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Case Report

Bilateral Hirayama Disease: A Case Report

Furqan Mohd. Akram Khan[1], Mohammed Adnan Sheerazi[2]

[1]Senior Resident, Department of Neurology, Dr. D. Y. Patil Medical College, Hospital and Research College, Pimpri, Pune, Maharashtra, India, [2]Former Medical Intern, Department of Medicine, D. Y. Patil School of Medicine, Nerul, Navi Mumbai, Maharashtra, India

Abstract

Hirayama disease is a rare restricted form of motor neuron disease. It commonly affects young males. Patients typically present with the insidious onset of unilateral weakness and atrophy of the hand muscles that often progresses to the forearm. In some cases, the syndrome is bilateral but often asymmetrical. Of note, the brachioradialis muscle is usually spared. The syndrome affects C7–C8–T1 muscles with sparing of the C5–6 muscles. We report a case of a 25-year-old male who presented with 2 years of history of progressive wasting and weakness of muscles of bilateral hands and forearms. Based on clinical features, electrodiagnostic studies and dynamic magnetic resonance imaging cervical spine diagnosis of Hirayama disease were made. The patient was treated conservatively with a cervical collar. Over a period of 8 months follow-up, no progression was seen.

Key words: Hirayama disease, Juvenile non-progressive amyotrophy, Oblique amyotrophy, Snake eye appearance

INTRODUCTION

Hirayama disease also known as monomelic amyotrophy, Sobue disease, juvenile segmental muscular atrophy, or benign focal amyotrophy was first described by Keizo Hirayama as juvenile muscular atrophy of unilateral upper extremity.[1] It is a very rare benign neurological disorder, mainly affecting young males in the second or third decade of life. The onset of this disease usually corresponds to the beginning of the adolescent growth spurt. The distinctive clinical features include insidious onset and slow progression of muscular atrophy with weakness of the forearms and hands, the muscular atrophy reaches a plateau phase after 2–5 years of the onset of disease after which this disease neither improves nor worsens. Sensory deficits are generally absent although some patients may experience paresthesia. It caused by dynamic compression of the lower cervical cord resulting from sustained or repeated neck flexion. The pathologic finding is ischemic changes in the anterior horn cells of the localized lower cervical cord. Dynamic magnetic resonance imaging (MRI) (neutral and flexed) of the cervical spine has become the mainstay for confirming clinical diagnosis. For decades, the disease was thought to be unilateral, later on, bilateral cases were described by many authors as part of short or long case series but it was relatively uncommon compared to unilateral cases. In cases of bilateral diseases, it is often asymmetric and very rarely symmetric.

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CASE REPORT

A 25-year-old male reported with a 2-year history of asymmetric slowly progressive weakness and atrophy of both distal upper limbs that started first in the left hand and the forearm and 6 months later involved the right hand and the forearm. The hand weakness limited several activities of his daily living. He complained of paresthesia in bilateral hands but was able to perceive all sensations normally. There was no history of pain in the neck or radicular symptoms. There was no history of trauma, febrile illness, exposure to toxins, or heavy metals in the past. His past medical history was non-contributory, he denied any addiction, and none of his family members had similar symptoms.

On examination, there was striking muscular atrophy and weakness affecting bilateral hands and forearms left more than the right [Figures 1 and 2] with preserved bulk of brachioradialis giving the characteristic appearance of oblique amyotrophy [Figure 3]. The bulk of arms and shoulders was maintained. The rest of the neurological and general examination was normal.

Results of routine blood analysis were normal, there were negative results for vasculitis screening (rheumatoid factor,

Corresponding Author: Dr. Mohammed Adnan Sheerazi, F-1004, Palm Beach Residency, Palm Beach Road, Nerul West, Sector-4, Navi Mumbai - 400 706, Maharashtra, India.

antinuclear antibody, extractable nuclear antigens, and antiphospholipid antibody) and viral serology: Human immunodeficiency virus, hepatitis B, and hepatitis C.

Serum creatine phosphokinase was mildly raised (210 IU/L), while other markers of muscle injury myoglobin, lactate dehydrogenase, and aspartate aminotransferase were within the normal range.

