A 37-year-old woman was referred to us with a 20-year history of hypertension. She was examined by cardiologists for secondary hypertension. Results from blood tests including renin-angiotensin-aldosterone system and catecholamine were normal, and computed tomography of the abdomen was also normal. Her blood pressure (BP) was 190/120 mm Hg despite combination therapy with amlo- dipine 10 mg, olmesartan 40 mg, doxazosin 4 mg, diltiazem 100 mg, spironolactone 25 mg, indapamide 2 mg, bisoprolol 5 mg, and guanabenz 4 mg. MRI of the brain showed that the left vertebral artery (VA) was obviously compressing the left medulla oblongata (Figure C), and a presumptive diagnosis of refractory neurogenic hypertension was made. To ensure our diagnosis, an angiographic examination was performed for preoperative evaluation under direct measurement of arterial pressure. Angiography showed marked contortion of the left VA to the medial side (Figure A). Straightening the left VA with a guidewire to relieve the compression of the medulla decreased her BP (Figure B). The effect of BP lowering continued for 24 hours, but her BP gradually increased again. Taking the successful angiographic evaluation into consideration, neurovascular decompression through a left lateral suboccipital approach was performed. The medulla oblongata was obviously compressed by the left VA, and the left VA was lifted up to separate it from the medulla by using Teflon tape. The patient’s BP was significantly decreased immediately after surgery. Postoperative MRI showed that the left VA was apart from the medulla (Figure D). Her BP decreased to a normal range without any medications. The patient was monitored for 1 year, and her BP still remained within a normal range.

Hypertension is a major risk factor for heart disease, stroke, congestive heart failure, and kidney disease. Approximately 90% patients are classified as having essential hypertension when no obvious underlying medical cause is identified. Physicians believe that 5% to 30% of the overall hypertensive population have refractory hypertension. Previous research suggests that 20% of patients with essential hypertension have an underlying neurogenic etiology resulting in refractory hypertension. Vascular compression of the brainstem at the level of the rostral ventrolateral medulla (RVLM) has been suggested as 1 cause of secondary hypertension. RVLM is a major cardiovascular center that regulates systemic control of blood pressure. RVLM contains neurons that are the major tonic source of supraspinal sympathoexcitatory outflow to the heart, kidneys, and vessels. Arterial pulsatile of the RVLM seems to enhance sympathetic nerve activities, which could contribute to refractory hypertension. Jannetta et al introduced the concept of neurogenic hypertension caused by neurovascular compression of the left RVLM. They reported that vascular decompression of the RVLM could normalize high BP. This concept has been confirmed by autopsy, MRI, intraoperative observation, and animal studies. MRI, computed tomography, and angiography have been used to assess neurovascular compression of the RVLM. To date, MRI is the most effective method for studying details of the brainstem and the surrounding vessels involved in neurovascular compression because of its noninvasiveness and sensitivity. However, vascular decompression of the RVLM has not been equally effective among the patients with refractory neurogenic hypertension, and it is necessary to investigate how patients should be selected. Although reliable criteria for accurate and reproducible imaging techniques to visualize compression have not been established, we herein introduced preoperative evaluation using a simple angiographic technique to confirm neurovascular compression of the RVLM. This method could assess the surgical efficacy for refractory neurogenic hypertension preoperatively. Hypertension is a common disease worldwide; however, the possibility of neurogenic hypertension should be considered, especially in patients with refractory hypertension. A high index of suspicion and appropriate imaging studies are important for making a proper diagnosis.

Disclosures

None.

References


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**Figure.** The cause of neurogenic hypertension. **A,** Digital subtraction angiography showing the contortion of the left vertebral artery (arrow). **B,** Fluoroscopy showing the straightening of the left vertebral artery by guidewire (arrow). **C,** Preoperative MRI showing the left vertebral artery compressing the medulla (arrow). **D,** Postoperative MRI showing the relief of the compression of the medulla by the left vertebral artery.
One Cause of Secondary Hypertension: Neurogenic Etiology
Takashi Fujimoto, Yoichi Morofuji, Nobutaka Horie, Tsuyoshi Izumo, Kentaro Hayashi, Hiroaki Kawano, Takayuki Matsuo and Izumi Nagata

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