Extensive laminectomy in the cervical spine has usually been applied in the treatment of cervical myeloradiculopathy due to stenotic conditions of the cervical spinal canal, such as congenital canal stenosis, multiple-level spondylosis, and ossification of the posterior longitudinal ligament. However, the procedure may be complicated by postoperative instability resulting in deformity, particularly kyphosis. In addition, postlaminectomy membranes have been implicated in restenosis of the spinal canal. Various cervical laminoplasty techniques have been used in efforts to minimize these problems. The etiology of postlaminectomy membrane has been described, but whether laminoplasty can reliably prevent laminectomy membrane formation is still debated.

This case report describes the presentation and treatment of a patient with remarkable postlaminectomy membrane even after osteoplastic laminoplasty. Her neurological condition had improved 1 month after the initial laminoplasty procedure, and MR images obtained at that time showed effective enlargement of the spinal canal. During the next month, however, her condition deteriorated and she developed symptoms compatible with myelopathy, and by 4 months after laminoplasty she was bedridden. An MR imaging study revealed massive epidural scar formation compressing the spinal cord. The patient underwent further laminectomy and removal of epidural scar tissue, which resulted in neurological cure.

Case Report

History and Presentation. This 81-year-old woman initially presented with complaints of numbness and tingling pain in the upper extremities. She also had dysuria and gait disturbance (JOA score of 9.5). Cervical radiography revealed narrowing of the spinal canal and mild kyphotic change without remarkable instability (Fig. 1A–C). An MR imaging study also demonstrated diffuse spinal cord compression (Fig. 1D). The patient had a history of stomach cancer but had no history of other major disease, bleeding tendency, or allergy.

References

The authors report on an 81-year-old woman whose condition deteriorated 2 months after undergoing osteoplastic laminoplasty with placement of hydroxyapatite spacers. Magnetic resonance imaging showed postlaminectomy scar formation compressing the cervical spinal cord. The patient underwent laminectomy and removal of remarkably thick epidural scar tissue, which resulted in resolution of her symptoms. Histological diagnosis of the scar was fibrous granulation tissue with foreign body granuloma, characterized by multinucleated giant cells and marked increases of capillary vessels, fibroblasts, and collagen fibers. This case of symptomatic postlaminectomy scar formation after osteoplastic laminoplasty suggests that osteoplastic laminoplasty cannot always prevent laminectomy membrane formation. (DOI: 10.3171/2011.6.SPINE10930)

Key Words • osteoplastic laminoplasty • hydroxyapatite • epidural scar formation • foreign body reaction • myelopathy • cervical spine

Abbreviation used in this paper: JOA = Japanese Orthopaedic Association.
First Operation and Postoperative Course. Cervical laminoplasty was performed, with placement of hydroxyapatite spacers from C-3 to C-7 (Kurokawa’s method\textsuperscript{15}). Postoperatively, the patient recovered most motor power in her extremities, but had residual spasticity. Five days after surgery, she started walking without support (JOA Score 11), and at the 1-month follow-up visit her condition had improved. Follow-up MR imaging performed 1 month postoperatively showed decompression of the spinal cord with slight residual stenosis at the C5–6 level (Fig. 2B). During the next month, however, she began to notice tingling pain in the upper and lower extremities (JOA Score 7). An MR imaging study performed 3 months after surgery demonstrated marked spinal cord compression by an epidural mass (Fig. 2C). Cervical radiography showed ideal positioning of the hydroxyapatite spacers and slightly improved sagittal alignment without instability (Fig. 2A). By 4 months after surgery she had difficulty in standing and walking and was essentially bedridden (JOA Score 2.5). Additional MR images obtained before and after intravenous injection of gadolinium revealed massive epidural scar formation compressing the spinal cord (Fig. 3A and B). Computed tomography showed ideal positioning of the hydroxyapatite spacers and excluded lamina subduction or hinge fracture (Fig. 3C). Four months after the first surgery, a second operation was undertaken.
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Second Operation. The previous skin incision was reopened and extended from C-3 to C-7. A layer of extraordinarily firm and thickened fibrous tissue was observed surrounding the laminae and hydroxyapatite spacers at the level of the previous laminoplasty (Fig. 4A). This layer was sharply dissected from the laminae and spacers using a monopolar coagulator, the sutures that fixed the spacers in place were cut, and the spacers were removed. A total of 5 spacers were removed and 5 casts were revealed (Fig. 4B). Residual laminae were removed with an air drill and the thick granulated epidural scar was removed cautiously, after which the cord became pulsatile, as confirmed by intraoperative ultrasonography (Fig. 4C). The histological diagnosis was fibrous granulation tissue with foreign body granuloma, characterized by multinucleated giant cells and marked increases of capillary vessels, fibroblasts, and collagen fibers (Fig. 5).

