Usefulness of Hemilaminectomy for Microsurgical Management of Intraspinal Lesions

Helmut Bertalanffy1), Shinji Mitani, Mitsuhiro Otani, Kiyoshi Ichikizaki2) and Shigeo Toya

Department of Neurosurgery, School of Medicine, Keio University, Tokyo, Japan, University of Freiburg, Freiburg, Germany1) and The Second Tokyo National Hospital, Tokyo, Japan2)

(Received for publication on December 13, 1991)

Abstract. Hemilaminectomy is a limited, unilateral approach to the spinal cord that provides excellent exposure of the dorsolateral and ventral portions of the spinal canal. This approach is most suitable for microsurgical management of the majority of extramedullary tumors. Contrary to conventional laminectomy, the posterior supporting structures of the spine are completely preserved on the contralateral side with this access route. The procedure has been applied in 3 patients who harbored a cervical neurilemmoma, a cervical lipoma, and a thoracic neurilemmoma, respectively. Optimal exposure of the lesion was achieved in each case, and each patient’s symptoms improved or completely resolved postoperatively. There were no surgical complications. It is concluded that hemilaminectomy combined with microsurgical techniques should be given priority over standard laminectomy in the surgical management of extramedullary lesions arising in the spinal canal. (Keio J Med 41 (2): 76-79, June 1992)

Key words: spinal stability, spinal tumor, microsurgery

Introduction

Standard laminectomy is the classical surgical technique for exposure of the spinal cord,1-4 and the most frequently applied procedure for treatment of intraspinal lesions. Multiple level laminectomy, however, may be followed by deformity or instability of the spinal column, particularly in children, but also in adults.5-9 To overcome this disadvantage, reconstructive procedures with instrumentation,9 or laminoplasty,5 have been proposed. Yet, even with these methods, initial destruction of posterior supporting structures is unavoidable, and postoperative immobilization may become necessary.5

Analysis of a large patient population has demonstrated that an equally good operative exposure of the spinal cord, and even better surgical results, may be achieved with a unilateral approach combined with microsurgical techniques.10,11 Since hemilaminectomy is still infrequently applied by spinal surgeons, we feel encouraged to present three patients with intraspinal lesions who underwent tumor removal via this access route. The purpose of the present communication is to illustrate the utility of the unilateral approach to the spinal canal.

Surgical Procedure

In the majority of cases, the patient is placed in the prone position. A lateral park bench position may be preferable in cases of high cervical lesions. When the thoracic or lumbar regions are involved, where localization by palpation alone is not sufficient, a radiograph is taken after positioning with an external marker fixed on the patient’s back. This allows exact correlation between level of the skin incision and correct vertebral level. The skin incision is longitudinal, either over the midline, or, for access to the C1-C2 region, paramedian. To avoid unnecessary tissue damage, the length of the skin incision can be somewhat smaller than the longitudinal extent of deep exposure. Similarly, to minimize muscular trauma, only the involved ipsilateral laminae, and approximately half of the adjacent laminae, are exposed. Hemilaminectomy is performed with an air...
Fig 1 Illustration demonstrating the principle of the unilateral approach to the spinal canal. The spinous process and its base, as well as the contralateral lamina including the ligamentum flavum and all muscle attachments, are preserved. If necessary, lateral drilling may be extended to the facet and pedicle. The arrows indicate the various angles of visualization with the operating microscope.

drill and rongeur. Care must be paid to not completely remove the base of the spinous process, but to preserve its junction with the contralateral lamina (Fig 1). With this procedure, all dorsal static structures of the contralateral side are preserved. Extrudal tumors are removed in a piece-meal fashion, or, for instance in cases of neurilemmomas, after initial intracapsular decompression. Medial dissection is carried out with traction upon remaining tumor parts always in a lateral direction, in order to relieve the pressure from the cord. By changing the angle of the operating microscope, virtually all aspects of the thecal sac and spinal canal can be sufficiently visualized (Fig 1). Visualization is also facilitated by alternately tilting the operating table approximately 15° towards each side.

Case Reports

Case 1

This 57-year-old man sought treatment for mild dysesthesia of the extremities and a difficulty in walking. He first noticed a small mass at his left occipito-nuchal region 3 years before admission. Thereafter, the mass has gradually enlarged. On admission, there was impaired deep sensation and moderate spasticity with bilateral extensor plantar responses, but no paraparesis. Preoperative magnetic resonance imaging (MRI) scans are shown in Fig 2. Operation was performed with the patient in the lateral park bench position. A subnuchal tumorous mass was dissected free and gradually removed. The great occipital nerve which emerged from its distal portion, was cut after bipolar coagulation. The intraspinal portions of the tumor was removed after performing a C1-hemilaminectomy (Fig 3), and a dural area of approximately 1 cm² at the zone where the C2 root emerged from the thecal sac, was resected and replaced with a graft. Histological examination of the surgical specimen confirmed the diagnosis neurilemmoma. The postoperative course was uneventful, and the patient’s symptoms gradually normalized.
Case 2

