

Original Article

Myxomatous degeneration of the ligamentum flavum of the lumbar spine

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Study design: Report of two cases of acute lumbar nerve root compression caused by myxomatous degeneration of the ligamentum flavum.

Objective: To report a rare cause of acute lumbar nerve root compression.

Setting: Orthopaedic department, Osaka, Japan.

Summary of background data: Two patients, both 50-year-old men presenting with signs and symptoms suggestive of acute lumbar nerve root compression were found to have a ligamentum flavum mass. The masses were removed and the patients regained normal function postoperatively.

Methods: To reveal the nature of the mass, histopathological studies were made. Continuous sections were prepared from the removed mass lesions. The sections were stained with hematoxylin and eosin, van Gieson's stain, azan stain, periodic acid Schiff reaction, Alcian blue stain and von Kossa's stain.

Results: Histological examination revealed myxomatous degeneration of the ligamentum flavum. No elastic fibers were found at the degeneration site. Diffuse mucopolysaccharide deposition was found at the degeneration site, however, no cyst was found. Collagen fibers were not increased. Hypertrophy or ossification of the ligamentum flavum was not recognized in the sections. At a follow-up examination over 2 years later, the patients were free of symptoms and the findings of a neurological examination were normal.

Conclusion: Two cases of myxomatous degeneration of the ligamentum flavum of the lumbar spine were reported, which have seldom been described as the cause of acute lumbar nerve root compression.

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Keywords: ligamentum flavum; degeneration; elastic fiber; nerve root compression; myxomatous

Introduction

Acute lumbar radiculopathy is usually the result of a herniated nucleus pulposus. Occasionally it may be the result of a benign intraspinal, extradural mass.¹ Cysts of the ligamentum flavum have recently received attention in the literature,^{1–8} but to our knowledge, non-cystic myxomatous degeneration of the ligamentum flavum was seldom reported as a cause of acute sciatica.

Case report

Case 1

A 50-year-old man presented with a one-month history of severe burning pain radiating from the left buttock into the left posterolateral thigh and leg. The pain worsened with activity and was alleviated by bed rest.

The patient also reported paresthesia in the left leg and the left foot. Physical examination revealed restricted lumbar motion, knock pain of L4 spinous process, left sciatic notch tenderness, hypesthesia of the lateral aspect of left leg and the dorsal aspect of left foot, weakness of the left toes and positive straight leg raising examination for the left lower extremity. Lumbar spine radiographs demonstrated multi-level degenerative changes and L4–L5 degenerative spondylolisthesis. Conservative treatment for 6 weeks failed to alleviate the patient's symptoms. The MRI revealed a T1 low intensity and T2 high intensity mass with a T2 low intensity core in the L4–L5 ligamentum flavum, compressing the dural theca (Figure 1). A lumbar myelogram revealed a left posterolateral extradural compression above the L4–L5 disc (Figure 2). At surgery, a nodular lesion embedded in the L4–L5 ligamentum flavum was revealed. The nodular lesion was compressing the dural theca and the origin of the left fifth lumbar nerve root. The lesion had no pedicle. There were no cysts or tracks noted outside the

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ligamentum flavum. This lesion was removed *en bloc*. Macroscopically it was a $7 \times 5 \times 4$ mm large non-cystic nodule (Figure 3). No herniated disc was found and the disc was not disturbed. Continuous sections were

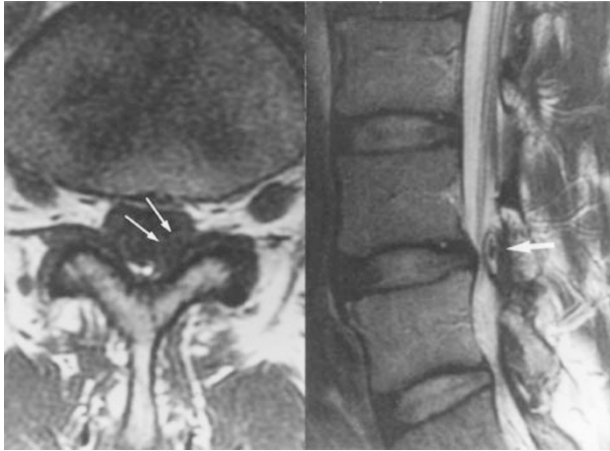


Figure 1 A magnetic resonance image (left: axial view, repetition-time, 400 msec; echo-time, 22 msec, right: sagittal view, repetition-time, 4000 msec; echo-time, 102 msec) revealed a T2 high intensity mass with a T2 low intensity core in the left L4–L5 ligamentum flavum (arrows)

