Hypertension Research (2024) 47:679–680
https://doi.org/10.1038/s41440-023-01556-9

COMMENT

Blood pressure variability in acute ischemic stroke

Kenichi Todo[1]

Keywords Stroke · Blood pressure variability · Hemorrhagic transformation

Received: 13 November 2023 / Revised: 21 November 2023 / Accepted: 23 November 2023 / Published online: 4 January 2024

Blood pressure variability (BPV) is defined as short-term or long-term fluctuations in blood pressure. Short-term fluctuations result from various factors, including autonomic nervous function, cardiopulmonary reflex, abnormal breathing, antihypertensive therapy, body position, behavior, body temperature, inflammation, pain, and emotional factor, all of which are strongly associated with acute stroke patients. Elevated BPV in acute stroke patients is thought to negatively affect the injured brain, where acute ischemia impairs cerebrovascular autoregulation and disrupts the blood-brain barrier. Repeated rise in blood pressure may cause hemorrhagic transformation; however, repeated fall in blood pressure may exacerbate ischemia. Indeed, observational studies have shown that BPV in acute stroke patients is an independent predictor of short-term and long-term outcome.

The present study by Wu et al. demonstrated that high BPV during the first 48 h after admission was associated with parenchymal hematoma within 72 h after admission in acute ischemic stroke patients with atrial fibrillation [1]. The authors cite four references that report an association between BPV and hemorrhagic transformation in acute ischemic stroke. In the second European Cooperative Acute Stroke Study (ECASS-II), in which patients were randomized to rt-PA or placebo, high BPV within the first 24 h was independently associated with hemorrhagic transformation within the first 7 days in patients treated with rt-PA but not in those treated with placebo [2]. Ko et al. showed that high BPV within the first 72 h was independently associated with hemorrhagic transformation within the first 14 days in patients with acute ischemic stroke treated with or without rt-PA [3]. Liu et al. showed that high BPV within the first 24 h, especially within the first 6 h, was independently associated with hemorrhagic transformation within the first 24 h in patients treated with rt-PA [4]. Kim et al. showed that high BPV within the first 24 h after successful endovascular recanalization therapy was independently associated with symptomatic hemorrhagic transformation within 1 day after endovascular therapy [5].

High BPV in acute ischemic stroke is also associated with early neurological deterioration (END) without hemorrhagic transformation. Chung et al. showed that high BPV within the first 72 h was independently associated with END within the first 72 h in patients with acute ischemic stroke [6]. Duan et al. also showed that high BPV within the first 72 h was independently associated with END within the first 72 h in patients with single small subcortical infarcts with parental arterial disease [7].

Consequently, it has been expected that BPV would be a novel target for therapeutic intervention. However, the biggest problem is that these studies did not adequately demonstrate a causal relationship between BPV and outcome. It is difficult to clarify the before and after relationship between BPV assessment and short-term outcome in these studies. There is a possibility that high BPV is only a result, not a cause, of HT or END (Fig. 1). In future study, the outcome assessment period should be separate from the BPV assessment period. There is also a possibility that high BPV is only a result of the potential confounding factors, including autonomic nervous function, cardiopulmonary reflex, abnormal breathing, antihypertensive therapy, body position, behavior, body temperature, inflammation, pain, and emotional factor, all of which could be associated with short-term outcome (Fig. 1). However, it is difficult to adjust for these confounders in observational studies. Nevertheless, the study by Wu et al. makes an important contribution to our understanding of the role of BPV in the acute phase of ischemic stroke. Well-designed studies are

✉ Kenichi Todo
ktodo@neurol.med.osaka-u.ac.jp

[1] Department of Neurology, Osaka University Graduate School of Medicine, Osaka, Japan

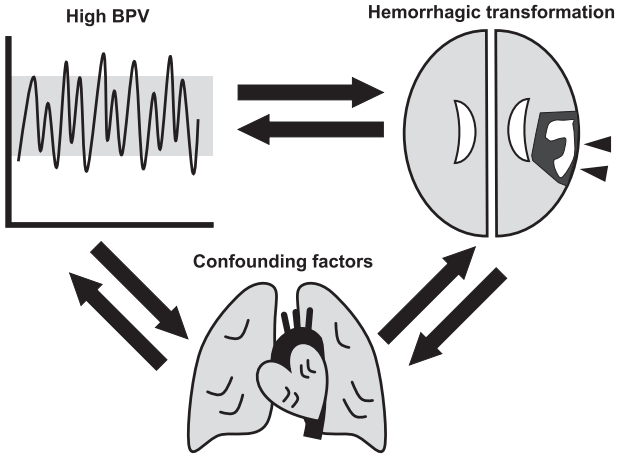

Fig. 1 Presumed causal relationship between blood pressure variability and hemorrhagic transformation in acute ischemic stroke. BPV blood pressure variability

needed to further elucidate the specific pathophysiology of BPV in acute ischemic stroke.

Compliance with ethical standards

Conflict of interest The author declares no competing interests.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

References

1. Wu MN, Liu YP, Fong YO, Lin HY, Yang IH, Chou PS, et al. The impact of blood pressure variability on the development of parenchymal hematoma in acute cerebral infarction with atrial fibrillation. Hypertens Res. 2023. https://doi.org/10.1038/s41440-023-01479-5.
2. Yong M, Kaste M. Association of characteristics of blood pressure profiles and stroke outcomes in the ECASS-II trial. Stroke. 2008;39:366–72.
3. Ko Y, Park JH, Yang MH, Ko SB, Han MK, Oh CW, et al. The significance of blood pressure variability for the development of hemorrhagic transformation in acute ischemic stroke. Stroke. 2010;41:2512–8.
4. Liu K, Yan S, Zhang S, Guo Y, Lou M. Systolic blood pressure variability is associated with severe hemorrhagic transformation in the early stage after thrombolysis. Transl Stroke Res. 2016;7:186–91.
5. Kim TJ, Park HK, Kim JM, Lee JS, Park SH, Jeong HB, et al. Blood pressure variability and hemorrhagic transformation in patients with successful recanalization after endovascular recanalization therapy: a retrospective observational study. Ann Neurol. 2019;85:574–81.
6. Chung JW, Kim N, Kang J, Park SH, Kim WJ, Ko Y, et al. Blood pressure variability and the development of early neurological deterioration following acute ischemic stroke. J Hypertens. 2015;33:2099–106.
7. Duan Z, Tao L, Tang T, Fu C, Liu J, Chen B, et al. Effect of blood pressure variability on early neurological deterioration in single small subcortical infarction with parental arterial disease. eNeurologicalSci. 2017;8:22–7.