

## Paradoxical Hemiparesis from Cerebellopontine Angle Tumor: A Case Report

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### Abstract

**Objective:** To report a vestibular schwannoma in the cerebellopontine angle presenting with paradoxical hemiparesis with the Kernohan-Woltman Notch Phenomenon (KWNP).

**Methods:** A 31-year-old female presented to the neurology clinic at Bhayangkara Hospital TK. I R. Said Sukanto, Indonesia, on 29 November 2021 with loss of balance, hearing, vision, and weakness in her left arm and leg. On physical examination, the patient had reduced left arm and leg muscle strengths against resistance (MRC grade 4), face deviation to the left, abnormal finger-to-nose test, dysdiadochokinesia, and inability to perform tandem gait. She was admitted for a brain MRI but did not return to the hospital for re-evaluation and surgery.

**Results:** The brain MRI showed a mass on the left side of the cerebellum with a size of 4.44x3.93x4.93 cm, suggesting vestibular schwannoma. The mass also caused the obliteration of the ventricle, causing hydrocephalus.

**Conclusion:** KWNP is an unusual finding resulting in a paradoxical hemiparesis, a false-localizing neurologic sign. Physicians should recognize KWNP in patients with hemiparesis, especially in space-occupying lesions. Imaging studies can help localize the lesion to minimize misdiagnosis and optimize patient treatment.

**Keywords:** Cerebellopontine angle, kernohan-woltman notch phenomenon, paradoxical hemiparesis, vestibular schwannoma

## Introduction

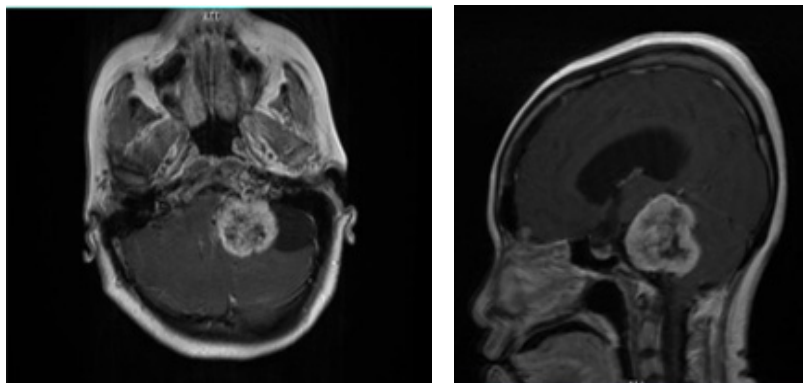
Expanding intracranial lesions occasionally produces focal neurological signs unrelated to the lesion's location. These paradoxical clinical signs are described as the "false-localizing signs".<sup>1-4</sup> Kernohan-Woltman notch phenomenon is a false-localizing neurologic sign presenting with hemiparesis ipsilateral to the primary lesion.<sup>5</sup> This phenomenon occurs during transtentorial herniation, which causes the contralateral cerebral peduncle to be compressed against the free edge of the tentorium, thus causing compression of descending corticospinal tract fibers.<sup>5-7</sup> Furthermore, the Kernohan-Woltman notch phenomenon is also considered an unusual finding. This article describes a patient with a space-occupying lesion of the cerebellum

complaining of ipsilateral hemiparesis. This study aimed to report a vestibular schwannoma in the cerebellopontine angle with paradoxical hemiparesis and the Kernohan-Woltman Notch Phenomenon (KWNP).

## Case

A 31-year-old female was presented to the Neurology Clinic of Bhayangkara Hospital TK. I R. Said Sukanto, Jakarta, Indonesia, on 29 November 2021 with a loss of balance since nine months ago. There was no history of trauma or falls. The patient also complained about loss of hearing, vision disturbance, and weakness in the left arm and left leg. Past medical history was unremarkable, and the patient was on no medications. On examination, she was stable hemodynamically,

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**Fig. 1 CPA Mass in Magnetic Resonance Imaging, (A) Axial View, (B) Sagittal View**

with reduced left arm and leg muscle strength against resistance (Medical Research Council, MRC, grade 4), deviation of the face to the left, reduced hearing function, and loss of balance. There was also abnormality identified upon finger-to-nose test, dysdiadochokinesia, as well as inability to perform tandem gait. The patient was then admitted for brain magnetic resonance imaging (MRI) which showed a mass in the left cerebellopontine angle (CPA) with a size of 4.44 cm x 3.93 cm x 4.93 cm, suggesting vestibular schwannoma (Fig.1). The mass also caused the fourth ventricle to be obliterated causing hydrocephalus. In this case, the CPA mass could cause the left cerebral peduncle to be compressed, causing a disruption of the descending corticospinal tract. Thus, the patient had a left hemiparesis. The patient did not return to hospital for re-evaluation and surgery.