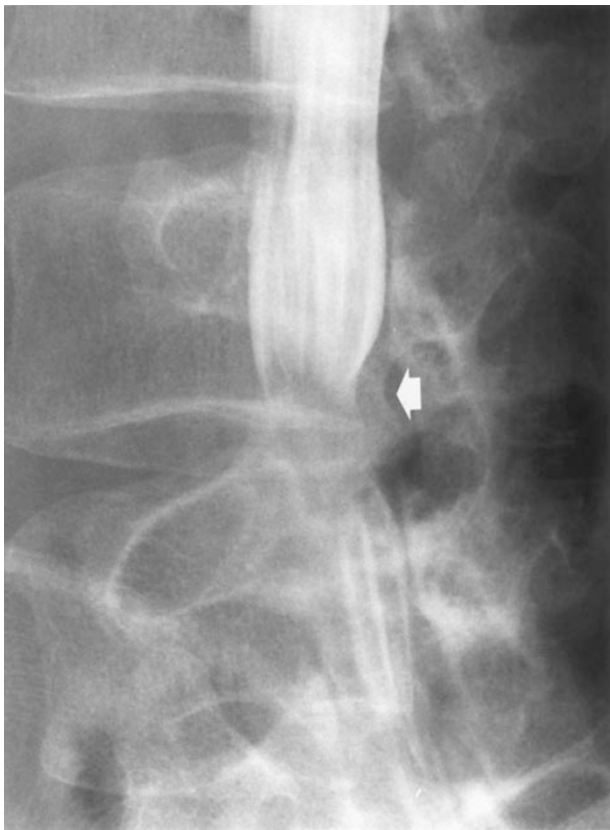


Figure 2 A lumbar myelogram revealed a left posterolateral extradural compression (arrow)

prepared from the removed nodule. The sections were stained with hematoxylin and eosin, van Gieson's stain, azan stain, periodic acid Schiff reaction, Alcian blue stain and von Kossa's stain. Histopathological examination of the mass revealed myxomatous degeneration of the ligamentum flavum (Figure 4). No elastic fibers were found at the center of the degeneration. Elastic fibers were irregularly arranged, ruptured, swollen, and few in number at the margin of the degeneration. Diffuse mucopolysaccharides deposition, with positive Alcian blue staining for acid mucopolysaccharides, was found at the degeneration site. Collagen fibers were not increased. Cartilage cell proliferation, hyalinization of collagen fibers or proliferation of fibrocartilage cells was not observed. Hypertrophy or ossification of the ligamentum flavum was not recognized in the sections. Calcium deposits were stained positively at the margin

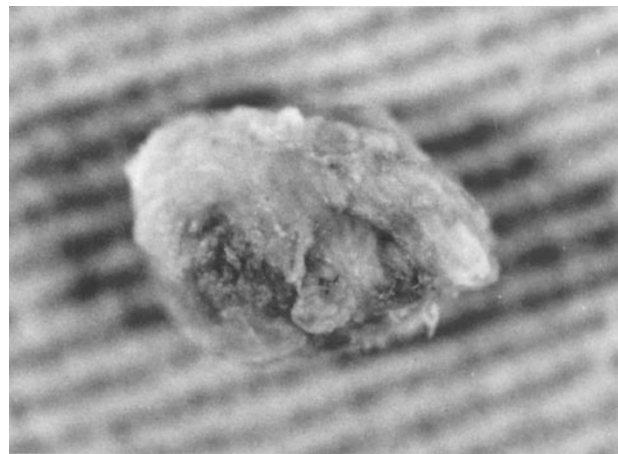


Figure 3 Case 1. Gross specimen of the nodule. It was a $7 \times 5 \times 4$ mm large, non-cystic nodule

