Available online at www.sciencedirect.com
ScienceDirect
Surgical Neurology 72 (2009) 470–475
SURGICAL NEUROLOGY
www.surgicalneurology-online.com

Spine

Safe and minimally invasive laminoplastic laminotomy using an ultrasonic bone curette for spinal surgery: technical note

Kiyoshi Ito, MD[a,*], Shigetoshi Ishizaka, MD[a], Tetsuo Sasaki, MD[a], Takahiro Miyahara, MD[a], Tetsuyoshi Horiuchi, MD[a], Keiichi Sakai, MD[a], Hiroaki Shigeta, MD[b], Kazuhiro Hongo, MD[a]

[a]*Department of Neurosurgery, Shinshu University School of Medicine, Matsumoto 390-8621, Japan*
[b]*Department of Neurosurgery, Nagano Children's Hospital, Azumino 399-8288, Japan*

Received 1 April 2008; accepted 15 January 2009

Abstract

Background: Ultrasonic surgical aspirators have been used mainly for removing brain tumors. Because of their longitudinal and torsional tip, they are used for cutting the bone structures in spinal surgery installing a scalpel-type tip. The purpose of this report is to describe the effectiveness and surgical pitfalls of an ultrasonic bone curette in laminoplastic laminotomy and hemilaminotomy.

Methods: We present 12 patients who underwent laminoplastic laminotomy and hemilaminotomy. We used a SONOPET UST-2001 ultrasonic bone curette with HB-05S handpieces (M and M Co, Ltd, Tokyo, Japan). After a tumor was removed, titanium plates were used for the laminoplastic laminotomy and hemilaminotomy. The technical advantage of an ultrasonic bone curette and procedure-related complication were examined.

Results: There were no major procedure-related complications such as cord injury. Wound infection and subcutaneous fluid collection caused by cerebrospinal fluid leakage did not occur for reconstruction of posterior bony structure. In 1 patient with calcified dura mater associated with tumor, dural tear occurred. The width of the tip was narrow enough for resected laminae to be fused postoperatively, and spinal instability did not occur in all cases.

Conclusion: The scalpel-type ultrasonic bone curette is useful for cutting bone and effective for reconstruction of the laminae. Laminotomy with an ultrasonic bone curette is safe and minimally invasive. To prevent dural tear, we recommend drilling laminae to make the bone thin as the first step, followed by cutting the remaining laminae using a bone curette especially in cases with calcified or tense dura mater.

Keywords: Laminoplastic laminotomy; Less invasive surgery; Spinal cord tumor; Ultrasonic bone curette

1. Introduction

Laminoplastic laminotomy has been applied for the posterior approach for removal of spinal cord tumors. In this procedure, the resected lamina is returned after tumor removal; and laminoplasty is performed with titanium plates. This procedure allows stronger posterior support compared with laminectomy, preventing postoperative subcutaneous fluid collection caused by spinal leakage and kyphotic deformity and infection caused by subcutaneous fluid collection [4,6,8,9,11,18]. In addition, laminoplasty is thought to prevent recurrent canal stenosis by avoiding scar formation that occurs when performing wide laminectomy; and this procedure reduces postoperative wound pain such as axial pain [16].

Conventional laminoplastic laminotomy, however, has a high technical demand on using high-speed drills, which may cause spinal cord and nerve injury with inappropriate handling [15]. Spinal cord and root injury has been reported

Abbreviations: AVF, arteriovenous fistula; CT, computed tomography; MR, magnetic resonance.

* Corresponding author. Tel.: +81 263 37 2690; fax: +81 263 37 0480.
E-mail addresses: kitoh@shinshu-u.ac.jp, kitoh@wondernet.ne.jp (K. Ito).

0090-3019/$ – see front matter © 2009 Published by Elsevier Inc.
doi:10.1016/j.surneu.2009.01.012