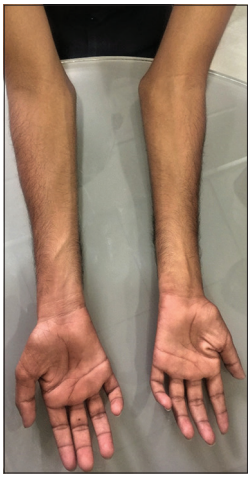

Figure 1: Bilateral wasting of muscles of hands and forearms, left more than right is seen

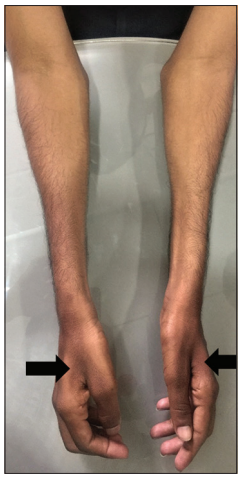

Figure 2: Bilateral wasting of 1st dorsal interossei (arrow heads) is seen along with wasting of other muscles of hands and forearms

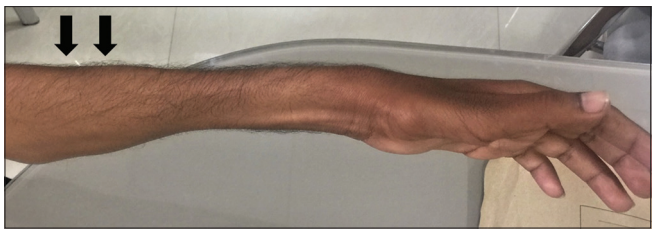

Figure 3: Preserved bulk of brachioradialis (arrow head) with wasting of muscles of hand and forearm is seen, producing a characteristic muscle wasting pattern of the forearm called "oblique amyotrophy"

On electrodiagnostic (EDX) studies, bilateral median and ulnar nerve conduction revealed normal distal motor latencies, low compound motor action potential (CMAP) amplitudes, and conduction velocities. The CMAP amplitudes were relatively lower on the left side. Bilateral median and ulnar nerves sensory onset latencies, sensory nerve action potentials (SNAP) amplitudes, and conduction velocities were normal. Needle electromyography (EMG) exam revealed fibrillations, large-amplitude, and prolonged-duration MUAPs with reduced recruitment suggestive of a chronic axonal neurogenic process in bilateral C8-T1 more than C7 innervated musculature, bilaterally along with the mild active denervation in some of the C8-T1 innervated muscles. The process was more severe on the left side.

The X-ray cervical spine showed a straightening of cervical spine curvature.

Dynamic MRI cervical spine study was done, which revealed the loss of cervical spine lordosis. Localized cervical cord atrophy at the C5-C7 levels was noted, which was asymmetrical on the axial image with a pear-shaped or triangular on axial images [Figure 4]. On sagittal T2-weighted images (T2WI), intramedullary linear hyperintensity extending from C5 to C7 was seen. On axial T2WI bilateral symmetrical small hyperintense foci in the anterior horn cells of the cervical spinal cord extending from C5 to C7 vertebrae were seen, giving the characteristic snake eye appearance [Figure 5]. On flexion study, mild prominence of the posterior epidural space was noted.

Based on clinical, EDX studies and radiological findings, the diagnosis of bilateral Hirayama disease was made.

The patient was managed conservatively with a cervical collar, muscle strengthening exercises, and training in hand-coordination. Over 6 months of follow-up, no worsening is seen.

DISCUSSION

Hirayama disease and the terms benign focal amyotrophy, brachial monomelic amyotrophy, or juvenile segmental muscular atrophy are used to describe a rare disorder characterized by lower motor neuron disease clinically restricted to the distal upper limb. Most cases are sporadic, although a familial form has been reported. The etiology is unknown. Autopsy studies have shown the affected region of spinal cord flattened, the anterior horn markedly atrophied and gliotic, and a reduction in the numbers of both large and small motor neurons. Based on neuroradiological studies, Hirayama, who established the disease entity, has proposed a mechanically induced limited form of ischemic cervical myelopathy, being the

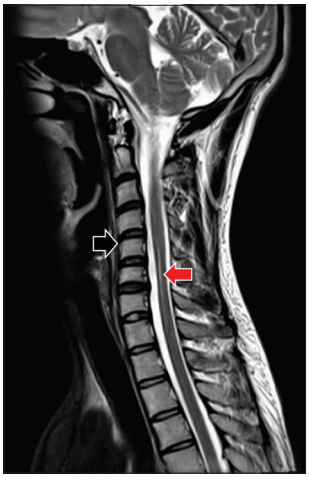

Figure 4: Sagittal T2-weighted magnetic resonance images showing loss of cervical lordosis (white arrow) with focal atrophy and intramedullary hyperintensity and focal atrophy extending from C5 to C7 level (red arrow)

