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CASE REPORT

Hirayama Disease: A Case Series and Literature Review

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Abstract:

Hirayama disease is a rare self-limiting benign disorder. It is a focal, lower motor neuron type of disease commonly affecting young males in their second and third decades of age. It is most commonly seen in Asian countries like India, Japan and China but in Bangladesh, there was no available data for incidence of the disease. MRI of the cervical spine in flexion will reveal the cardinal features of Hirayama disease. Here we report three cases of Hirayama disease presented at the outpatient department of Bangabandhu Sheikh Mujib Medical University, Dhaka. Among Three Cases two of them presented with asymmetrical distal bilateral upper limb weakness and wasting and one with unilateral involvement. Though Hirayama disease is benign and usually a self-limiting disorder but requires early diagnosis to reduce the progression of the disease. The use of Cervical Collar and physiotherapy can reduce the progression.

Keywords: *Hirayama disease, cervical collar, flexion MRI.*

Introduction:

Hirayama's disease is a very rare benign disorder, also referred to as monomelic amyotrophy (MMA), Juvenile non-progressive amyotrophy, Sobue disease. The disease is a focal lower motor neuron type of disease. The benign nature of the disease helps to distinguish it from other lower motor neuron disorders like amyotrophic lateral sclerosis (ALS). Mainly young males in their second and third decades of age are most commonly affected. It is seen most commonly in Asian countries like India and Japan[1,2].

Hirayama disease is characterized by unilateral or asymmetrical bilateral focal weakness and wasting of muscles innervated mainly by C7, C8, and T1. It shows a gradual onset and benign course. It was first described by Hirayama et al.[3] in 1959 as "juvenile muscular atrophy of unilateral upper extremity" and in 1984, Gourie-Devi et al.4 coined the term "monomelic amyotrophy"[4].

The exact pathogenesis is unknown but repeated flexion movements of the neck leading to forward displacement of the lower cervical dural canal causing microcirculatory changes in anterior horn cells of the lower cervical cord is thought to be a probable pathogenic mechanism of this disease[5,6]. Cervical Spine dynamic MRI with contrast is the preferred investigation modality which shows a spectrum of valuable diagnostic findings.

Here we report 3 cases of Hirayama disease having bilateral presentation in two patients and unilateral in one patient.

The cases

Case 1:

A 34-year-old gentleman presented in the Neurology department of BSMMU with wasting and weakness of both upper limbs for 8 years. It was insidious onset and slowly progressive. The first involved the right upper hand and and few months later also involved the left hand with gradual involvement of both forearm muscles. He had no history of neck pain, sensory disturbance, sphincteric disturbance and fasciculation. There

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was no history of neck trauma, past poliomyelitis, toxin exposure and no family history of such type of illness. On neurological examination his higher psychic function including speech was normal. All cranial nerves were normal. On motor system examination there was gross wasting and weakness of both the thenar and hypothenar muscles with dorsal guttering. Distal forearm muscles were also wasted with relative sparing of brachioradialis muscle on both sides (figure-1). Deep tendon reflexes were brisk. Hoffman's sign was negative. Sensory system, lower limb examination, coordination and gait were normal. Blood routine tests, blood sugar, thyroid function, renal and liver function tests all were normal. Nerve conduction study showed reduced amplitude of median and ulnar motor nerves with normal latency, velocity and intact sensory nerves. Needle electromyography showed spontaneous activity in the form of positive sharp wave and fibrillation with neuropathic MUAP in 1st dorsal interosseous, extensor digitorum superficialis, and deltoid with sparing of brachioradialis on both sides. Findings of the lower limb were normal. MRI revealed segmental atrophy of the cervical spinal cord ranging from C5 to T1 segment with intramedullary signal intensity (Figure 2). There was no disc prolapse.

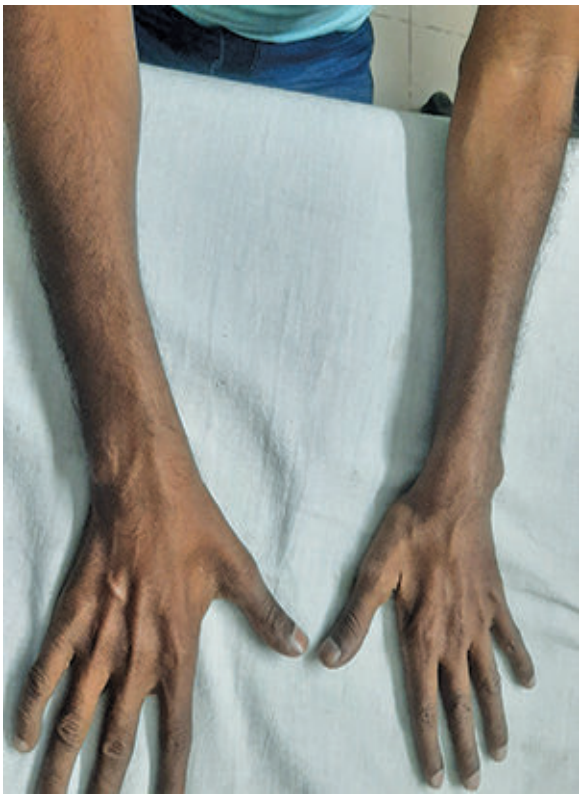

Fig.-1: *Picture showing asymmetrical wasting of both hands and forearm (left >right) sparing the brachioradialis muscle.*

