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Impact of Stroke Location and Cortical Autonomic Network Involvement on Cardiovascular and Autonomic Disturbances: A Scoping Review Protocol

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ADMINISTRATIVE INFORMATION

Support - NA.

Review Stage at time of this submission - Preliminary searches.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025120027

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 9 December 2025 and was last updated on 9 December 2025.

INTRODUCTION

Review question / Objective The objective of this scoping review is to map and summarize the existing evidence on the association between ischemic stroke location, including involvement of the cortical autonomic network, and cardiovascular and autonomic outcomes in adults with ischemic stroke. The review will describe which anatomical regions are associated with cardiovascular disturbances, the effect of laterality, the contribution of cortical autonomic network involvement, the available diagnostic approaches for detecting cortical autonomic network modulation, and the duration of cardiovascular and autonomic changes after stroke.

Background Ischemic stroke can disrupt cardiovascular and autonomic regulation, which may result in blood pressure instability, arrhythmias, myocardial injury, and changes in heart rate variability. These disturbances are thought to arise in part from injury to anatomical regions that make up the cortical autonomic network. The cortical autonomic network includes structures such as the insular cortex, anterior cingulate cortex, medial prefrontal cortex, amygdala, and related subcortical and brainstem autonomic nuclei. These regions participate in the integration of sympathetic and parasympathetic activity and are involved in cardiovascular control.

Existing studies suggest that certain stroke locations are more closely associated with cardiovascular changes, particularly when the insular cortex or brainstem autonomic centers are affected. Some research indicates that right hemisphere involvement, especially right insular injury, may be associated with heightened sympathetic activation. However, the literature remains inconsistent, partly due to variability in the definitions of cortical autonomic network involvement and the methods used to measure autonomic outcomes.

Several important questions remain unresolved. It is unclear which anatomical regions are most

strongly linked to cardiovascular disturbances after ischemic stroke. The influence of laterality on autonomic or cardiovascular abnormalities has not been clearly determined. The degree to which cortical autonomic network structures themselves produce these cardiovascular changes is uncertain. In addition, there is limited clarity on how cortical autonomic network modulation can be diagnosed using available physiological or biochemical markers. The duration of cardiovascular and autonomic disturbances following ischemic stroke also remains poorly understood.

A scoping review is needed to clarify these relationships and synthesize the current evidence.

Rationale Cardiovascular and autonomic disturbances after ischemic stroke contribute significantly to clinical outcomes. Despite this importance, the relationship between specific anatomical stroke locations, involvement of cortical autonomic network structures, and the development of cardiovascular or autonomic abnormalities has not been systematically examined. The existing literature varies in design, anatomical classification, and outcome measurement, which limits the ability to draw meaningful conclusions.

This review will clarify which anatomical regions are associated with cardiovascular disturbances after ischemic stroke and will explore the influence of laterality on these outcomes. It will also assess whether injury to cortical autonomic network structures contributes to the development of cardiovascular and autonomic abnormalities. In addition, the review will describe the methods used to diagnose cortical autonomic network modulation through physiological, biochemical, or autonomic testing measures. Finally, it will examine the duration and overall temporal pattern of cardiovascular and autonomic changes following ischemic stroke.

By mapping these domains, the review will help clarify how stroke location, especially involvement of the cortical autonomic network, contributes to cardiovascular instability and autonomic dysfunction.

METHODS

Strategy of data synthesis Data will be synthesized descriptively in accordance with the objectives of this scoping review. Extracted information will be organized to reflect the relationships between anatomical stroke location, involvement of the cortical autonomic network, laterality, and the reported cardiovascular and autonomic outcomes. Included studies will first be grouped by anatomical region, including whether the lesion involves any structure within the cortical autonomic network. Within each anatomical grouping, findings will be summarized in relation to the specific cardiovascular or autonomic alterations reported, such as arrhythmias, myocardial injury, blood pressure instability, or changes in heart rate variability. When studies compare right and left hemisphere involvement, these results will be synthesized to clarify potential lateralized effects.

Outcome measures will be narratively mapped to describe how each study defined and quantified cardiovascular and autonomic disturbances, including methods used to assess autonomic modulation such as physiological testing, biochemical markers, or autonomic function indices. Temporal patterns, when available, will be synthesized to illustrate the duration and evolution of cardiovascular and autonomic abnormalities following ischemic stroke.