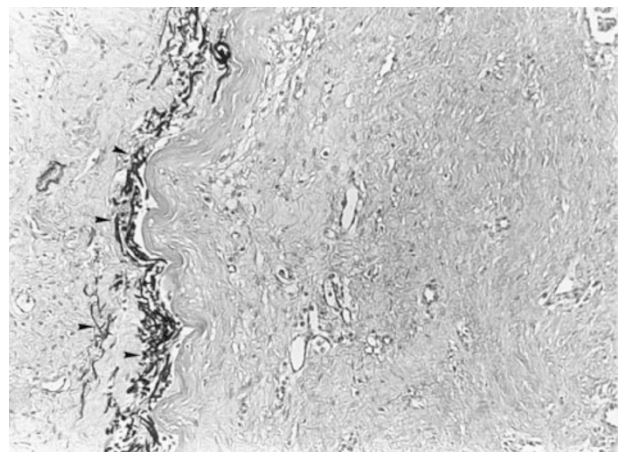


Figure 4 Case 1. Photomicrograph of the specimen showing no elastic fibers at the center of the degeneration (the center of the photograph). Elastic fibers were irregularly arranged, ruptured, swollen, and few in number at the margin of the degeneration (arrow heads). van Gieson's stain, $\times 100$

of the degeneration by von Kossa's stain. The patient's postoperative course was uneventful. The patient noted immediate and complete relief of pain. The patient returned to regular activities 6 weeks postoperatively. At a follow-up examination 2 years later, the patient was free of symptoms and the findings of a neurological examination were normal.

Case 2

A 50-year-old man presented with 10 days history of severe burning pain radiating from the left buttock into the left posterolateral thigh and leg. The patient also reported paresthesia in the left leg and the left foot. Physical examination revealed restricted lumbar motion, knock pain of L4 spinous process, left sciatic notch tenderness, hypesthesia of the lateral aspect of left leg and the dorsal aspect of left foot, weakness of the left toes and positive straight leg raising examination for the left lower extremity. Lumbar spine radiographs demonstrated multilevel degenerative changes of facet joints but no degenerative spondylolisthesis. Conservative treatment for 6 weeks failed to alleviate the patient's symptoms. The MRI revealed a T2 low intensity mass in the L4–L5 ligamentum flavum, compressing the dural theca (Figure 5). A lumbar myelogram revealed a left posterolateral extradural compression above the L4–L5 disc. At surgery, a nodular lesion embedded in the L4–L5 ligamentum flavum was revealed. The nodular lesion was compressing the dural theca and the origin of the left fifth lumbar nerve root. This lesion was removed *en bloc*. Macroscopically it was a 6 × 4 × 4 mm large non-cystic nodule. No herniated disc was found and the disc was not disturbed. Histopathological examination of the mass revealed the same findings as in case 1: myxomatous degenera-

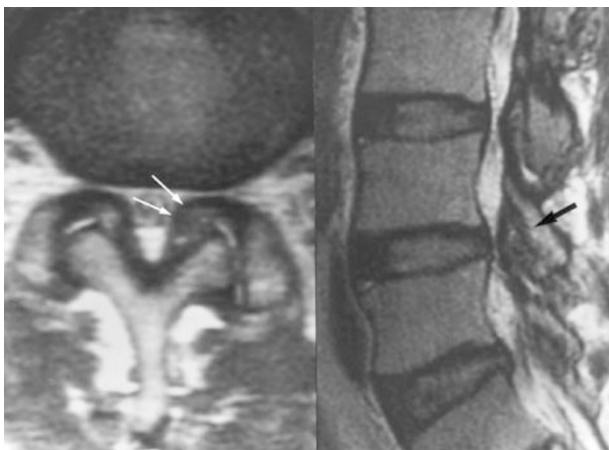


Figure 5 Case 2. A magnetic resonance image (left: axial view, right: sagittal view. Repetition-time, 4000 msec; echo-time, 98 msec.) revealed a T2 low intensity mass in the left L4–L5 ligamentum flavum (arrows)

tion of the ligamentum flavum (Figure 6). Calcium deposits were not found by von Kossa's stain. The patient noted immediate and complete relief of pain and neurological symptoms. At a follow-up examination 2 years and 4 months later, the patient was free of symptoms and the findings of a neurological examination were normal.

