



Research Paper

# Use of Miniplates and Local Bone Grafts to Prevent Spring Back in Laminoplasty for Cervical Spondylotic Myelopathy

## 用金屬小網板和骨移植來防止椎板回彈的技術在椎板成形術中的應用



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### ABSTRACT

**Background/Purpose:** Cervical spondylotic myelopathy/ossification of posterior longitudinal ligament can be treated by anterior or posterior decompression. For multiple levels, it is common to perform posterior decompression by laminoplasty. Hirabayashi described his open-door expansive laminoplasty in 1977, which soon became popular. Spring back of the lamina has always been a problem. Many methods including suturing to soft tissue, suture anchors, bone grafts, hydroxyapatite blocks, and ceramic spacers were used to prevent this problem, but with considerable failure. Recently, miniplates were used to prevent spring back.

**Methods:** Twenty-nine consecutive patients who had underwent Hirabayashi open-door expansive laminoplasty in a single centre were recruited in this retrospective study. Miniplates were used to keep the laminae open. In addition, the spinous processes of lower cervical vertebrae were excised and used as local bone grafts to fill the gap between the cut laminae. Computerized tomography scans were performed postoperatively for all patients to assess bone union and spring back.

**Results:** A total of 126 levels of laminoplasty and 51 local bone grafts were studied. The minimal follow-up period was 12 months. Signs of bone union were demonstrated in 123 hinges (97.6%) and 51 bone grafts (100%). No spring back was detected. The clinical outcome in terms of Hirabayashi recovery rate was 47.2%.

**Conclusion:** Miniplates and local bone grafts are promising and effective tools for preventing spring back in cervical laminoplasty.

### 中文摘要

引言：後縱韌帶脊髓型頸椎病(CSM)/後縱韌帶骨化(OPLL)可以通過前路或後路減壓治療。在多節的病例,椎板成形術是常見的後路減壓方法。Hirabayashi在1980年代描述了他的單門椎管成形術,並很快廣為採用。椎板回彈一直是椎板成形術的問題。許多方法包括縫合軟組織,錨縫合線,骨移植,人工骨塊hydroxyapatite等,但具有一定的失敗比率。最近,金屬小網板開始被用來防止椎板回彈。

方法：在單一醫院的回顧性研究。病者都接受了Hirabayashi式的單門椎管成形術,並使用金屬小網板來防止椎板回彈。此外,手術中將棘突切除並用作本地骨移植,放在椎板的開口。術後病者會接受電腦掃描來評估骨癒合和椎板回彈。

結果：29病例,共有126節椎板進行的椎板成形術,51節進行骨移植。隨訪時間最少12個月。骨癒合出現在123節椎板鉸鏈(97.6%)和51骨移植(100%)。沒有椎板回彈。病者在JOA恢復方面的臨床結果良好。

### Introduction

Cervical laminoplasty has been a means of posterior decompression for numerous cervical conditions, such as congenital cervical canal stenosis, ossification of posterior longitudinal ligament, cervical spondylotic myelopathy, posterior compression

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from ligament hypertrophy, etc. In cervical laminoplasty, a greater dimension of the spinal canal is created without disrupting the dorsal elements and, thus, maintaining posterior stability.<sup>1,15</sup> Hirabayashi first introduced the method of unilateral open-door laminoplasty in 1977,<sup>2</sup> and it soon became popular. Traditionally, Hirabayashi used stay sutures over the spinous processes and paraspinal muscles to keep the laminae open. The problem of spring back causing reclosure of laminae was soon encountered, reporting in up to 34% of cases<sup>3,4</sup> or up to 10% at 6 months.<sup>5</sup> Thereafter, a variety of methods were introduced to prevent spring back of the opened door. These included the use of titanium plates, suture anchors, hydroxyapatite blocks, ceramic spacers, and bone grafts, with variable outcomes.<sup>1,6–11</sup> The aim of our study is to look into the clinical and radiological outcomes of the use of miniplates (ARCH plates; Synthes, PA, USA) and local bone grafts in cervical laminoplasty, as well as to find out whether they are effective in preventing spring back.