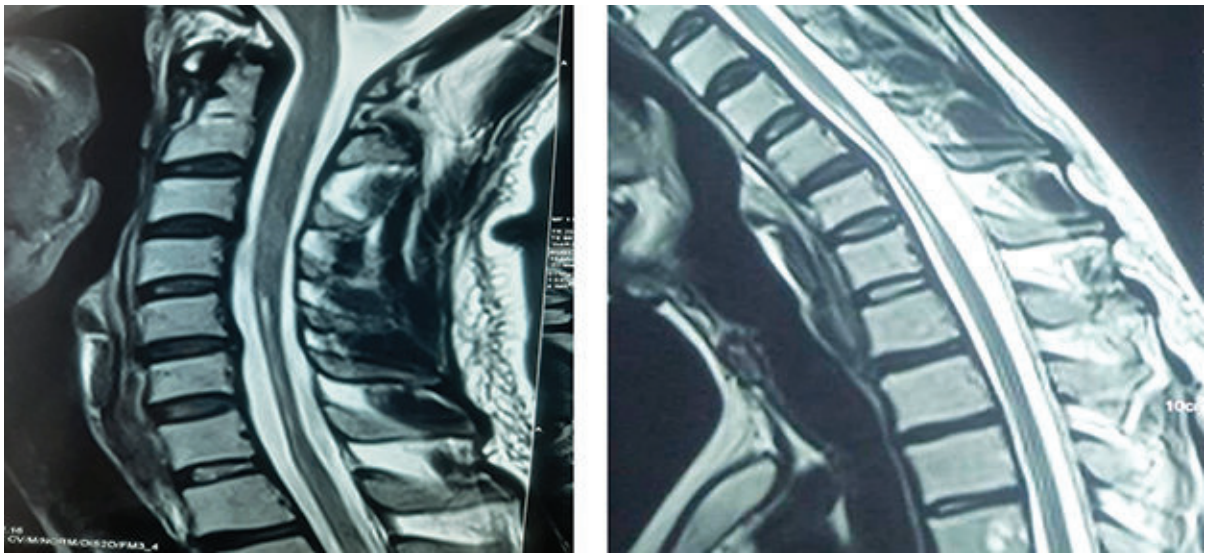

Fig.-2: *Cervical spine MRI showing segmental narrowing of the cord at C5 to C7 levels with intramedullary signal changes (both neutral and flexion view).*

Case 2:

A 28 years female housewife presented with weakness and wasting of right hand and forearm for 2 years and left hand for 6months. Her weakness and atrophy started initially in the small muscles of the right hand and gradually progressed to involve the right forearm muscles. Subsequently she also noticed weakness of right hand without gross wasting. She had no history of pain, fasciculation, sensory complain or neck trauma. Neurological examination showed she was well alert, conscious, and oriented with normal speech and higher mental functions. Her cranial nerves were normal. Motor examination showed atrophy and weakness (G4/5) of the thenar, hypothenar, interosseous, and mild wasting of forearm muscles with sparing of the brachioradialis muscle on the right side (Fig. 3). There was no fasciculation. Deep tendon reflexes were diminished in right upper limb and normal in other limbs. Lower limb examination, sensory examination, co-ordination and gait were normal. Routine laboratory investigations (complete blood count, renal function tests, liver function tests, serum electrolytes, thyroid function tests, erythrocyte sedimentation rate, and creatine phosphokinase) were within normal limits. Nerve conduction study showed a low compound muscle action potential (CMAP) amplitude in the ulnar motor nerve while recording abductor digiti minimi. Electromyogram (EMG) showed evidence of denervation in C5, C7, C8 distribution with sparing of the brachioradialis muscle. lower limb examination was normal. Magnetic resonance imaging (MRI) of the cervical spine showed straightening of the neck with atrophy of the cord opposite C5–6. With neck flexion, there was no significant anterior displacement of the posterior dura but intramedullary signal changes with focal atrophy was observed from C5 to C6 segment (Fig. 4).

