

Introduction

After traumatic spinal cord injury (TSCI), the injured cord is compressed by dura [1]. Here we show that laminectomy + duroplasty decompress the injured cord more effectively than laminectomy alone. The study was recently published [2].

Methods

Open label, prospective trial. 21 patients with acute, severe TSCI (AIS A – C) had re-alignment of the fracture and fixation within 72 h. 11 patients had laminectomy (laminectomy group) and 10 had laminectomy and duroplasty (laminectomy + duroplasty group) [FIG 1].

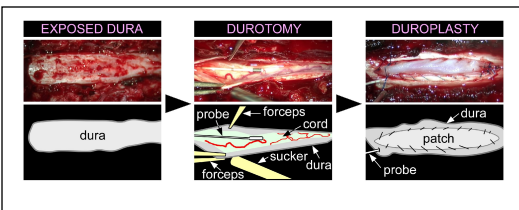


FIG. 1. Duroplasty technique. (left) Exposed dura after laminectomy. (middle) Durotomy held open with forceps. (right) Sutured dural patch.

Primary outcomes were MRI evidence of cord decompression (increase in intradural space, presence of cerebrospinal fluid around the injured cord) and spinal cord physiology (intraspinal pressure (ISP), spinal cord perfusion pressure (SCPP), spinal vascular pressure reactivity index (sPRx)). ISP was monitored from a pressure probe placed intradurally at the injury site and arterial blood pressure from a catheter placed in the radial artery. SCPP = mean arterial pressure minus ISP. sPRx is the running correlation coefficient between ISP and arterial blood pressure.

Results

The laminectomy and laminectomy + duroplasty groups were well matched. Compared with the laminectomy group, the laminectomy + duroplasty group had greater increase in intradural space at the injury site (50 % vs. 20 %) and more effective decompression of the injured cord (78 % vs. 0 % had MRI CSF signal round the injured cord) [FIG. 2].

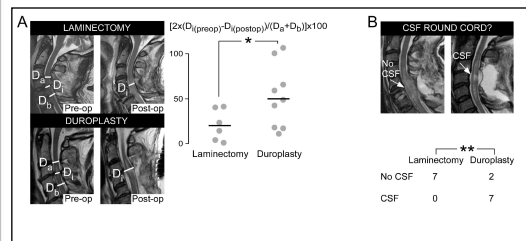


FIG. 2 Duroplasty increases space round the injured cord. A. (left) MRI before and after laminectomy or laminectomy + duroplasty. (right) % increase in D_i . Points are patients, lines are means. B. (top) Postoperative MRI looking for space round the injured cord. (bottom) Patients with CSF round the injured cord. * $P < 0.05$, ** $P < 0.01$

After laminectomy + duroplasty, ISP was lower (12.7 vs. 18.0 mmHg), SCPP higher (83.1 vs. 66.8 mmHg) [Fig. 3] and sPRx lower (0.04 vs. 0.14, $P < 0.01$) [FIG. 4], i.e. improved vascular pressure reactivity, than after laminectomy.

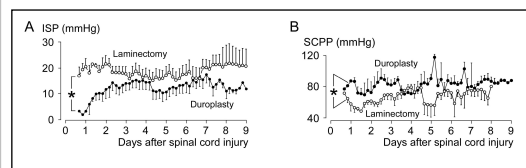


FIG. 3. ISP and SCPP. Mean four hourly A. ISP and B. SCPP of laminectomy and laminectomy + duroplasty patients. Lamincetomy open circles $n = 11$. Lamincetomy + duroplasty closed circles $n = 9$. Mean +/- SEM, * $P < 0.05$.

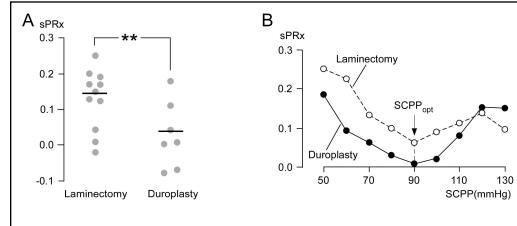


FIG. 4. sPRx. A. Mean sPRx after laminectomy and laminectomy + duroplasty. B. sPRx vs. SCPP after laminectomy and laminectomy + duroplasty. SCPPopt corresponds to minimum sPRx. Points are patients, lines are means. ** $P < 0.01$.

Laminectomy + duroplasty caused CSF leak that settled with lumbar drain in 1 patient and pseudomeningocele that resolved completely in 5 patients.

Followup was 26 +/- 5 months after laminectomy vs. 9 +/- 7 months after laminectomy + duroplasty. Change in ASIA grade (ASIA grade at followup minus ASIA grade on admission), walking ability, bladder and bowel function were better in the laminectomy + duroplasty group vs. the laminectomy group though not significant [FIG. 5].

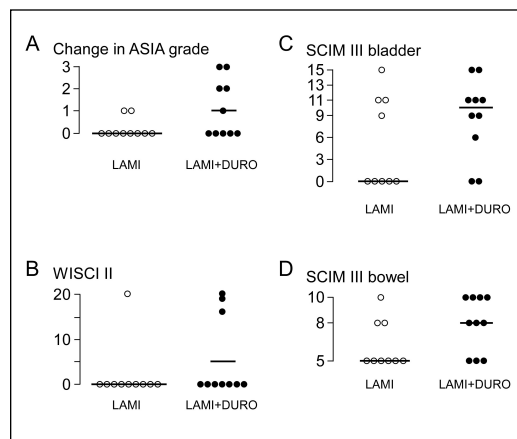


FIG. 5. Outcomes after laminectomy (LAMI) and laminectomy + duroplasty (LAMI + DURO) at followup. A. Change in ASIA grade, B. WISCI II, C. SCIM III bladder, and D. SCIM III bowel.

Conclusions

1. Laminectomy + duroplasty performed after severe TSCI is safe.
2. After severe TSCI, laminectomy + duroplasty improves spinal cord radiological parameters more effectively than laminectomy.
3. After severe TSCI, laminectomy + duroplasty improves ISP, SCPP and sPRx more effectively than laminectomy.

Learning Objectives

By the conclusion of this session, participants should be able to:

- 1) Appreciate that the dura causes spinal cord compression after injury
- 2) Describe the effect of laminectomy after spinal cord injury
- 3) Describe the effect of laminectomy and duroplasty after spinal cord injury.

References

1. Werndle MC et al. Monitoring of spinal cord perfusion pressure in acute spinal cord injury. *Crit Care Med* 2014; 42: 646-655.
2. Phang I et al. Expansion duroplasty improves intraspinal pressure, spinal cord perfusion pressure and vascular pressure reactivity index in patients with traumatic spinal cord injury. *J Neurotrauma* 2015; 32: 865-874.