Discussion

The ligamenta flava are paired structures that connect adjacent lamina. The elastin content of the ligamentum flavum is approximately 80%, versus a collagen content of 20%. Elsberg⁹ described an enlarged ligamentum flavum that compressed the nerve roots. Several other authors described additional instances of hypertrophy of the ligamentum flavum.^{10–14} Yoshida¹⁵ classified pathogenesis of the hypertrophied ligamentum flavum into three groups. The groups were (1) fibrocartilage change due to proliferation of type II collagen, (2) ossification, (3) calcium crystal deposition. Overgrowth of collagen was common in these three groups. We believe that our cases were different from the hypertrophy of the ligamentum flavum. The ligamentum flavum has a low signal on the T2 weighted image in the hypertrophy of the ligament. The lesion had a high signal on the T2-weighted image in case 1. The clinical onset of the hypertrophy of the ligamentum flavum is usually gradual. The clinical onset was acute in our cases. At surgery, in cases of hypertrophy of the ligamentum flavum, diffuse hypertrophy of the ligament is found around the nodular lesion. The surrounding ligaments were found to be normal in our cases. The pathological findings of our cases were different from the findings described by Yoshida and other authors because no overgrowth of collagen was found in our cases.

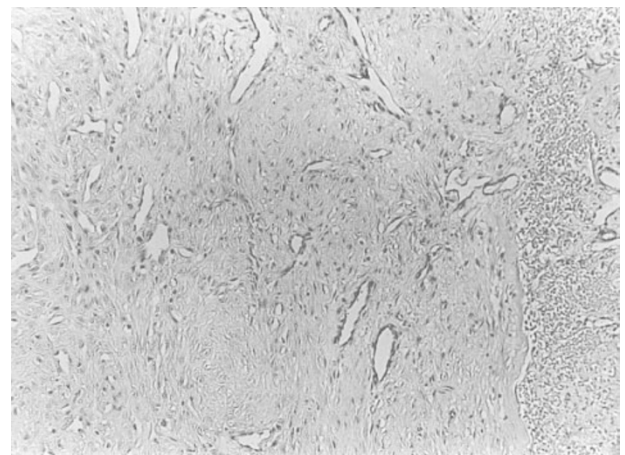


Figure 6 Case 2. Photomicrograph of the specimen. Stained with hematoxylin and eosin, × 100

Several reports of ligamentum flavum cyst causing acute sciatica have been made.¹⁻⁸ Diffuse mucopolysaccharide deposition was found at the degeneration site, however, no cyst was found macroscopically and microscopically in our cases. Sweasey reported two cases of ligamentum flavum hematoma, which compressed the nerve root.¹⁶ Hematoma was not found in our cases. Moiel reported a case of a nodule of the ligamentum flavum as a cause of nerve root compression.¹⁷ A small cyst was centrally placed in the nodule that was composed of degenerated collagen and elastic connective tissue in Moiel's case. Marked degeneration of elastic fibers was found but no cyst was found in our cases.

An etiological connection is assumed between the degeneration of elastic fibers and minor trauma. A theory of myxomatous degeneration of certain fibrous tissue structures has been advanced to explain their genesis. Flexion and torsion of the trunk produce repetitive minor trauma in the ligamentum flavum. Especially, hypermobility associated with degenerative spondylolithesis can subject the ligament to stress. It was not clear why the clinical presentation was acute but possibly a change of osmotic pressure may result in acute expansion of the lesion. The treatment should be total excision of the mass lesion.

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