This 57-year-old female presented with marked gait disturbance and dysesthesia over the scalp and upper extremities. The patient's symptoms have gradually developed over a period of 13 years, but rapidly worsened 3 months prior to admission when her gait became unsteady and she required support. MRI scans of the craniospinal junction on sagittal view demonstrated a dorsolateral spinal lipoma extending from the medulla oblongata to the middle C3-level. Neurological examination documented a sensory level at D1 and mild hyperreflexia in all extremities. Surgery was performed with the patient in the lateral park bench position. Following C1- and C2-hemilaminectomy, approximately 80% of the tumor mass were removed with the aid of the Cavitron Ultrasonic Surgical Aspirator (CUSA). Most of the dorsal C2 rootlets were encased by the lipoma, but could be preserved. Total removal of the mass was not attempted since there were no well-defined boundaries to the atrophic cervical cord. The patient experienced no additional neurological deficits postoperatively, and her symptoms gradually improved.

Case 3

This 52-year-old woman had suffered a poliomyelitis in her childhood which led to permanent weakness of her left leg and slight gait disturbance. Eight months prior to admission, the patient noted paresthesias in both legs and back pain involving the left trunk. These symptoms progressed over the following months, and her gait disturbance gradually worsened. Neurological examination revealed paraparesis (3/5 in the left and 4/5 in the right leg), a sensory level at D8 with hypesthesia and hypalgesia, and severe gait disturbance. Pertinent neuroradiological findings are shown in Figs 4 and 5. Surgical exploration was performed with the patient in the prone position. An extradural tumor, a neurilemroma, was exposed by D8-hemilaminectomy, and bony drilling was extended to the ipsilateral pedicle since the tumor also invaded the vertebral body (Fig 5). Radical removal of the lesion was achieved without producing additional deficits or spinal instability. The patient's symptoms that were caused by the spinal tumor resolved completely over several weeks.

Discussion

The primary goal of spinal tumor surgery is to decompress the cord and/or the involved spinal roots, whenever possible by radical resection of the underlying space-occupying lesion, without creating spinal instability, and avoiding damage to the neural elements.

Our results as well as reports from the literature,10–13

Fig 4 Case 3. Preoperative gadolinium-enhanced T1-weighted MRI. The sagittal (left) and axial (right) sections show a well-demarcated mass at the level of the eighth thoracic vertebra. The tumor consists of a predominantly cystic intraspinal portion that compresses the thoracic cord, and a solid paraspinal mass that extends to the pleura.

Fig 5 Top: Preoperative contrast-enhanced CT scan showing partial destruction of the left lamina, articular facet, transverse process and pedicle of the eighth thoracic vertebra. Bottom: Postoperative CT scan (bone window) demonstrating complete tumor removal and showing the surgical approach.
clearly demonstrate that this goal may be achieved with excellent results via a unilateral approach. Success of such a procedure requires knowledge of the exact anatomical location and extent of the lesion, and the ability to work in a narrow surgical field. The former is provided by modern neuroradiological techniques, in particular by MRI with triplanar sections, the latter by microsurgical methods including optimal illumination and magnification.

Chiou et al.11 recommended hemilaminectomy for any kind of spinal tumor, in particular for juxtamedullary lesions, because a higher rate of surgical radicality, fewer complications, a shorter duration of hospitalization and better early results were found in their group of patients who underwent hemilaminectomy, as compared to the laminectomy group. The main advantage of hemilaminectomy is the complete preservation of dorsal static structures of the vertebral column, such as the spinous processes, the interspinous and supraspinous ligaments, and the unilateral preservation of the intervertebral joints, laminae, ligamentum flavum and paraspinal muscles. Reconstruction or postoperative immobilization is usually unnecessary, since there is virtually no risk for postoperative instability with this approach. There is also a shorter duration of the surgical procedure, reduced blood loss, improved wound healing, and less risk for postoperative infection. All these benefits allow for earlier ambulation and rehabilitation of patients.

Potential problems with hemilaminectomy include insufficient exposure of the spinal lesion, for instance when the contralateral recess is also involved by tumor. However, there is always the possibility to extend the exposure, either in longitudinal direction, or to the contralateral side, when required. In cases of dumbbell neurilemmomas, unilateral drilling may be extended to the facets which, when necessary, can be partially resected. This provides a more lateral visualization and allows a greater opportunity for anterior maneuvering than exposure with a standard laminectomy. On the other hand, however, it may increase the risk of postoperative segmental instability, and facet fusion may be required. In cases of thoracic lesions, the unilateral approach may be combined with costotransversectomy.

It is concluded that hemilaminectomy is a safe and reliable procedure for the surgical management of extramedullary spinal lesions, which, in combination with microsurgical techniques, is considered superior to conventional laminectomy.

Acknowledgments: Dr H Bertalanffy is the recipient of a fellowship from the Japanese Society for the Promotion of Science, Tokyo, Japan, and the Alexander-von-Humboldt Foundation, Bonn, Federal Republic of Germany.

References