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CORRESPONDENCE

Effect of left-sided brain stem decompression on blood pressure and short-term cardiovascular regulation in resistant hypertension

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In resistant hypertension (HT), after excluding all of the so-called conventional secondary etiological factors, the neurovascular pulsatile compression (NVPC) of the rostral ventrolateral medulla (RVLM) on the left side may be the root cause.

Trigeminal and glossopharyngeal neuralgia and hemifacial spasms are caused by NVPC of elongated and/or not typically placed arteries. Approximately 30 years ago, it was reported that the posterior inferior cerebellar artery (PICA) and/or the vertebral artery can compress the root entry zone of cranial nerves IX and X and/or the C1 neurons containing retro-olivary sulcus near the root entry zone on the left side of the brain stem in association with HT.[1,2]

Cardiac autonomic neuropathy (CAN) with early parasympathetic damage may lead to a relative sympathetic overactivity, resulting in increased heart rate and HT.[3]

Baroreflex sensitivity (BRS) is a marker of the parasympathetic activity that is responsible for short-term cardiovascular regulation. Spontaneous BRS control is impaired in HT patients.[4]

A 57-year-old white woman had resistant HT to 10 different antihypertensive agents (Table 1). The duration of her HT was 36 years. She had impaired glucose tolerance, her body mass index was 26.33 $kg\,m^{-2}$ and her glomerular filtration rate was 79.5 $ml\,min^{-1}$. She had target organ damage of mild left ventricular hypertrophy (the posterior wall was 10 mm, and the interventricular septum was 11 mm) and Keith–Wagener–Baker grade II hypertensive retinopathy. There were no trigeminal neuralgia or hemifacial spasms in her case history. After excluding all of the possible secondary causes, a magnetic resonance investigation combined with angiography (MRA) was performed. The volume thickness was 60–70 mm, and the slice thickness was 1 mm. The requirement of a positive MRA finding was contact between any of the looping arteries and the surface of RVLM at the root entry–exit zone of nerves IX and X or between any of the looping arteries and the cranial nerves IX and X on the left side.

In this case, the MRA showed mild compression on the left anterior surface of the RVLM at the level of the PICA. In June of 2009, neurosurgical neurovascular decompression (NVD) was performed under anesthesia. A tissue-friendly hemostatic sponge (Spongostan, Ethicon, Inc., West Somerville, NJ, USA) was placed between the cranial nerves and the PICA.

CAN was assessed with the five standard CV reflex tests proposed by Ewing *et al.*[5] The sum of the scores (0–10) gives a total CAN score. A patient is considered as CAN-positive if the score is 2 or higher (at least two tests with borderline or one test with abnormal values).

Spontaneous BRS was calculated in supine and standing positions with a sequence method using a software package for BRS analysis (Nevrokard BRS 5.1.3; Medistar) before and after the operation. The systolic blood pressure (SBP) and interval between ventricular depolarizations (RRI) files were generated via the beat-to-beat data acquisition system by finger photoplethysmography (Finometer, TPD Biomedical Instruments, Finapres Medical Systems B.V., Amsterdam, The Netherlands) at 200 Hz combined with ECG. BRS calculation by this method is based on the quantification of sequences of at least three beats in which SBP consecutively increases or decreases, which is accompanied by changes in the same direction of the RRI of the subsequent beats. The software scans the RRI and SBP records, identifies sequences and calculates the linear correlation between RRI and SBP for each sequence. Data were recorded on the day of NVD just prior to the procedure and on postoperative day 9.

Norepinephrine (NE) was quantitatively determined in plasma by a competitive enzyme immunoassay in a microtiter plate format (2-CAT RIA, DIAsource ImmunoAssays S.A., Louvain-La-Neuve, Belgium). Samples for NE were collected on the day of NVD just prior to the procedure and on postoperative days 1 and 9.

Before and after NVD, 24-h ambulatory blood pressure monitoring (ABPM) was performed with an ABPM-04 device (Meditech Ltd., Budapest, Hungary).

During the NVD procedure, the MRA finding was confirmed. NVD was successful, and no serious complications of the intervention were observed. Both SBP and DBP decreased after NVD, as measured with the ABPM-04. During the active period, the mean BP was 163/73 mm Hg before and 115/62 mm Hg after NVD. During the passive period, the mean BP was 130/60 mm Hg before and 113/50 mm Hg after NVD. The hyperbaric time index decreased from 76.63/7.61% to 8.47/0.0%. Less antihypertensive medication was needed within a short period after NVD; only five different drugs were needed from approximately postoperative day 8 (Table 1).

Normally, the spontaneous BRS decreases after standing up, and this dynamic was also preserved after NVD. In the supine position, the BRS was 5.62 ms per mm Hg before and 7.51 ms per mm Hg after NVD. In the standing position, the BRS was 3.29 ms per mm Hg before and 5.57 ms per mm Hg after NVD. The BRS increased after NVD in both positions.

Table 1 The change of the antihypertensive therapy before and after the neurovascular decompression

Before NVD	*After NVD*
• Dihydralazine 0–3–2–1 tab.	• Metoprolol 50 mg 2 × 1/2 tab.
• Doxazosin 4 mg 2 × 1 tab.	• Indapamide at lunch 1 tab.
• Metoprolol 50 mg 2 × 1/2 tab.	• Isosorbid mononitrate 60 mg at morning 1 cap.
• Indapamide at lunch 1 tab.	• Amlodipine 5 mg 2 × 1 tab.
• Urapidil 90 mg 3 × 1 cap.	• Losartan 50 mg ½–0–1 tab.
• Guanfacine2 × 1 tab.	
• Isosorbid mononitrate 60 mg at morning 1 cap.	
• Amlodipine 5 mg 2 × 1, 5 tab.	
• Losartan 100 mg 2 × 1 tab.	
• Moxonidine 0.4 mg 0–1–1 tab.	

Abbreviations: cap, capsule; NVD, neurovascular decompression; tab, tablet.

The sum of the CAN score did not change; it remained 3. However, the decrease in BP after standing up decreased to half of the value detected before NVD.

The plasma NE level decreased to almost half of the level measured before NVD (421 pg ml^{-1} *vs.* 282 pg ml^{-1}, before *vs.* after).

A recent study using high-resolution MRI scans with 1 mm slices showed that the frequency of NVPC of the RVLM was clearly and significantly higher in patients with primary HT (73.5%) than in patients with secondary HT (12.5%).[6]

In our previous work, we described positive MRA findings in 43 of 50 primary HT patients. In 18 cases, a successful NVD was performed, and after follow-up of 9 patients for 2 years, the BP values and the therapeutic effort were decreased compared with the preoperative period.[7]

The lower plasma NE level and higher BRS values after NVD confirm that there is sympathetic overactivity in RVLM pulsatile compression. NVD confirms that C1 neurons may have an important role in the maintenance of this sympathetic overactivity. After NVD, the repetitive discharge of C1 neurons was halted.

As a part of CAN, the degree of orthostatic hypotension decreased, which can also be explained by the improvement in short-term CV regulation.

In our case, after NVD, the BRS, BP and the need for antihypertensive medication improved.

ETHICS COMMITTEE APPROVAL

Approved by the Human Investigation Review Board, University of Szeged, Albert Szent-Gyorgyi Medical and Pharmaceutical Center (2/2007).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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