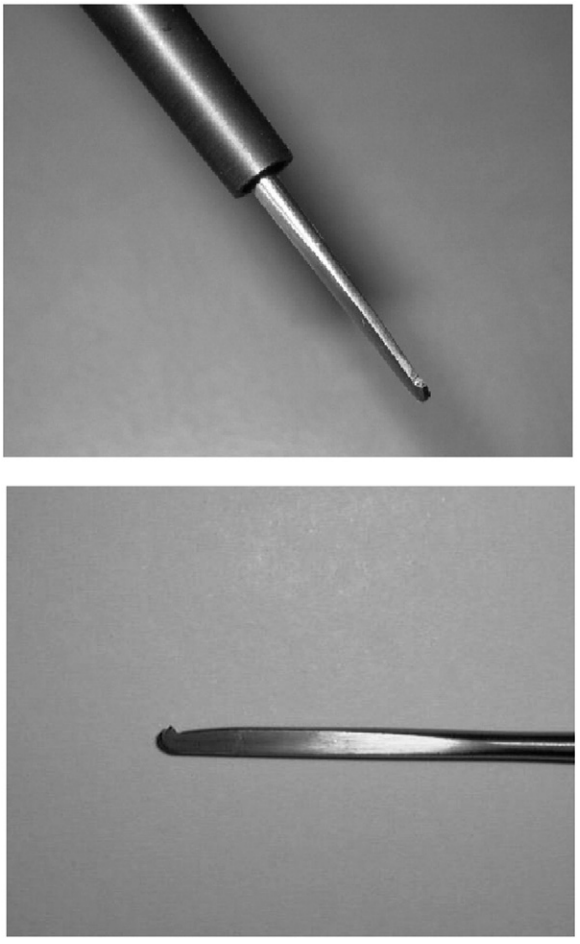

Fig. 1. Photographs of a scalpel-type ultrasonic bone curette, of which the tip is 0.7 mm wide: superior oblique view of the tip (upper) and lateral view of the tip (lower).

in laminotomy using threadwire saw [5]. On the other hand, a scalpel-type ultrasonic bone curette, which has recently been introduced in the neurosurgical field, is an instrument for resecting bones with oscillation without rolling movement [2,3,13,17]. It is commonly used for intracranial surgery. Because of its longitudinal and torsional oscillating motions, it facilitates bone resection during spinal surgery [7,14]. Scalpel-type ultrasonic bone curette, which was reformed, made it possible to cut the bony structure.

We performed laminoplastic laminotomy and hemilaminotomy for removal of the spinal cord tumor using the scalpel-type ultrasonic bone curette. We report our experience with the laminoplastic laminotomy and hemilaminotomy using the scalpel-type ultrasonic bone curette and discuss the technical advantages and safe use of this instrument.

2. Material and methods

The subjects were 12 patients who underwent laminoplastic laminotomy and hemilaminotomy between June 2006 and September 2007: 8 patients with neurinomas, 1 patient with cavernous angioma, 1 patient with perimedullary arteriovenous fistula of the cervical cord, and 2 patients with tethered cord syndrome associated with a filar-type spinal lipoma. We used a SONOPET UST-2001 scalpel-type ultrasonic bone curette with HB-05S handpieces (M and M Co, Ltd, Tokyo, Japan) for cutting the posterior laminae (Fig. 1, upper). The tips (0.7 mm wide) worked with scratching motions to resect bones (Fig. 1, lower). While the curette was being operated, the handpiece end was cooled by automatic irrigation of physiologic saline. Surgical procedures of laminoplastic hemilaminotomy are briefly described as follows: After a midline skin incision, unilateral paravertebral fascia and muscles were dissected to preserve the posterior tension band including the nuchal, supraspinous, and interspinous ligaments and the spinous processes. The laminae were cut with a scalpel-type ultrasonic bone curette at the laminoarticular line and the base of the spinous process under an operating microscope (Fig. 2A). After exposure of dural theca, the intradural

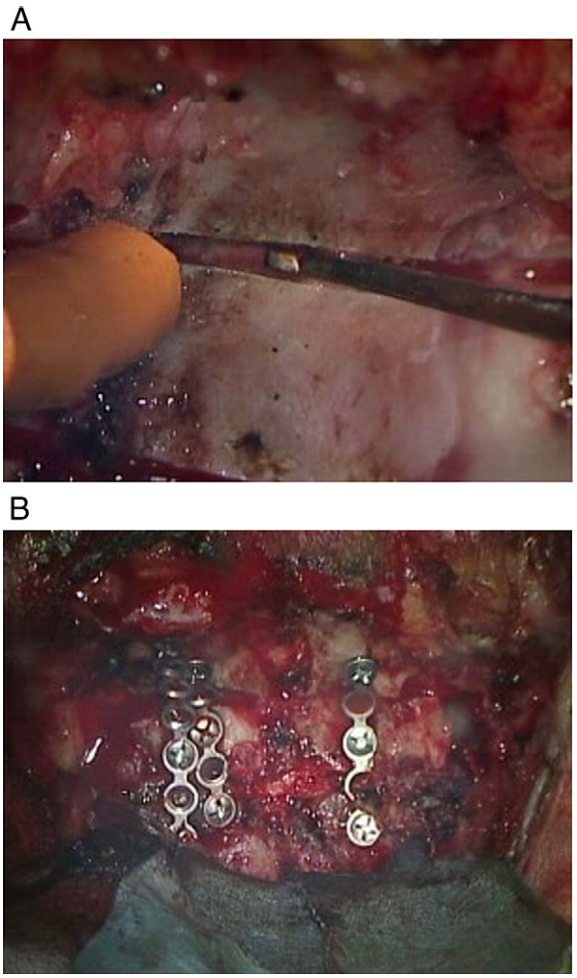

Fig. 2. Laminoplastic hemilaminotomy. A: Intraoperative photograph of a scalpel-type ultrasonic bone curette–assisted cutting of the lamina. The tip is visible under an operative microscope. B: Intraoperative photograph showing fixation of the lamina with miniplates for hemilaminotomy.