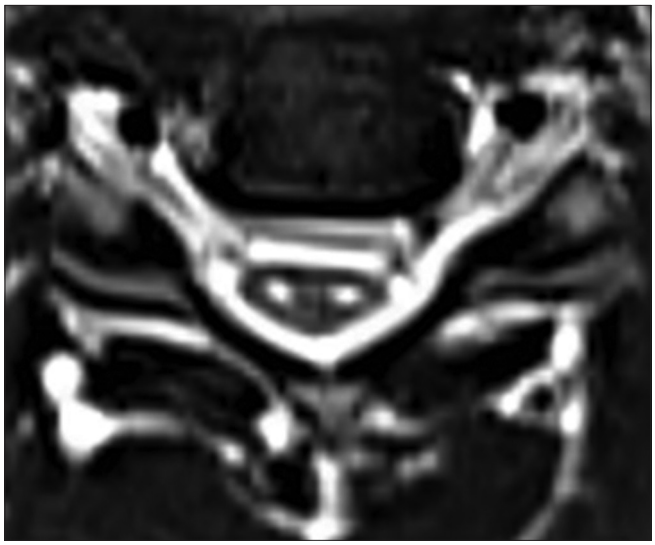

Figure 5: Axial T2-weighted magnetic resonance images at C6 level showing, bilateral symmetrical small hyperintense foci in the anterior horn cells showing characteristic "snake eye appearance" with pear shaped/ triangular anteroposterior cord flattening

result of local compression of the dura and spinal cord against vertebrae during repeated neck flexion/extension, in turn, due to disproportionate growth between the contents of the dural sac and the vertebral column.[2,3] Toma and Shiozawa proposed that the disproportionate shortening of the dural sac is accentuated during the juvenile growth spurt.[4] Another school of thought is that this is a segmental, perhaps genetically determined, spinal muscular atrophy, but the actual cause is still unknown. The disease usually begins in the late teens, but many cases can present in the fourth decade. More than 60% of patients are men. Although originally described in Indian and Japanese patients, the disorder is now recognizable around the world.

The most common presentation is one of an idiopathic, slowly progressive, painless weakness, and atrophy in one hand or forearm. The most common pattern is unilateral atrophy of C7–T1 innervated muscles, with sparing of the brachioradialis referred as the "oblique atrophy" pattern. Muscle stretch reflexes are invariably hypoactive or absent in the muscles innervated by the involved cord segment but are normal elsewhere. UMN signs are not present, and if they are, one should consider the onset of amyotrophic lateral sclerosis (ALS) instead. Approximately 20% have hyperesthesia to pinprick and touch, usually located on the dorsum of the hand. The cranial nerves, pyramidal tracts, and the autonomic nervous system are normal. Weakness and atrophy may progress steadily for the initial 2–3 years, but most patients have stabilized within 5 years. In some patients, there is an aggravation of weakness when exposed to cold, a phenomenon known as cold paresis. Spread may occur to the contralateral limb in about 20% of cases.[5]

No pathognomonic laboratory or EDX tests exist for this condition; their main purpose is to exclude alternative diagnoses.

Motor nerve conduction studies are either normal or may reveal asymmetrically low median or ulnar CMAP amplitudes in the affected hand; normal or a modest reduction in SNAPs occurs in up to one-third of patients. The EMG examination may show some fibrillation and fasciculation potentials, and chronic neurogenic motor unit changes are prominent.

The serum creatine kinase concentration may be modestly elevated, but other routine laboratory test results are normal.

Cervical MRI reveals various findings on neutral and flexion positioning. On neutral MRI, localized lower cervical cord atrophy, asymmetric cord flattening, parenchymal changes in the lower cervical cord, abnormal cervical curvature, loss of attachment between the posterior dural sac, and subjacent lamina have been described.[6] Among these, localized lower cervical cord atrophy, asymmetric cord flattening, and loss of attachment have an accuracy of 80% in the identification of the disease; loss of attachment is the most valuable finding for diagnosing Hirayama disease in the neutral position.[6,7] On flexion MRI, forward migration of the wall of the dura mater is observed with an enlarged posterior epidural space.[2,8,9] A hyperintense, crescentic epidural mass showing curvilinear flow voids, and uniform enhancement after administration of contrast is seen in the posterior epidural space.[9]

Snake-eyes appearance (SEA) is a unique radiological finding characterized as a symmetrical bilateral small high

signal intensity lesion on an axial T2-weighted MRI and is named because of its similar appearance to the eyes of a snake. The description of the SEA was initially given in a computed tomography myelography study of seven cervical spondylotic myelopathy patients in the 1980s.[10] Its pathologic result is cystic necrosis at the junction of the central gray matter and the ventrolateral posterior column and loss of anterior horn cells.[11] SEA is an irreversible lesion, appears late in the course of Hirayama disease, and it signifies a poor prognosis.[12]

Two diseases require distinction from Hirayama disease: ALS, which is almost always a relentlessly progressive terminal disease and MMNCB, which is a treatable peripheral motor neuropathy. A small proportion of ALS presents as Hirayama disease, albeit in an older patient population. It is only with follow-up examination that the more widespread anterior horn cell disorder becomes apparent and upper motor neuron signs appear. Deep tendon reflexes are almost always hyperactive early in the evolution of ALS. Furthermore, the EDX finding of generalized widespread acute and chronic motor neuron loss distinguishes ALS from the segmental motor neuron involvement of benign focal amyotrophy. The slowly progressive focal weakness that is distinctive of benign focal amyotrophy may also be the presenting picture of MMNCB, but detailed motor nerve conduction studies and serum tests for elevated titers of anti-GM1 antibodies can differentiate these two conditions.