Because the purpose of this review is to map the breadth and nature of existing evidence, no meta-analysis will be performed. Instead, the synthesis will characterize patterns in anatomical involvement, heterogeneity in outcome definitions and measurement techniques, and areas where evidence is limited or inconsistent. Tables and figures will be used to summarize study characteristics, anatomical classifications, and reported associations between stroke location and cardiovascular or autonomic outcomes.A range of cardiovascular and autonomic outcome measures reported after ischemic stroke will be extracted. For clarity, we group outcomes into two broad categories, with specific definitions for each:

Cardiovascular alterations: This includes any cardiac or hemodynamic complications occurring post-stroke that reflect disturbances in cardiovascular regulation or heart function. Examples include cardiac arrhythmias (such as new-onset atrial fibrillation, ventricular ectopy, atrioventricular block or other ECG abnormalities), myocardial injury or infarction (e.g. elevated cardiac troponin levels or clinically diagnosed myocardial infarction), left ventricular dysfunction or heart failure (including acute stress cardiomyopathy or decreased ejection fraction), blood pressure dysregulation (such as marked blood pressure instability or variability), and sudden cardiac death. These events are often collectively described as neurocardiogenic or “stroke-heart syndrome” complications. For instance, acute ischemic stroke can trigger a surge

in sympathetic output and catecholamines, leading to arrhythmias and even myocardial damage; strokes involving autonomic-regulating regions (like the insula) have been specifically linked to higher rates of arrhythmia, myocardial injury, and cardiac enzyme elevations. We will record any such cardiovascular outcomes reported in the included studies, along with their definitions (e.g. type of arrhythmia, criteria for myocardial infarction, etc.).

Autonomic alterations: This category encompasses markers of autonomic nervous system dysfunction or imbalance following stroke. Key outcome measures here include heart rate variability (HRV) parameters, baroreflex sensitivity, sympathetic skin responses (or sweat test results), and circulating stress hormones or neurotransmitters (for example, plasma or serum catecholamine levels such as norepinephrine, epinephrine, or dopamine, as well as cortisol levels as an index of HPA-axis activation). Heart rate variability in time-domain or frequency-domain indices is a well-established noninvasive metric of autonomic balance (sympathovagal activity), and stroke-induced changes in HRV are a central focus (e.g. reduced HRV indicating sympathetic dominance and parasympathetic withdrawal). Autonomic alterations also include any reported abnormal blood pressure or heart rate variability patterns (e.g. loss of circadian BP rhythm, exaggerated heart rate responses) attributable to autonomic dysfunction. We will extract all such autonomic outcome measures and their definitions as provided by each study (for instance, which HRV indices were used, how autonomic dysfunction was defined, etc.).

Eligibility criteria Data will be synthesized descriptively in accordance with the objectives of this scoping review. Extracted information will be organized to reflect the relationships between anatomical stroke location, involvement of the cortical autonomic network, laterality, and the reported cardiovascular and autonomic outcomes. Included studies will first be grouped by anatomical region, including whether the lesion involves any structure within the cortical autonomic network. Within each anatomical grouping, findings will be summarized in relation to the specific cardiovascular or autonomic alterations reported, such as arrhythmias, myocardial injury, blood pressure instability, or changes in heart rate variability. When studies compare right and left hemisphere involvement, these results will be synthesized to clarify potential lateralized effects.
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Source of evidence screening and selection Two reviewers will independently examine the list of titles and, if available, the abstracts to assess the potential usefulness of each article. The final inclusion of articles will be determined through independent full-text review by two reviewers. Any disagreements will be resolved through collaborative discussion between the reviewers, or, if necessary, by consulting a third reviewer to reach a consensus.

Data management Extracted data will include study characteristics, patient demographics, anatomical stroke location, involvement of cortical autonomic network structures, cardiovascular outcomes, autonomic markers such as heart rate variability or catecholamines, methods used to measure autonomic function, duration of follow up, outcome definitions, and covariates used in adjusted analyses. All data will be verified for accuracy and completeness. Relevant data from all eligible studies will be abstracted in duplicate using a standardized data extraction form. An independent reviewer will verify all data entries and check for completeness and accuracy at least twice.

Language restriction None.

Country(ies) involved Canada.

Keywords Stroke; Brain Ischemia; Autonomic Nervous System; Autonomic Nervous System Diseases; Cardiovascular Diseases; Heart Rate Variability; Blood Pressure; Insular Cortex.

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