Familial monomelic amyotrophy (Hirayama disease): Two brothers with classical flexion induced dynamic changes of the cervical dural sac

Sir,

In Hirayama disease or monomelic amyotrophy (MMA), dynamic changes of the cervical dural sac and spinal cord associated with neck flexion have been suggested to cause transient cord compression. This finding has not been reported in familial MMA. Two brothers were clinically evaluated and underwent magnetic resonance imaging (MRI) of the spinal cord. They were born to nonconsanguineous parents and had classical manifestations of MMA of the upper limb. Both demonstrated presence of characteristic flexion induced dynamic changes of the cervical dural sac with enhancing posterior epidural space. This observation among familial MMA has not been reported till date.

Hirayama disease or MMA has been documented in hundreds of patients mostly from Japan and other Asian countries including India, Sri Lanka, Korea, Hong Kong, Taiwan, and Malaysia.^[1,2] It is rarely familial.^[3,4] Hirayama and others have reported dynamic changes of the cervical dural sac and spinal cord during flexion movements and have suggested that these dynamic changes may result in transient cord compression.^[5] The dynamic changes of the cervical dural sac and spinal cord associated with neck flexion have been not been reported in familial MMA.

The proband a 19-year-old boy, born to nonconsanguineous parents, presented with four years history of progressive weakness of right hand and forearm. Two years after the onset of wasting he also noticed mild tremulousness of left hand. Examination showed moderate degree of wasting of forearm and small muscles of the right hand. Thenar, hypothenar, and interosseious muscles were severely weak. Deep tendon reflexes were normal in the upper limbs and brisk in the lower limbs. Proband's elder brother, aged 21 years, had progressive weakness and wasting of left hand and forearm of three years duration. The deficit progressed over two years and attained a stationary course. He had moderate wasting of left forearm and hand muscles with relative sparing of the brachioradialis. Thenar, hypothenar, interosseious and the long flexor muscles were moderately weak on the left side. Deep tendon reflexes were normal in the upper limbs and brisk in the lower limbs.

Electromyography (EMG) of affected muscles in both patients revealed features of chronic denervation with reinnervation. Motor and sensory conductions were normal with no conduction block. Contrast magnetic resonance imaging (MRI) of cervical spine was performed in neutral and fully flexed positions of neck. Both had mild atrophic lower cervical spinal cord at C6-C7 level [Figure 1a and 2a]. Index patient did not show any other abnormality in neutral position [Figure 1a-c]. Elder brother showed high intensity signals extending from C5 to C7 vertebrae on T2-weighted images (WI). On axial plane these hyperintense signals were mainly localized to bilateral anterior horns of the grey matter [Figures 2b and 2e]. Posterior epidural space showed



Figure 1a-f: Magnetic resonance imaging of proband: (a) T1w sagittal; (b) T2w sagittal showing normal cervical curvature and normal cord; (c) T1w sagittal post contrast in neutral position demonstrates no abnormal enhancement; (d) T1w sagittal post contrast in flexion position demonstrates enhancing epidural space from C3-C7 level; (e) T2w axial; and (f) T1w axial post contrast do not show any cord atrophy



Figure 2a-f: Magnetic resonance imaging of elder brother: (a) T1w sagittal flexion; (b) T2w sagittal flexion showing reversal of cervical curvature with prominent epidural space from C3-C6 levels; (c) T1w sagittal post contrast in neutral position demonstrates no abnormal enhancement; (d) T1w sagittal post contrast in flexion position demonstrates intensely enhancing epidural space; (e) T2w axial at C5 level shows cord atrophy; and (f) T1w axial post contrast showing abnormal enhancing epidural space

mixed intensity signals on T1 and T2 WI in elder brother and enhanced homogenously and intensely following contrast administration [Figure 2a-d]. On complete neck flexion, both the patients had forward movement of lower cervical spinal cord which was compressed and anteroposteriorly flattened against the vertebral bodies [Figures 1a-d and 2a-d]. The posterior wall of the dural sac moved forwards and obliterated the subarachnoid space. Posterior epidural space which was not visible in neutral position in index case became [Figure 1d] prominent and appeared as a crescent shaped area in both patients in flexion, which extended from C2 to C7 vertebrae. No vessels were seen traversing epidural space. This finding disappeared after the patient returned to neutral position [Figure 1a-c].

Since the first report of Hirayama disease in 1959,^[1] there has been a total of eight reports of familial MMA in the English literature. Interestingly, in five families, the affected siblings were males. Our present patients were also males. In our series of 262 patients of MMA (unpublished) seen over a period of 32 years, this is the second familial case of MMA. The first report was on an affected mother and son.^[3] In the present report, both the brothers exhibited the classical features of brachial MMA. Forward displacement of the lower dural sac and injury to the cord during flexion has been proposed as a mechanism for MMA.[5,6] The dramatic forward displacement of the dural sac and flattening of lower cervical cord in fully flexed position of neck was the highly characteristic observation in both our patients and this finding according to earlier studies is a classical and almost diagnostic MRI feature in MMA.[5,6] Dynamic MRI studies of the cervical spine in both the brothers had this classical finding The explanation for the familial occurrence of this mechanical cervical cord compression is indeed interesting and needs further

studies. The cord flattening was asymmetrical and more on the side of the atrophic upper limb. Hirayama *et al.*, described the dynamic compression of the lower cervical cord on neck flexion as an unequivocal finding confined to the progressive stage of the disease.^[5,6] They have also demonstrated that this finding is absent in elderly patients in whom the disease has been arrested, thus suggesting that the dynamic compression has a pathogenic significance.^[5,6] Both our patients had a disease duration of less than five years and the proband was still in the progressive phase.

The epidural high signal behind the displaced lower cervical cord suggests circulatory changes in the spinal cord during neck flexion. These findings represent passive dilatation of epidural venous plexus due to displacement of dural sac, although their pathogenic role is unknown. The classical finding of forward displacement of lower cervical dural sac demonstrated in our two siblings has not been described earlier, and possibly there might be certain genetic contribution to this mechanical dysfunction which may be operating as a causative or promoting factor in familial monomelic amyotrophy.

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