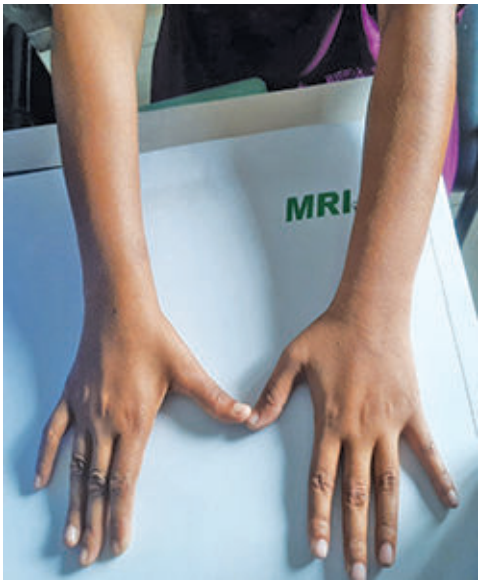

Fig.-3: *Picture of forearm and hand showing asymmetrical wasting of both hand (right >left)*

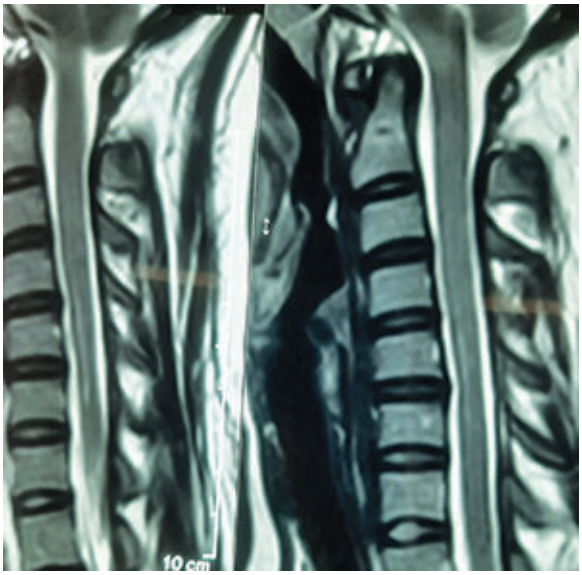

Fig.-4: *MRI of cervical spine in flexion view showing narrowing of the cord at C5, C6 level with intramedullary signal changes extending from C$ to C6 level and mild anterior displacement of posterior dura.*

Case 3:

A 17 years old young man presented with wasting and weakness of right hand without any fasciculation for 2 years. It was insidious in onset and started from hand muscles and slowly progressed to forearm. He had no history of neck pain, trauma and sensory complain. On examination there as gross wasting of 1st dorsal interossei and both thenar and hypothenar muscles (figure:5). Wasting was more in hypothenar than thenar in contrast to motor neuron disease (reverse split hand). Wasting was also observed in right forearm muscles sparing brachioradialis muscle.

Biceps and supinator jerks were diminished on right side. Left upper limb and lower limbs examination were normal. Routine blood investigation were within normal limits. MRI of cervical spine in flexion view showed segmental atrophy of C5-6 spinal segment without any compression and widening of posterior dural sac (figure:6). NCS and EMG findings were consistent with segmental denervation involving C5, C7 and C8 distribution.

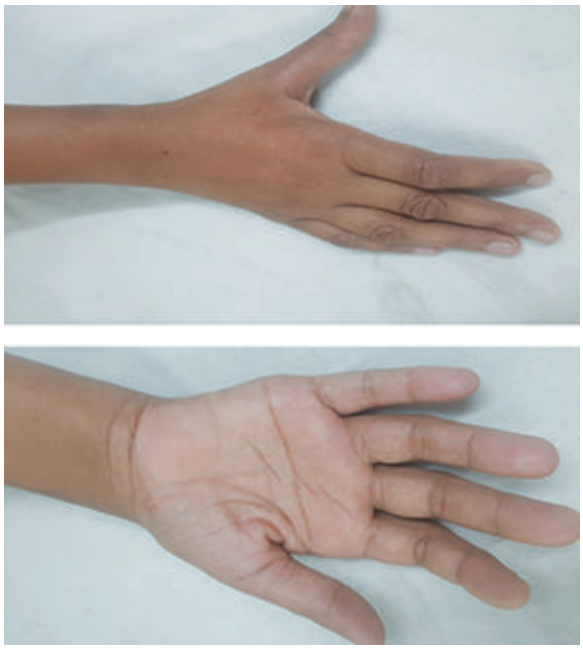

Fig.-5: *Picture of right hand showing hypothenar and 1st dorsal interosseous muscle was more wasted than thenar muscle.*

