One-and-a-half syndrome as an initial presentation of multiple sclerosis

Scott Custo[1]

Emma Tabone[1]

Reuben Grech[2,3]

Author details can be found at the end of this article

Correspondence to:
Scott Custo;
scott.custo.17@um.edu.mt

Introduction

A 39-year-old woman presented to the accident and emergency department with dizziness and diplopia, but no extraordinary medical or surgical history. Ophthalmic review revealed left lateral gaze palsy and absent adduction in the right eye, diagnosed as left one-and-a-half syndrome. This extraocular movement disorder is the manifestation of brainstem lesions impairing an abducens nucleus and/or the paramedian pontine reticular formation, with concurrent impairment of the ipsilateral (post-decussation) medial longitudinal fasciculus (Bae et al, 2013). One-and-a-half syndrome is not a diagnosis, but a sign of underlying pathology that is often poorly appreciated, so investigation is always necessary to elucidate the aetiology and extent of the lesions. Multiple sclerosis was subsequently diagnosed.

Discussion

One-and-a-half syndrome can never be considered a stand-alone diagnosis, but rather a sign of underlying pathologies, so further investigation is always crucial. Unfortunately, because it is rare, many clinicians are unaware of this.

The most commonly reported conditions that may manifest as one-and-a-half syndrome are multiple sclerosis (demyelination), infarction, infections (including brainstem encephalitis and neurocysticercosis), tumours, arteriovenous malformations, pontine haemorrhage, basilar artery aneurysms and trauma. Infarction, specifically lacunar infarcts of the brainstem, is the most common cause (Wall and Wray, 1983; Bolanos et al, 2004; Xue et al, 2017).

Case report

A previously healthy 39-year-old woman presented to the accident and emergency department with a few weeks' history of dizziness and diplopia. There was no previous medical or surgical history of note. Ophthalmic examination in the accident and emergency department revealed a left lateral gaze palsy, with right internuclear ophthalmoplegia (inability to adduct), consistent with left one-and-a-half syndrome (Figure 1). The patient was referred for immediate neurological review, where she reported peripheral sensory symptoms of numbness and tingling.

The patient was sent for magnetic resonance imaging of her brain and spinal cord, CSF analysis for oligoclonal immunoglobulin G (IgG) bands and serological tests.

Although serological tests were unremarkable, oligoclonal bands were detected in the patient's CSF (oligoclonal band testing in blood was not requested by neurology). Magnetic resonance imaging revealed a symmetrical hyperintensity in the dorsal aspect of the caudal pons (Figures 2 and 3). It also showed several periventricular and subcortical demyelinating lesions, some of which showed open ring type enhancement. Two other demyelinating plaques were seen in the cervical spine.

Multiple sclerosis was diagnosed, based on the above biochemical tests and magnetic resonance imaging findings (that satisfied MAGNIMS criteria).

The patient was referred to a multiple sclerosis clinic for assessment and management, where she was prescribed oral methylprednisolone (500 mg daily for 5 days) and started on interferon beta-1 alpha (30 micrograms once a week) with regular follow up.

Left one-and-a-half syndrome resolved over the course of 3 days. Radiological progression continued to be closely monitored via magnetic resonance imaging. Her neurological team deemed this regimen successful, as she remains clinically stable and asymptomatic, and no new plaques have been detected at the time of writing.

How to cite this article:
Custo S, Tabone E, Grech R. One-and-a-half syndrome as an initial presentation of multiple sclerosis. Br J Hosp Med. 2022. https://doi.org/10.12968/hmed.2021.0523

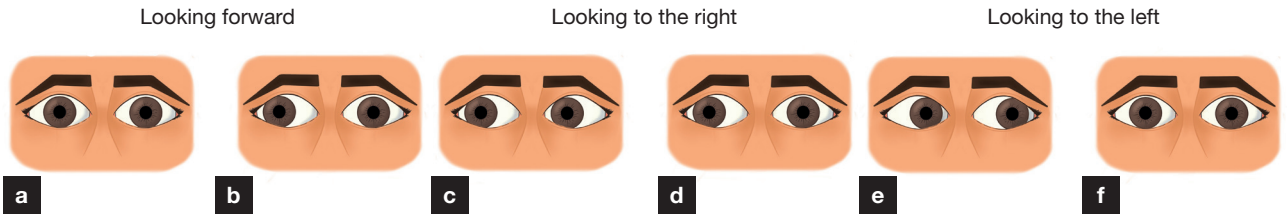

Figure 1. A graphical comparison of (a, c, e) an unaffected patient vs (b, d, f) one with left one-and-a-half syndrome.

