sinus. Hematogenous spread from the cavernous sinus or internal carotid may lead to distant cerebral infarction and/or abscess, usually ipsilateral to the initial disease. Bony destruction is relatively uncommon. However, the infection spreads from one bony or fascia lined space into an adjacent one via natural dehiscences in fascia or through foramina, fissures and canals within the bone.[5] The CNS may be invaded by direct extension of the infection through the cribriform plate, orbital fissure or basal foramina.[2,3,6] Infections of the hard and soft palate can access the greater and lesser palatine nerves, while infections of the cheek and orbital soft tissues can access the infraorbital nerve. These main branches form the maxillary nerve, which ascends to the pterygopalatine fossa, entering the cavernous sinus via the foramen rotundum. From the cavernous sinus, infection can spread to Meckel's cave and then along the cisternal portion of the trigeminal nerve to the lateral aspect of the pons or the trigeminal nuclei. We believe the MRI findings coupled with the route of involvement to the pons and the macroscopic appearance of the maxillary nerve at operation were strongly suggestive of perineural spread of mucormycosis via the maxillary division of the trigeminal nerve.

The trigeminal nerve may be involved in a variety of disease processes that may be visualized with modern imaging techniques.[7,8] Multiplanar capability and high soft tissue contrast enhancement makes MRI the modality of choice for the study of the entire cranial trigeminal nerve pathway[9] Furthermore, since bony destruction is uncommon, and MRI is better than CT in assessing intracranial spread, we chose to evaluate and follow-up our patient with MRI.

As far as we know, radiological demonstration of perineural spread of rhinocerebral mucormycosis is very rare and there are only two other cases (also involving the trigeminal nerve) reported in the English literature. McLean et al.[6,10] reported the radiologic-pathologic findings while Press et al. reported the MRI findings of extension of the disease from cavernous sinus to the pons. The isolated pontine infarction reported by Callı et al.[11] was thought to result from basilar arteritis secondary to mucormycosis.

Although radiological demonstration of perineural extension in mucormycosis is uncommon, imaging findings of perineural spread of head and neck malignancies is a very well known entity, where the tumor disseminates to noncontiguous regions along the endoneurium or perineurium.[12–15] Facial, skin, sinus, nasopharyngeal and salivary gland tumors have a propensity to spread along this pathway. The same pathway has occasionally been described as being the route of intracranial extension of inflammatory lesions such as sarcoidosis and Wegener's granulomatosis of the skull base.[16,17] Atri et al.[18] described a case of actinomycotic granuloma of the trigeminal ganglion. Given these data it seems logical to assume the same pattern of spread for rhinocerebral mucormycosis, particularly when there is evidence of thickening and enhancement of the trigeminal nerve along its tract and involvement of pons.

Aggressive surgical debridement, antifungal chemotherapy, correction of impaired immunity and controlling blood glucose levels are the treatment strategies for mucormycosis. The prognosis of cerebral mucormycosis is poor with 5-year survival rates of just 20%–45%.[3]

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# Ossified ligamentum flavum of the atlantoaxial region

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**Summary** A 30-year-old male presented complaining of a six-month history of progressive weakness and paraesthesia in all four limbs. Symptoms occurred following moderately severe neck trauma. Investigations revealed ossification of the ligamentum flavum (OLF) between the atlas and axis, with marked cord compression. The patient showed remarkable neurological recovery following excision of the OLF. OLF causing cord compression is rare and has never been reported in the atlantoaxial region.


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## INTRODUCTION

Ossification of the ligamentum flavum (OLF) is most commonly observed in the lumbar region. There are isolated reports of OLF in the cervical spine. Our literature review revealed no reported case of segmental OLF in the atlantoaxial region. We present a case of OLF in the atlantoaxial region and the relevant literature is briefly reviewed.

## CASE REPORT

A 30-year-old male presented with progressive paraesthesia and weakness of all four limbs following a fall from a bicycle 6 months previously. Additionally, he had increased frequency of micturition and constipation. On admission, he was severely disabled and unable to sit or stand without support. Examination revealed spastic grade 3 quadriparesis and diminished spinothalamic and kinaesthetic sensation below the second cervical (C2) dermatome.

Investigation revealed unusual abnormal bony transformation of the entire ligamentum flavum between the lamina of the axis and the arch of atlas, resulting in focal spinal stenosis and severe cord compression. The rest of the cervical spine showed no significant abnormality (Figs. 1–3).

