Cervical laminoplasty

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Laminoplasty may have better postoperative stability when posterior approach surgery is used to treat cervical spondylotic myelopathy; at the same time, a vertebral titanium mini-plate can achieve almost the same effect as the traditional titanium mini-plate after surgery for LP. In addition, it has specific potential due to the porous structure promoting bone fusion ¹⁾

Cervical laminoplasty is an established treatment for cervical myelopathy.

Fields et al., ²⁾ observed in their randomized study comparing the effects of cervical laminectomy and laminoplasty in the rabbit, that laminectomized animals had poorer clinical outcome at 3 months post-operatively, associated with statistically significant angular deformity.

Similarly, Baisden et al., ³⁾, using a goat model, concluded that laminoplasty is superior to laminectomy in maintaining sagittal Cervical spine alignment and preventing spinal deformities. The removal of bony and ligamentous structures of the posterior cervical spine might alter the biomechanics of the vertebral column and predispose to instability.

Classification

Cervical lift-up laminoplasty

Double-door posterior cervical laminoplasty (French door laminoplasty)

Single-door posterior cervical laminoplasty

History

The first laminoplasty technique was the modification of Kirita's technique for laminectomy, in which

the laminae were thinned and then partially removed in the midline using an air drill. The lateral edges of the laminae close to the pedicles were further thinned until the laminae could be bent and lifted up. It was considered important to lift multiple laminae expeditiously so that multiple segments of the cord could be simultaneously decompressed. The laminae were then removed with scissors ⁴).

Based on this technique, Oyama et al. developed z-plasty method of laminoplasty. After thinning the laminae, z-shaped cuts were made in each laminae, which were lifted and then fixed with sutures to reconstruct the expanded spinal canal. They reported that all the 15 cases were neurologically improved after the operation 5).

Tsuji reported a variation of en bloc laminectomy in which laminae were cut bilaterally along the imaginary line separating laminar arches and articular processes and made completely free from their bony attachments. The lamiae were reflected as a flap and then permitted to float on the cord without fixing sutures or bone grafting ⁶⁾.

Expansive open-door laminoplasty was devised by Hirabayashi et al. in 1977, as relatively easier, safer, and better than the ordinary cervical laminectomy from the standpoint of structural mechanics of the cervical spine.

Operative results in the patients with cervical OPLL, spondylosis, and canal stenosis were satisfactory, and optimal widening of the AP diameter of the spinal canal is considered to be over 4 mm. From this procedure a bilateral, open-door laminoplasty has been devised for extensive exploration at the intradural space.

Cervical laminoplasty was devised to avoid problems associated with laminectomy such as postoperative segmental instability, kyphosis, perineural adhesions, and late neurological deterioration ⁷⁾.

Kurokawa et al. developed spinous process splitting laminoplasty, in which the spinous processes and laminae are split in the midline and hinges are made bilaterally along the lateral borders of the laminae, which are lifted bilaterally ⁸).

This is also called double-door laminoplasty⁹⁾, French-window¹⁰⁾ or French door laminoplasty¹¹⁾

There are multiple variations, many advocating the use of allograft, but for the best technique controversy persists.

Complications

Neck pain after cervical laminoplasty.

Case series

2017

Thirty-two consecutive patients (19 male, 13 female, average age 66 yr) from a prospective outcome registry that underwent cervical laminoplasty between 2009 and 2013 were reviewed. Computed tomography (CT) scan was performed immediately postoperatively and at 6-mo follow-up. Parameters

included patient perception of outcome, Nurick score, Neck Disability Index (NDI), visual analog scale for neck pain, and SF-36.

On retrospective analysis, all patients felt improved at 3 mo postoperatively; at 2 yr, this rate was 91%. Improvements were seen in Nurick scores, from 3.16 ± 0.9 preoperatively to 1.94 ± 0.8 at 2 yr; NDI score from $28.7\% \pm 9\%$ preoperatively to $20.8\% \pm 9.6\%$ at 2 yr; visual analog scale from 2.8 ± 1.2 preoperatively to 1.7 ± 0.9 at 2 yr; and SF-36 physical component summary from 27.9 ± 10 preoperatively to 37.8 ± 11.9 at 2 yr. All values reached significance at all follow-up points (P < .05) with the exception of 6-mo NDI values (P = .062). No C5 palsy, graft complications, or reclosure was observed in any patient during the follow-up period.

Laminoplasty with autograft is a safe and effective method to treat cervical myelopathy, with good medium-term clinical outcome. No reclosures were observed. Bony fusion was seen in all cases on CT scan. The study found good outcomes in the performance of open door laminoplasty without hardware, in the treatment of cervical stenosis ¹².

2016

Sakaura et al., reported that the presence of chronic kidney disease (CKD) and/or extended abdominal aortic calcification was associated with significantly worse clinical outcomes after posterior lumbar interbody fusion. CKD is one of the highest risk factors for systemic atherosclerosis. Therefore, impaired blood flow due to atherosclerosis could exacerbate degeneration of the cervical spine and neural tissue. However, there has been no report of a study evaluating the deleterious effects of CKD and atherosclerosis on the outcomes after decompression surgery for cervical spondylotic myelopathy.

They analyzed data from 127 consecutive cases involving patients who underwent cervical laminoplasty for CSM and met their inclusion criteria. Stage 3-4 CKD was present as a preoperative comorbidity in 44 cases. Clinical status was assessed using the Japanese Orthopaedic Association (JOA) cervical myelopathy evaluation questionnaire before surgery and 2 years postoperatively. As a marker of systemic atherosclerosis, the presence of aortic arch calcification (AoAC) was assessed on preoperative chest radiographs.

AoAC was found on preoperative chest radiographs in 40 of 127 patients. Neither CKD nor AoAC had a statistically significant deleterious effect on preoperative JOA score. However, CKD and AoAC were significantly associated with reductions in both the JOA score recovery rate (mean 36.1% in patients with CKD vs 44.7% in those without CKD; 26.0% in patients with AoAC vs 48.9% in those without AoAC) and the change in JOA score at 2 years after surgery (mean 2.3 points in patients with CKD vs 3.1 points in those without CKD; 2.1 points for patients with AoAC vs 3.2 points for those without AoAC). A multivariate regression analysis showed that AoAC was a significant independent predictor of poor outcome with respect to both for the difference between follow-up and preoperative JOA scores and the JOA score recovery rate.

CKD and AoAC were associated with increased rates of poor neurological outcomes after laminoplasty for CSM, and AoAC was a significant independent predictive factor for poor outcome ¹³.

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