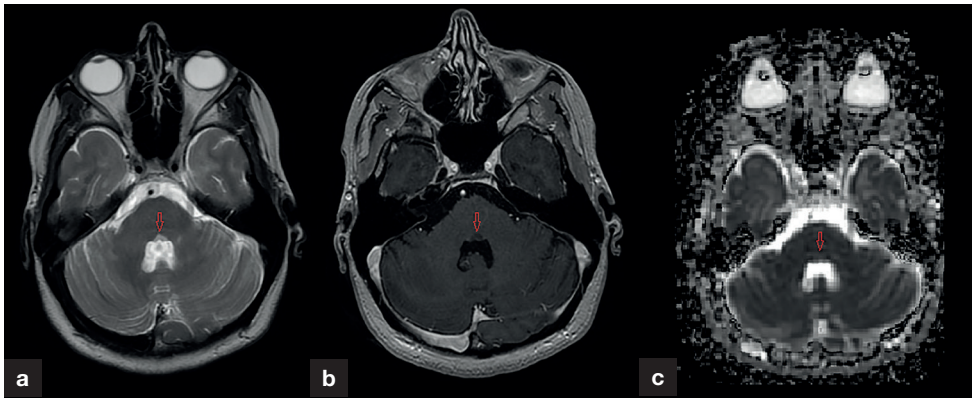

Figure 2. a. Axial magnetic resonance imaging T2 sequence demonstrates a triangular and symmetrical hyperintensity (arrow) in the dorsal aspect of the lower pons. b. There is no pathological enhancement (arrow) on a T1 post-contrast acquisition. c. Apparent diffusion coefficient map through the region of concern does not reveal restricted diffusivity (arrow).

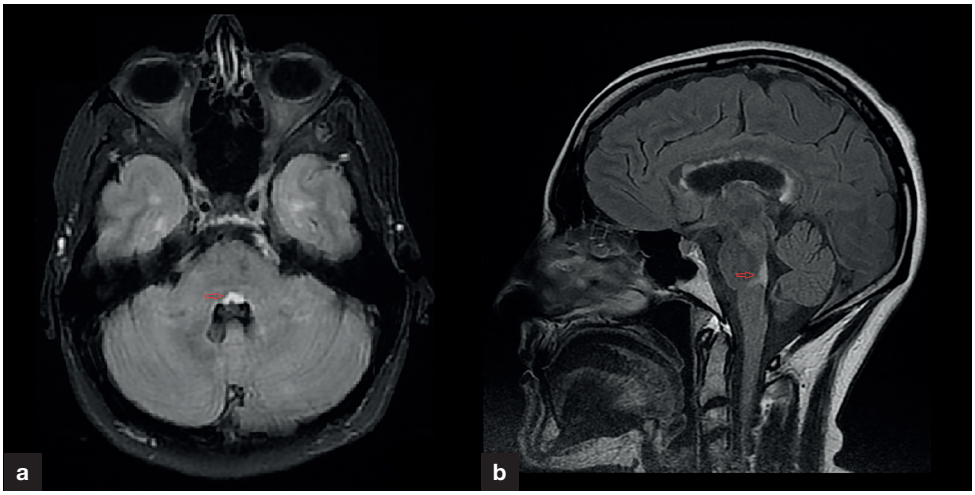

Figure 3. a. Axial FLAIR image shows a midline T2 hyperintense lesion (arrow) in the ventral pons abutting the floor of the 4th ventricle. Anatomically, this region corresponds to the site of the medial longitudinal fasciculus which is involved bilaterally in this case. b. Midline sagittal FLAIR sequence confirms the location of a triangular T2 hyperintensity (arrow) in the lower dorsal pons.

During differential diagnosis, particularly if the more common aetiologies are ruled out, it is important to consider other rare disorders or rare manifestations of common disorders that may manifest as one-and-a-half syndrome. These mainly include neuromyelitis optica, myasthenia gravis and metastatic lesions (Davis and Lavin, 1989; Bandini et al, 2001; Hsu et al, 2008; Kitthaweesin and Vongkulsiri, 2008; Patil et al, 2017).

