position used in magnetic resonance imaging [MRI] diagnosis), the tumor (lumbar but also thoracic schwannomas) may migrate cranially with the extension of the cord because of the position on the operating table. Thus, if the mass is not identified, it should be sought first by extending the opening cranially. Intraoperative echography imaging using dedicated probes is helpful before meningeal opening. The dura is then opened paramedially, leaving enough medial flap to permit an easy suture. Cord or roots are then visualized through a tangential corridor. Visualization may be enhanced by rotating the operating table to obtain good exposure of the ventral cord. The tumor may be removed en bloc (Figures 2, 3 and 4) or piecemeal (Figure 5), depending on its consistency and size. The use of an ultrasonic aspirator device is required to reduce tumor volume. We resected only the involved rootlet, sparing the main root in schwannomas. In thoracic meningiomas, a root may be sacrificed to gain more working space. Section of the dentate ligament to rotate the cord may be unnecessary with this tangential approach (Figures 2 and 5).

Up until 6 years ago, the dura was closed with 5-0 or 6-0 long-term resorbable sutures. Having had 2 patients requiring surgical revision because of dural closure failure, we prefer unresorbable suturing material (6-0 Prolene). In 8 patients with meningioma, whose dura had been partially resected, a patch with fascia and fat was used for a good closure. In these cases and in others in which the suture does not seem acceptable, application of a sheet of dural sealant is useful.

The duration of surgery ranged from 100 to 320 minutes (average 160 minutes). The cases of double-level thoracic meningioma, removed in 1 stage, and the huge cervical dumbbell schwannoma were the most time consuming. One patient with



**Figure 1.** Postoperative three-dimensional computed tomography scan from a patient with a low thoracic right schwannoma. The angle of view and the bony window are evident after this 2-level right hemilaminectomy.

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