## Methods

### Patient population

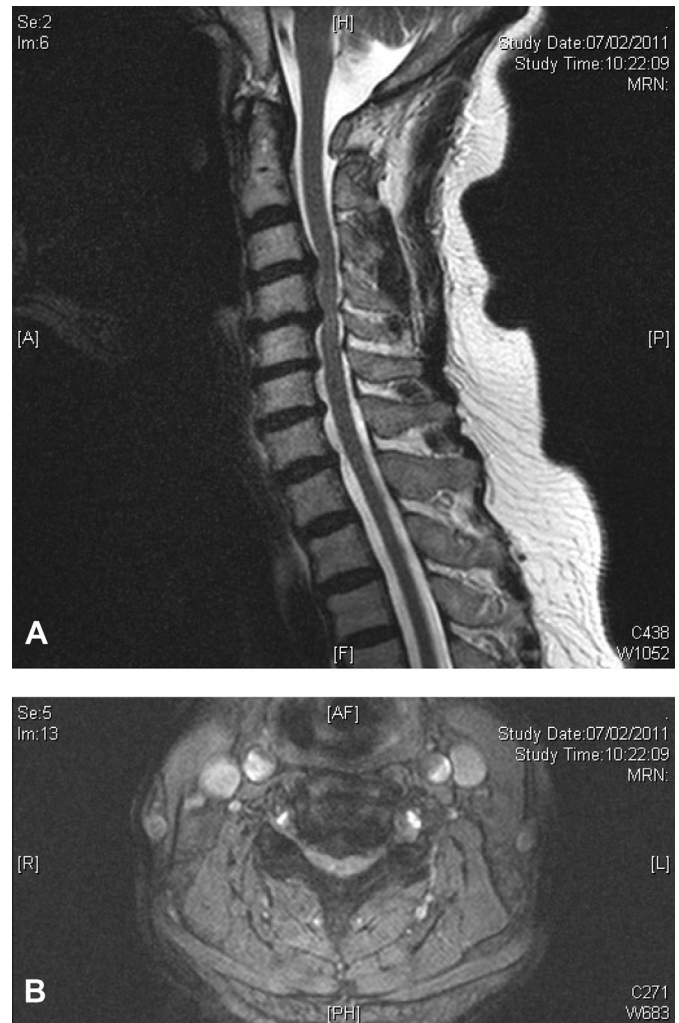
Thirty-two consecutive patients who underwent unilateral open-door laminoplasty in United Christian Hospital, between June 2011 and July 2012, were reviewed retrospectively (Table 1). The diagnosis of cervical spondylotic myelopathy/ossification of posterior longitudinal ligament was made clinically and radiologically. All patients underwent magnetic resonance imaging preoperatively (Figure 1A and B).

Patients with infection, tumours, trauma with fractures, and rheumatoid disorders were excluded. Cases with cervical spine X-rays demonstrating kyphosis were not excluded.

**Table 1**  
Patients' characteristics and operative details

Age	
Range	42–81
Mean	66.6
SD	10.35
Sex	
Female	8
Male	21
Disease	
Cervical spondylotic myelopathy	20
Ossification of posterior longitudinal ligament	9
Levels of laminoplasty	126
Bone grafts	51
Operative time (min)	
Range	110–235
Mean	174.93
SD	33.3
Levels of decompression	
4	19
5	10
Preoperative JOA score	
Range	3–14
Mean	8.62
SD	3.05
Postoperative JOA score	
Range	0–17
Mean	12.3
SD	3.63
Hirabayashi recovery rate (%)	
Range	0–100
Mean	47.23
SD	23.8

\* Data are presented as *n* unless otherwise indicated.  
JOA = Japanese Orthopaedic Association.



**Figure 1.** Preoperative magnetic resonance imaging of a patient with cervical spondylotic myelopathy: (A) sagittal image; (B) axial image.

### Surgical technique

The operation was performed by spine specialists. Patients were laid prone, with head slightly flexed with a horse-shoe support. A longitudinal midline incision was made. Paraspinal muscles were retracted off the laminae and spinous processes of C3–6 (or C7 if necessary) subperiosteally. Spinous processes of C5 and C6 (C7 as well if it was included in the laminoplasty) were identified and split in the middle by a mini-saw down to the base and then osteotomized. C5 spinous processes were sometimes too small in the Chinese population and were not suitable for use as bone grafts in this operation. The bone grafts were saved to be used at a later stage. Gutters were created in the usual manner using a high-speed burr and Kerrison rongeurs. A hinge is made on the less symptomatic side, by creating a greenstick crack leaving only the ventral cortex intact, while the lamina door is opened on the more symptomatic side by drilling through both the ventral and the dorsal cortices. The gaps of the lamina opening were measured, and the bone grafts were fashioned to fit the gap size. The bone grafts were fixed to the centre of the miniplates by screws and nonabsorbable sutures. Patients with small spinous processes, which could not be used, would have only alternate levels of the laminoplasty gaps filled with bone grafts. The miniplates with or

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