Neuromyelitis optica, a demyelinating syndrome, has similar symptomatology to multiple sclerosis and can also present as one-and-a-half syndrome (Kitthaweesin and Vongkulsiri, 2008). It may be distinguished from multiple sclerosis via clinical and radiological examination as well as serological investigation (specifically by testing for NMO-IgG, an anti-aquaporin-4 autoantibody) (Weinshenker et al, 2006).

Learning points

- One-and-a-half syndrome cannot be a standalone diagnosis, as it only describes the physical manifestation of these pontine lesions, which are the result of an underlying pathology.
- Further investigation in the context of the patient's presentation and history is crucial to elicit the lesions' underlying aetiology. Magnetic resonance imaging of the entire neuroaxis should be carried out to ascertain the underlying pathology.
- The most common conditions that may present as one-and-a-half syndrome include demyelinating conditions, infarction, infections, tumours, ischaemia, trauma and infarcts, and less commonly neuromyelitis optica, myasthenia gravis and rare metastatic lesions.
- Variations of one-and-a-half syndrome exist, encompassing one-and-a-half syndrome with additional symptomatologies, and are usually caused by expansion of the lesions into adjacent structures.

Myasthenia gravis is an autoimmune disorder that disrupts the function of nicotinic acetylcholine receptors of neuromuscular junctions. It is diagnosed via investigation (eg antibody tests and single-fibre electromyography) or through elimination. Ocular myasthenia gravis may present as a lateral gaze palsy in one direction, with preservation of movement in the other direction, albeit with much weaker adduction. If the adductive movement is missed, one may incorrectly note a total horizontal gaze palsy in the respective eye, with internuclear ophthalmoplegia in the other, hence this presentation is referred to as 'pseudo one-and-a-half syndrome' (Davis and Lavin, 1989; Bandini et al, 2001).

Author details

[1]Faculty of Medicine and Surgery, University of Malta, Msida, Malta

[2]Department of Medical Imaging, Mater Dei Hospital, Msida, Malta

[3]Department of Clinical Radiology and Nuclear Medicine, Faculty of Medicine and Surgery, University of Malta, Msida, Malta

References

Bae YJ, Kim JH, Choi BS, Jung C, Kim E. Brainstem pathways for horizontal eye movement: pathologic correlation with MR imaging. RadioGraphics. 2013;33(1):47–59. https://doi.org/10.1148/rg.331125033

Bandini F, Faga D, Simonetti S. Ocular myasthenia mimicking a one-and-a-half syndrome. J Neuroophthalmol. 2001;21(3):210–211. https://doi.org/10.1097/00041327-200109000-00010

Bolanos I, Lozano D, Cantu C. Internuclear ophthalmoplegia: causes and long-term follow-up in 65 patients. Acta Neurol Scand. 2004;110(3):161–165. https://doi.org/10.1111/j.1600-0404.2004.00278.x

Davis TL, Lavin PJM. Pseudo one-and-a-half syndrome with ocular myasthenia. Neurology. 1989;39(11):1553–1553. https://doi.org/10.1212/WNL.39.11.1553

Hsu W-H, Tsai W-C, Chu S-J, Tsao Y-T. Acute myeloid leukemia presenting as one-and-a-half syndrome. Am J Emerg Med. 2008;26(4):513.e1–513.e2. https://doi.org/10.1016/j.ajem.2007.05.014

Kitthaweesin K, Vongkulsiri S. One-and-a-half syndrome in neuromyelitis optica. Neuroophthalmology. 2008;32(6):305–308. https://doi.org/10.1080/01658100802465006

Patil M, Ganger A, Sharma S, Saxena R. Metastatic renal cell carcinoma presenting as one-and-a-half syndrome. Indian J Ophthalmol. 2017;65(9):895. https://doi.org/10.4103/ijo.IJO_347_17

Wall M, Wray SH. The one-and-a-half syndrome-a unilateral disorder of the pontine tegmentum: a study of 20 cases and review of the literature. Neurology. 1983;33(8):971–971. https://doi.org/10.1212/WNL.33.8.971

Weinshenker BG, Wingerchuk DM, Pittock SJ, Lucchinetti CF, Lennon VA. NMO-IgG: a specific biomarker for neuromyelitis optica. Dis Markers. 2006;22(4):197–206. https://doi.org/10.1155/2006/586306

Xue F, Zhang L, Zhang L et al. One-and-a-half syndrome with its spectrum disorders. Quant Imaging Med Surg. 2017;7(6):691–697. https://doi.org/10.21037/qims.2017.12.04