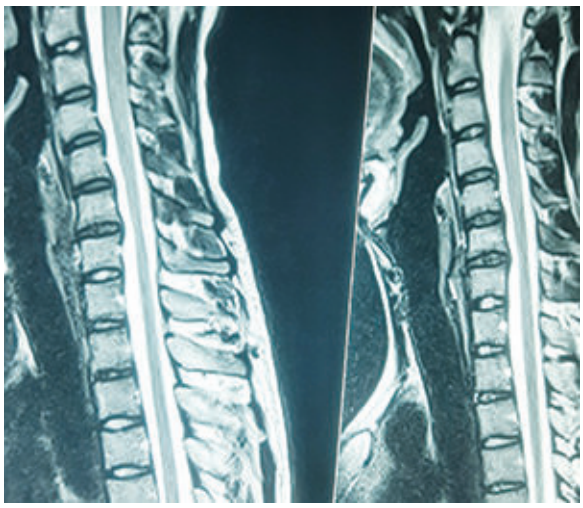

Fig.-6: *MRI of cervical spine in flexion view showing atrophy of the C5 and C6 segment of the spinal cord with some displacement of posterior dura.*

Discussion:

Hirayama disease is a benign disorder characterized by insidious onset, gradually progressive weakness and wasting of hand & forearm affecting unilaterally or bilaterally asymmetrically. It progresses for 2–3 years and a maximum of up to six years followed by a static course. The characteristic clinical features as originally described by Hirayama[7] include weakness and wasting predominantly in C7, C8, and T1 myotomes in one upper limb or asymmetrically in both upper limbs with sparing of brachioradialis ('oblique amyotrophy'), electromyography evidence of chronic denervation in the clinically or subclinically affected muscles, and absence of substantial sensory loss/reflex abnormalities, cranial nerve, pyramidal tract in lower limb, sphincter, or cerebellar deficits[8].

Most commonly seen in Asian countries like India, Japan and Malaysia [9]. In Bangladesh, we also found some cases of Hirayama disease but there was no study regarding the incidence of the disease in our country. Here we report a few cases of Hirayama disease with variable clinical features and radiological and electrophysiological findings. Flexion MRI shows anterior displacement of the posterior dura with an enlarged epidural space seen as a crescent high T1 and T2 intensity posteriorly on axial images containing flow voids and prominent enhancement on postcontrast images within these spaces which correspond to enlarged posterior veins. The electromyography results in Hirayama disease show denervation of atrophied muscles with occasional contra-lateral denervation of the same muscles, along with evidence of denervation in triceps brachii and less than a quarter of patients in biceps brachii, deltoid, and brachioradialis, even though there is no clinically visible wasting[10,11]. Hirayama disease may be confused clinically with several conditions like amyotrophic lateral sclerosis, syringomyelia, cervical spondylosis associated with myelopathy, spinal cord tumour and traumatic myelopathy. All of these conditions may cause focal amyotrophy of the distal arm. Imaging modalities are required for differentiation[12].

All three patients in our case series were young adults presented in the 2nd and 3rd decades. Two of them were male and one female. The first two cases presented with asymmetrical bilateral wasting and weakness of the upper limbs and 3rd case presented with unilateral wasting and weakness of the right upper limb. The Brachioradialis muscle was spared in all three cases. Hirayama disease was confirmed based on clinical radiological and electrophysiological findings. We exclude other differential diagnoses of upper limb muscle wasting. Diagnosis of Hirayama disease is mainly based on flexion MRI of the cervical spine. Routine MRI in a neutral position is often reported as normal, but it can also show lower cervical cord atrophy or abnormal cervical curvature. MRI of the cervical spine of our three patients showed focal atrophy ranging from C5 to C7 segment. However, the classical MRI findings of the cervical spine in neck flexion include forward displacement of the posterior wall, loss of the posterior dural sac attachment with adjacent lamina, and a well-enhanced crescent-shaped mass in the posterior epidural space of the lower cervical canal[12]. Flexion MRI of our patient did not show classical findings except focal cord atrophy with intramedullary signal changes. The possible explanation for this may be due to a lack of practice of doing proper flexion view of MRI in our country. EMG findings are indicative of chronic denervation noted in the C7, C8, and T1 innervated muscles, with or without acute denervation potentials (fasciculations, positive sharp waves and fibrillations potentials). “Reverse split hand syndrome,” which is characterized by decreased/ absent CMAP amplitude in the abductor digit minimi while preserved in the abductor pollicis brevis, is usually seen in nerve conduction studies. It differentiates “Hirayama disease” from ALS which shows classical “Split hand syndrome”[13,14]. All 3 patients of our case series had almost similar electrophysiological findings

Conclusion:

Hirayama disease is benign and usually a self-limiting disorder but requires early diagnosis to reduce the progression of the disease. Routine MRI may miss the classical findings of early diagnosis. So young onset slowly progressive asymmetric distal upper limb weakness with neurogenic changes in the EMG and the findings of focal segmental cord atrophy on regular nonflexion cervical spine MRI studies, the diagnosis of Hirayama disease should always be considered and flexion MRI should be done to confirm the diagnosis. Repeated neck flexion was thought to be the underlying cause so the use of a cervical collar to prevent neck flexion has been shown to halt the progression of the disease.

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