Clinical feasibility of minimally invasive cervical laminoplasty

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Minimally invasive approaches to the cervical spine for lateral disc herniation or foraminal stenosis have recently been described. Lower rates of blood loss, decreased narcotic dependence, and less tissue destruction as well as shorter hospital stays are all advantages of utilizing these techniques. These observations can also be realized with a minimal access approach to cervical laminoplasty. Multiple levels of the cervical spine can be treated from a posterior approach with the potential to decrease the incidences of postoperative axial neck pain and kyphotic deformity. In this report the authors present a concise history of the open laminoplasty technique, provide data from previous cadaveric studies (6 cases) along with recent clinical experience for minimally invasive laminoplasty, and describe the advantages and challenges of this novel procedure. (DOI: 10.3171/FOC/2008/25/8/E3)

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of segments that typically require treatment as well as the inherent hazard associated with surgery to decompress the severely compressed spinal cord.

Minimally Invasive Cervical Laminoplasty

We have explored the feasibility of performing a multi-level laminoplasty via an exposure that could be achieved with a tubular retractor system in cadavers. A minimally invasive approach to cervical laminoplasty would preserve important muscular attachments (the semispinalis cervicis and multifidus muscles), prevent muscle atrophy, and potentially reduce the incidence of postoperative axial neck pain and kyphotic deformity. Several Japanese investigators have explored this concept of preserving muscle attachments while utilizing open operative techniques. They have developed the “skip laminectomy” and “double-door laminoplasty” (Fig. 1) as well as laminoplasty methods through access windows between critical muscular attachments. Although no definitive studies have demonstrated the superiority of these techniques over traditional open methods, several concepts have emerged from clinical experience. Perhaps the most important idea is the maintenance of musculoligamentous attachments to the axis and vertebral prominens. The spinous processes at these anchor points at the top and bottom of the cervical lordotic curve provide lever arms and actuators important in the dynamic “tension band,” which confers stability to the cervical spine. In addition, observed rates of postoperative infection, when compared with open techniques, may be lower given the decrease in tissue devitalization.

Cadaveric Experience with Minimally Invasive Laminoplasty

We have demonstrated the feasibility of performing minimally invasive laminoplasty at multiple levels in human cadavers at the University of Miami. Our study involved 6 adult specimens requiring an average time of 1.5–2 hours per procedure. Cadavers with thicker, more muscular necks required a longer 5-cm tubular retractor, and the placement of the rib allograft was more difficult in these specimens. Average spinal canal areas changed from 1.24 ± 0.24 cm² (mean ± standard deviation) preoperatively to 3.09 ± 0.13 cm² postoperatively, whereas the sagittal diameter increased from 1.24 ± 0.098 to 1.71 ± 0.11 cm at the C-5 level. These changes in both the spinal canal area (p = 0.0004) and sagittal diameter (p = 0.0001) were statistically significant.
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obtained to ensure proper preparation of the dorsal arch for en-bloc lifting. 2) The proper docking site onto the laminar facet junction must be confirmed to avoid drilling the gutters too laterally. 3) A slightly medially directed trajectory must be maintained for drilling of the gutters. 4) Careful elevation of the laminae under tension must be achieved to allow the natural tension of the ligaments to maintain spacer placement. 5) Meticulous hemostasis must be obtained with the use of powdered gelatin formulations. 6) Avoid using the Steinman pin for tube placement as it may inadvertently enter the spinal canal or anterior neck. 7) Release the table-mounted retractor attachment when lifting the laminae so that the tube does not prevent proper dorsal movement of the laminae.

This technique remains challenging and the typical surgical procedure time is more than twice the duration of open laminoplasty procedures. Nonetheless, it is likely that the development of specific instruments to allow safer drilling and laminar elevation could make this technique more feasible for wide application. Large studies with proper controls and objective patient-driven outcome assessments are necessary to validate the ability of minimal access techniques to reduce postoperative neck pain, discomfort, and stiffness.

Conclusions

The standard laminoplasty technique is a technically straightforward method of achieving long-segment spinal canal decompression. Complications associated with the technique are low; however, a considerable number of patients experience lingering neck or interscapular pain after the procedure. It is thought that this pain is due to the removal of muscle and tendinous attachments from the lower cervical vertebrae. Our goal was to develop a less invasive technique that could provide spinal cord decompression but leave the midline muscular and tendinous attachments intact. Minimally invasive cervical laminoplasty, although technically challenging, may become more feasible in the future after the development of instruments specific for this approach.

Disclaimer

The authors do not report any conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

References


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