Cervical radiculopathy may also appear in a manner somewhat akin to Hirayama disease. However, radicular pains and sensory impairment are typical of radiculopathies. Cervical syringomyelia or a benign tumor involving nerve roots or the spinal cord may also cause progressive weakness in a monomelic fashion. Careful EMG studies and neuroimaging should differentiate these diseases.

Hirayama disease is not life threatening, but it nevertheless severely impairs motor function in the involved extremity, although most patients adapt very well to their disability. Supportive care consists of physical and occupational therapy and effective use of assistive devices such as splinting and braces. Application of a cervical collar is believed to prevent the progression of the disease in early stages.[13] In selected cases, not responding to conservative measures duraplasty, anterior cervical decompression, and reconstructions with tendon transfers have yielded encouraging results.[14] Tendon transfers are a consideration in selected patients with focal weakness in a muscle group whose function is crucial for certain activities of daily living.

CONCLUSION

Hirayama disease is a rare self-limiting disease but disabling. Early diagnosis is important as the use of a simple cervical collar which will prevent neck flexion, has been shown to stop the progression. While dynamic contrast MRI shows characteristic findings, routine MRI has a high predictive value for diagnosis; in all clinically suspected cases of Hirayama disease, dynamic flexion study should be done as it aids diagnosis in patients of focal wasting if routine imaging is normal. All young adolescents with focal upper limb wasting should be evaluated to exclude Hirayama disease, a benign condition amenable to collar therapy.

REFERENCES

1. Hirayama K, Toyokura Y, Tsubaki T. Juvenile muscular atrophy of unilateral upper extremity: A new clinical entity. J Psychiatr Neurol 1959;61:2190-7.
2. Hirayama K. Juvenile muscular atrophy of unilateral upper extremity (Hirayama disease)-half century progress and establishment since its discovery. Brain Nerve 2008;60:17-29.
3. Hirayama K, Tokamaru Y. Cervical dural sac and spinal cord in juvenile muscular atrophy of distal upper extremity. Neurology 2000;54:1922-6.
4. Toma S, Shiozawa Z. Amyotrophic cervical myelopathy in adolocent. J Neurol Neurosurg Psychiatry 1995;58:56-64.
5. Gourie-Devi M, Nalini A. Long-term follow up of 44 patients with brachial monomelic amyotrophy. Acta Neurol Scand 2003;107:215-20.
6. Chen CJ, Hsu HL, Tseng YC, Lyu RK, Chen CM, Huang YC, *et al*. Hirayama flexion myelopathy: Neutral position MR Imaging findings-importance of loss of attachment. Radiology 2004;231:39-44.
7. Mukai E, Matsuo T, Muto T, Takahashi A, Soube I. Magnetic resonance imaging of juvenile-type distal and segmental muscular atrophy of upper extremities. Clin Neurol 1987;27:99-107.
8. Pradhan S, Gupta RK. Magnetic resonance imaging in juvenile asymmetric segmental spinal atrophy. J Neurol Sci 1997;146:133-8.
9. Chen CJ, Chen CM, Wu CL, Ro LS, Chen ST, Lee TH. Hirayama disease: MR diagnosis. AJNR 1998;19:365-8.
10. Jinkins JR, Bashir R, Al-Mefty O, Al-Kawi MZ, Fox JL. Cystic necrosis of the spinal cord in compressive cervical myelopathy: Demonstration by lopamidol CT-myelography. Am J Roentgenol 1986;147:767-75.
11. Mizuno J, Nakagawa H, Inoue T, Hashizume Y. Clinicopathological study of "snake-eye appearance" in compressive myelopathy of the cervical spinal cord. J Neurosurg 2003;99:162-8.
12. Xu H, Shao M, Zhang F, Nie C, Wang H, Zhu W, *et al*. Snake-eyes appearance on MRI occurs during the late stage of Hirayama disease and indicates poor prognosis. Hindawi BioMed Res Int 2019;2019:8.
13. Tokumaru Y, Hirayama K. Cervical collar therapy for juvenile muscular atrophy of distal upper extremity (Hirayama disease) results from 38 cases (abstr). Rinsho Shinkeigaku 2001;41:173-8.
14. Chiba S, Yonekura K, Nonaka M, Imai T, Matumoto H, Wada T. Advanced Hirayama disease with successful improvement of activities of daily living by operative reconstruction. Intern Med 2004;43:79-81.

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