## Discussion

Supratentorial lesions is known as common cause of neurological impairment of movement on the contralateral side of the body, resulting from contralateral corticospinal projections.<sup>7</sup> These projections arise from cortical regions of the brain and decussate in the caudal medulla, then continue traveling down the spinal cord.<sup>8</sup> Almost all fibers decussate, resulting in contralateral clinical findings.<sup>8</sup> However, in a patient following hemorrhage, tumor, abscess, or infarction with brain swelling, a lateral and downward displacement of subthalamic-upper brainstem structures and herniation of the medial part of the temporal lobe into the opening in the tentorium are usually observed in large, destructive or space-occupying lesions.<sup>3</sup> The upper

midbrain is pushed against the tentorium's contralateral edge, causing weakness and a Babinski sign ipsilateral to the hemispherical lesion known as the Kernohan-Woltman notch phenomenon (KWNP).<sup>3</sup> KWNP is one of the causes of false localizing neurological signs, manifesting an ipsilateral neurological deficit and defying the corticospinal decussation principles.<sup>9</sup> Kernohan and Woltman propose the mechanism in which the descending pressure caused the squeezing of the cerebral crus's opposite side against the cerebellum's tentorial edge.<sup>10,11</sup> Based on MRI and CT studies by Carrasco *et al.*,<sup>12</sup> direct pressure of the cerebral peduncle from the tentorium would lead to the degeneration of myelinated fibers of the corticospinal tract, which leads to hemiparesis. The corticospinal tract controls voluntary movements for the somatic motor system from the neck to the feet.<sup>13</sup> This tract carries impulses from the primary motor cortex through the internal capsule, cerebral peduncles, and ventral pons, then decussate to the contralateral via the pyramidal decussation.<sup>13</sup>

The false localizing sign of KWNP can cause several diagnostic difficulties in the clinical setting, including operating on the wrong side of the hematoma, requiring neuropsychological testing to localize the lesion, and a case of tetraparesis, leading to a misdiagnosis of consciousness.<sup>4</sup> CPA is a subarachnoid space located in the ventral surface of the brainstem and medial cerebellar hemisphere, bordered laterally by the superior and inferior limbs of the cerebellopontine fissure. Medially at the CPA, the lateral recess of the fourth ventricle opens to the CPA through the foramen of Luschka.<sup>14</sup> Tumors found in this region are usually vestibular schwannoma, also known

as acoustic neuroma, which accounts for 90% of the cases, meningioma (3%), primary cholesteatoma, and facial nerve schwannoma.<sup>15</sup> Tumors in the CPA usually present with signs and symptoms resulting from compression of cranial nerve V, VII, VIII, and lateral aspect of the pons and cerebellar peduncle, which depends on the size and extension of CPA tumors.<sup>15,16</sup> This patient, the findings from an MRI scan suggested a vestibular schwannoma in the left CPA. The patient complained about left-side hemiparesis, right facial palsy, hearing loss, and loss of balance. Surgical approaches for vestibular schwannoma include the retrosigmoid, middle fossa, and translabyrinthine approach.<sup>17</sup> In 208 cases described by Rauniyar *et al.*,<sup>18</sup> the most common complication of patients undergoing the suboccipital retrosigmoid approach was hearing loss (50%), facial nerve palsy (10.09%), and hydrocephalus (8.65%). The middle fossa approach needs to be more utilized compared to the retrosigmoid and translabyrinthine approaches. In an article by Raheja *et al.*,<sup>19</sup> the outcome of 78 patients undergoing the middle fossa approach was generally good, with good functional preservation of the facial nerve (90%), 75.5%

with class A/B Association of Otolaryngology-Head and Neck Surgeons (AAO-HNS) hearing class, and no cerebrospinal fluid (CSF) leak, postoperative seizure, and dysphasia. Only three patients reported wound infections. Lastly, the translabyrinthine approach is a practical surgical approach for vestibular schwannoma. In a retrospective study from 1996 to 2017 by de Boer *et al.*,<sup>20</sup> a total of 596 with vestibular schwannoma underwent surgery with a translabyrinthine approach. The facial nerve function is preserved in 509 patients (85%) according to House-Brackmann (HB) grading system with a score of HB 1–2. Postoperative complications that can occur are CPA hematoma, meningitis, CSF leak, and wound infection. De Boer *et al.*<sup>20</sup> also points out that preoperative tumor size is the predictor for postoperative facial palsy.

In conclusion, KWNP is an unusual finding resulting in a paradoxical hemiparesis, a false-localizing neurologic sign. Physicians should be aware of KWNP in a patient with hemiparesis, especially in the setting of space-occupying lesions. Imaging studies can help to localize the lesion to minimize the misdiagnosis and optimize the treatment of the patient.

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