Bilateral medial medullary infarction in association with a vertebral artery aneurysm
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A 83-year-old man with a history of dyslipidemia was admitted to the emergency department with instability and left-sided weakness of recent appearance. Neurologic examination confirmed left hemiparesis including the facial nerve region, associated with milder right-sided hemiparesis, right upper extremity ataxia, and dysarthria. No sensitive deficit was present.

Imaging Findings:
A computed tomography (CT) was performed first. The non-enhanced passage (Fig 1) showed a hyperdense rounded structure with peripheral calcifications adjacent to the right border of the medulla oblongata, corresponding to a 5 mm aneurysm after injection of contrast media, developed from the right vertebral artery (Fig 2a, 2b). There was no subarachnoid haemorrhage.
The patient underwent a magnetic resonance (MR) 8 hours later, which showed a bilateral heart-shaped zone of restricted diffusion in the anteromedial medulla oblongata (Fig 3a), consistent with acute ischemia. The zone was hyperintense on FLAIR and T2-weighted sequences (Fig 3b, 3c). Partial thrombosis and calcification of the aneurysm created a susceptibility artifact on the T2*-weighted images (3d). The aneurysm was successfully treated by transcatheter coil embolization in the angiography suite (Fig 4a, 4b, 4c, 4d).

Discussion:
In contrary to lateral medullary infarction (Wallenberg syndrome), unilateral medial medullary infarction is a rare form of posterior circulation ischemic stroke, accounting for less than 1% of cases [1, 2]. Still rarer is bilateral medial medullary infarction (BMMI), typically involving the rostral part of the medulla oblongata [1, 3-6]. The medulla oblongata is divided into four vascular territories: antero-medial, antero-lateral, lateral and posterior, with blood supply from the two vertebral arteries and the inconsistently unpaired anterior spinal artery [3, 6]. They form a complex arterial network [1, 3]. In medullary stroke, embolism secondary to atherosclerosis of one of the abovementioned large vessels (vertebral arteries in 38.5%) is the main pathomechanism, followed by small vessel disease ("branch disease"), frequently occurring in a context of diabetes or hypertension [5-7]. Cardiac embolism is
a rare cause, and dissection normally occurs in a traumatic context [4, 5]. In the here presented case, the infarction occurred probably as complication of a voluminous vertebral artery aneurysm. Even on MR angiography, it is often difficult to identify the exact vessel implicated, including leptomeningeal branches.

Clinical presentation of BMMI is heterogeneous. Most common are motor dysfunction (in 78.4% of cases) with quadriaparesis/quadriplegia and facial paresis, lemniscal sensory loss, respiratory distress, dysarthria (in 48.6%), dysphasia and hypoglossal palsy (40.5%), vertigo and ataxia, and ocular symptoms like nystagmus, ptosis and ophthalmoplegia [1-4, 6, 7].

Radiology has a major role in diagnosing the condition. MRI diffusion-weighted images show a pathognomonic "V" or "heart shape" signal increase in the rostral medulla oblongata which is due to infarction of the antero-medial and antero-lateral vascular territories [1, 3]. BMMI can be associated with cerebellar infarction.

The condition can clinically be misdiagnosed as early stage Guillain-Barré Syndrome, before brain MRI is performed [1, 3]. The clinical outcome is usually poor - in contrast with unilateral medial medullary infarction - with old age, severe motor dysfunction at admission, and central post-ischemic pain being predicting factors for poor prognosis. The in-hospital mortality rate is 23.8% [7]. Respiratory disorders sometimes complicate the clinical course of the disease [4, 6]. A significant proportion of patients (61.9%) remain dependent after BMMI [7]. In our patient, swallowing difficulties persisted after the event.

In conclusion, BMMI is a rare form of posterior circulation stroke, usually presenting with quadriaparesis/quadriplegia, deep sensory loss, and bulbar dysfunction. On diffusion-weighted MRI imaging, the infarcted zone typically presents with the classic form of a "V" or "heart shaped" rostral medullary hypersignal.

**Differential Diagnosis List:** Bilateral medial medullary infarction, Unilateral medial medullary infarction, Demyelinating lesion, Infection, Brainstem neoplasm, Vasculitis

**Final Diagnosis:** Bilateral medial medullary infarction

**References:**


Description: Non-contrast axial CT image of posterior fossa shows rounded hyperdense structure with annular calcifications (arrow) adjacent to medulla oblongata on the right side. Origin: Geneva University Hospitals
Figure 2

Description: Axial MIP image of CT angiogram shows rounded structure (arrow) to be of vascular origin and consistent with an aneurysm, developed from right vertebral artery (arrowhead). Origin: Geneva University Hospitals
Description: Sagittal MIP reconstruction of CT angiogram shows aneurysm (arrow) connected to right vertebral artery (arrowhead) by a narrow aneurysmal neck. Origin: Geneva University Hospitals
Description: Axial image of diffusion-weighted MR sequence shows heart-shaped bilateral hyperintensity (arrow) in anterior and medial portion of medulla oblongata. Origin: Geneva University Hospitals
**Description:** FLAIR sequence coronal image shows bilateral hyperintensity in paramedian anterior medulla oblongata (arrow). **Origin:** Geneva University Hospitals
Description: T2-weighted axial image of posterior fossa shows hypointense right vertebral artery aneurysm (arrowhead) and associated parenchymal hypersignal in bilateral anteromedial medulla oblongata (arrow). Origin: Geneva University Hospitals
Description: Axial image of T2* sequence shows moderate blooming artifact in aneurysm (arrow), related to parietal thrombus and calcifications. Origin: Geneva University Hospitals
**Description:** Lateral view of right vertebral artery catheter angiogram shows aneurysm (arrow) developed just proximal to right postero-inferior cerebellar artery (arrowhead) depart. **Origin:** Geneva University Hospitals
Description: Lateral angiogram shows advancement of catheter (arrow) into aneurysm. Origin: Geneva University Hospitals
Description: Lateral angiogram of right vertebral artery shows deployment of coils (arrow) within aneurysm. Origin: Geneva University Hospitals
**Description:** Final control subtraction image shows embolized aneurysm (arrow) entirely excluded from circulation. **Origin:** Geneva University Hospitals.