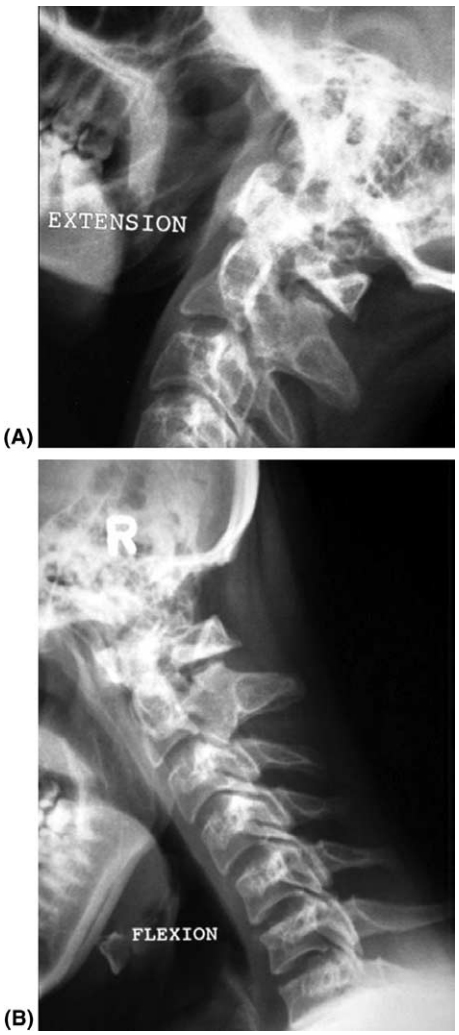


**Fig. 1** Plain radiograph of the cervical spine in extension (A) and flexion (B). There is no craniovertebral instability. The OLF appears as mound-like bony excrescence arising from the inferior border of the arch of the atlas and superior border of the lamina of the axis.

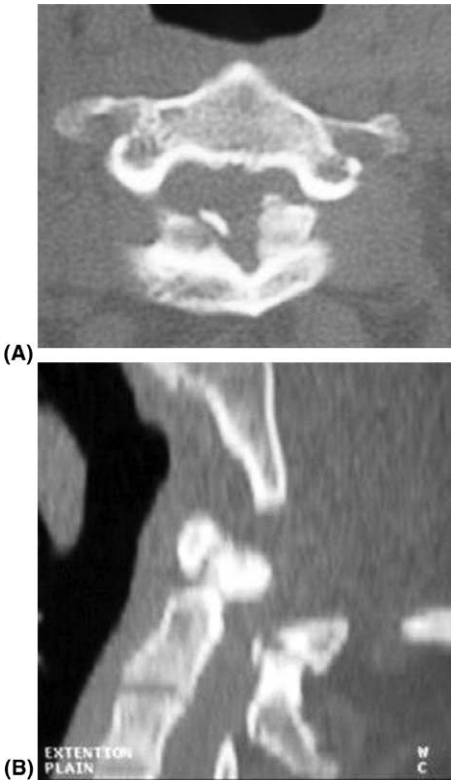


**Fig. 2** CT of the cervical spine. (A) Axial CT at the level of atlas demonstrates the OLF causing severe cervical canal stenosis. (B) Sagittal reconstructed CT shows the OLF bridging the atlas and axis in the interlaminar portion, forming a block of bone.

The patient underwent posterior decompressive surgery. The bone of the posterior atlas and axis was thick, sclerotic and hard and the intervening ligamentum flavum had been transformed into a block of hard bone. Laminectomy and excision of the ossified ligamentum flavum was performed using bone rongeurs and a high-speed drill. The dura was not adherent to the ligamentum flavum. Following surgery, the patient made a remarkable clinical motor and sensory recovery. At 6 month follow-up, he was almost asymptomatic. Histological examination of the surgical specimen showed endochondral ossification, lamellar bone structure and marrow formation suggestive of OLF. Post-operative radiology demonstrated adequate decompression of the cervical cord and complete excision of the atlantoaxial OLF (Figs. 4 and 5).

## DISCUSSION

OLF is frequently seen in the lumbar and dorsal regions and is most often secondary to a chronic degenerative spondylotic process.[1–6] Congenital or post-traumatic OLF is rare, even in the lumbar spine. There are isolated case reports of OLF in the cervical spine.[2,4,7–11] Although stenosis of the spinal canal in the atlantoaxial region in isolation[12] and in association with rest of the cervical spine has been reported, segmental calcification or ossification of the atlantoaxial region of the ligamentum flavum has not been reported.

The exact pathogenetic mechanism for OLF is unclear. Dynamic, chronic and excessive stresses on the ligamentum flavum have been suggested.[3,8,13–15] Trauma to the ligamentum flavum