Postoperative Course. The patient’s clinical condition improved after surgery. She could stand up without help 5 days postoperatively. Residual tingling pain was present in both hands but improved gradually. Two months after surgery, she started walking without support and returned home (JOA Score 10). Fourteen months postoperatively, the patient had recovered well (JOA Score 11, same as first postoperative state) and follow-up MR imaging showed sufficient decompression of the cervical cord (Fig. 6).

Discussion

Osteoplastic laminoplasty was first developed by Hat-tori et al. and many modifications have been proposed since. The aim of laminoplasty is to avoid problems associated with expansive laminectomy, to expand the spinal canal to preserve the posterior structure of the cervical spine in an effort to secure stability, and to prevent the formation of postlaminectomy membrane. However, whether laminoplasty is better than laminectomy in preventing postlaminectomy scar formation remains controversial.

The patient in the present case was initially treated with osteoplastic laminoplasty with placement of hydroxyapatite spacers. Although neurological and radiological cure was confirmed at 1 month after the procedure, by 2 months postoperatively, the patient’s condition had deteriorated. Additional MR imaging showed postlaminectomy scar formation compressing the cervical spinal cord. After removal of the spacers and remarkable epidural scar tissue, good recovery was again obtained.

Only a few reports have discussed the etiology of postlaminectomy membrane. In the normal course of wound healing, the process of fibroblast migration replaces normal epidural tissues like ligamentum flavum or fat with fibrotic tissue. In one case of lumbar laminectomy, a postoperative hematoma formed and developed over time into fibrous tissue. However, Ratliff and Cooper reviewed 71 series of laminoplasties and reported that the occurrence of postlaminectomy membrane causing clinically significant deterioration of neurological function could not be confirmed. Liu et al. analyzed cases in which patients required revision surgery following cervical laminoplasty in their institution and found that although disease progres-
sion was the reason in most cases, laminoplasty closure was the reason in 25%.

In our case, CT before revision surgery revealed correct positions of the laminae and hydroxyapatite spacers, but the neural components were compressed by granulation tissue. Magnetic resonance imaging showed rapid progression of postlaminectomy membrane formation without findings of epidural or subcutaneous hemorrhage. Contrast-enhanced MR imaging showed massive granulation at both ventral and dorsal sides of the spacers. These findings, together with the histological findings, may be due to foreign body reaction to hydroxyapatite. Several foreign body reactions to hydroxyapatite have been reported in both clinical and basic papers. Rosner et al. reported a case of moderately intense foreign-body giant cell reaction to an artificially synthesized hydroxyapatite orbital implant that was removed 19 days after implantation. Li et al. examined rats for tissue reaction to hydroxyapatite and reported an increased proportion of macrophages 6–20 months after implantation due to deposition of amorphous material adjacent to the implant. Such deposits may indicate biodegradation. Macrophages at the site of implantation fuse to form foreign-body giant cells, which we found in the epidural granulation tissue in our patient. Such foreign body reactions are thought to occur to varying degrees after every laminoplasty surgery in which hydroxyapatite spacers are used. However, no case of restenosis after osteoplastic laminoplasty, as in our patient, has previously been reported. We think there are 3 reasons for the occurrence in our case. First, our patient presented with slightly kyphotic alignment before the first surgery, so subclinical instability might have been present and might have caused epidural scar formation. Second, the decompression of the first laminoplasty procedure might have been incomplete. In fact, the patient recovered well after the first operation, but slight residual stenosis of the spinal canal still remained (Fig. 2B). Third, the patient had a tendency to react very intensely to hydroxyapatite, although we cannot clarify the reason.

The intensity of individual reaction to hydroxyapatite and how long the reaction will continue cannot be predicted, so the period of epidural scar formation remains
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unknown. The skin patch test is not reliable because the results of testing after the second surgery were negative in our patient.

Conclusions

The present case of histologically confirmed foreign body reaction to hydroxyapatite causing symptomatic postlaminectomy scar formation after osteoplastic laminoplasty indicates that surgeons should consider the tissue reaction to hydroxyapatite in the laminoplasty procedure when establishing sufficient decompression. Osteoplastic laminoplasty cannot always prevent laminectomy membrane formation, so this pathological state should be taken into consideration if symptoms recur after laminoplasty.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Kuraishi. Analysis and interpretation of data: Kuraishi. Drafting the article: Kuraishi. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Kuraishi. Study supervision: Hanakita. Patient care: all authors.

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