

Research Article

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Managing Hypothermia after Acute Ischemic Stroke

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ABSTRACT

Peripheral hypothermia in stroke patients is a manifestation of abnormally cold hands, feet, or limbs is primarily caused by localized autonomic dysfunction, impaired vascular tone, and reduced muscular activity in paralyzed sides. Based on experimental data and early human experience, hypothermia has been rated one of the most active modes of neuroprotection. Hypothermia improves neurological outcome in survivors of cardiac arrest.

Post-stroke hypothermia is a physiological response driven by brain injury, not human psychology or emotional tension. It occurs due to the damages of the hypothalamus, the brain's internal thermostat disrupting normal temperature regulation. Psychological stress or tension cannot cause or reverse true clinical hypothermia.

Causes of Peripheral Hypothermia in Stroke, include

- Sympathetic Dysregulation- Brain damage alters the central nervous system's control over blood vessels, causing abnormal constriction in the limbs
- Lack of movement in hemiplegic or paretic limbs reduces local muscle contraction, which normally helps pump blood and generate heat
- Local circulatory disorders & endothelial damage restrict warm blood flow reaching extremities.

Common signs and symptoms include experiencing a distorted perception of temperature, feeling extreme cold even when tissue temperature is only mildly reduced and disturbances in peripheral circulation. The cold sensations in the limbs have been linked to functional changes in specific brain regions, including the insular cortex, anterior cingulate cortex, thalamus, primary somatosensory cortex, and prefrontal cortex.

This article is a review of current understanding of Hypothermia after Acute Ischemic Stroke and its management based on case t followed by this author in early August 2026. This report presents a rare and innovative approach to managing refractory post-stroke limb coldness by computed tomography (CT)-guided sympathetic nerve radiofrequency ablation.

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Received: September 19, 2026; **Accepted:** September 21, 2026; **Published:** September 30, 2026

Keywords: Acute Ischemic Stroke (AIS), Hypothermia, Hypothalamus, Computed Tomography (CT)-Guided Sympathetic Nerve Radio Frequency Ablation (CTRFA)

Abbreviations

AIS: Acute Ischemic Stroke Hypothermia

CT: Computed Tomography

CTRFA: Guided Sympathetic Nerve Radio Frequency Ablation

Introduction

Acute ischemic stroke (AIS) is an acute neurological deficit that results from focal cerebral ischemia associated with permanent brain infarction and is a leading cause of death and disability worldwide. Peripheral hypothermia in stroke patients is a manifestation as abnormally cold hands, feet, or limbs is primarily caused by localized autonomic dysfunction, impaired vascular tone, and reduced muscular activity in paralyzed sides. Based on experimental data and early human experience, hypothermia has been rated one of the most active modes of neuroprotection. Hypothermia improves neurological outcome in survivors of

cardiac arrest. In infants with hypoxic-ischemic encephalopathy, temperature of 33.5°C for 72 h is safe, reduces fatality, & improves neurodevelopmental outcome. Management must focus on gentle local passive rewarming, protecting skin, & optimizing physical therapy to restore blood flow.

Inversely, Therapeutic hypothermia has shown promise to improving neurological outcomes at several neurological conditions. At the clinical level, it has been shown to improve outcomes in comatose survivors of cardiac arrest and in neonatal hypoxic ischemic encephalopathy but has yet to be convincingly demonstrated in stroke post-stroke hypothermia (low body temperature) is a physiological response driven by brain injury, not human psychology or emotional tension. It occurs due to the damages of the hypothalamus, the brain's internal thermostat disrupting normal temperature regulation. Psychological stress or tension cannot cause or reverse true clinical hypothermia. The True Causes of Post-Stroke Temperature Changes is Brain Damage a direct injury to hypothalamic region, that impairs the body's ability to sense and regulate core temperature. Lower body

temperature can sometimes act as a natural, protective mechanism to reduce oxygen demand in damaged brain tissue. Spontaneous hypothermia or fever after a stroke is heavily linked to systemic issues like infections, metabolic failure, or severe neurological trauma rather than emotional state. Mental stress, anxiety, or “tension” can cause minor, temporary shivering or flushing due to adrenaline release, but it cannot alter core body temperature enough to cause clinical hypothermia. Stroke survivors often experience anxiety, depression, or frustration, which change behaviour and heart rate but remain separate from core thermoregulatory failure. Sweating, feeling cold, or shaking after a stroke are typically neurological or autonomic symptoms, not psychological reactions [1-4].

This article is a review of current understanding of Hypothermia after Acute Ischemic Stroke and its management based on case report followed by this author in early August 2026. This report presents an innovative approach to managing refractory post-stroke limb coldness using computed tomography (CT)-guided sympathetic nerve radiofrequency ablation.

Case Report

Mr Vijayan aged 55-years-old man with history of poorly controlled Hypertension for last 20 years, a businessman, faced some losses recently and reported with hemiplegia in his right extremities following a cerebral infarction on 10 August 2026 to a tertiary care private hospital in Bengaluru. He was provided standardized treatment, and his condition improved in 48 hrs. However, on 13th morning he and family noticed that his hands and feet were cold. His body temperature was 33°C. Other Signs observed were Shivering, slurring of words when he spoke, mild confusion, feeling very sleepy and slow. He and attendants also perceived disrupted temperature, feeling extreme cold even when the body temperature was mildly reduced.

On physical examination he had Slow, shallow breathing and a weak or slow pulse. His hands and leg movements were Clumsy with stiffness and had trouble moving arms and legs. His was Pale, & cold. The duty doctor told attendants that he had “Post-stroke hypothermia” and it is an abnormal drop in core body temperature (below 35°C or 95°F) that can happen after a stroke due to damage to the brain’s temperature control centre. He was advised to be

covered with blanket and keep giving hot coffee every hour. A sudden drop in temperature soon after a severe stroke can signal a severe neurological decline or a complication that needs urgent medical evaluation; therefore, he was advised to seek neurologist consultation.

The Neurologist after physical examination, MRI, CT scan told that neurologically there was nothing concerning and he would improve in 3-5 days. Surprisingly he attributed it to Tension the person is undergoing. Physical examination revealed decreased muscle strength on the patient’s left side, with grade 3 strength in the left upper limb and grade 4 in the left lower limb. The patient demonstrated increased muscle tone in both the upper and lower limbs, with an Ashworth score of 2, along with restricted shoulder joint mobility. The temperature of the left arm was 4°C lower than that of the healthy extremities. The patient was taking amlodipine 5 mg, atorvastatin 20 mg, and clopidogrel bisulphate 75 mg daily after experiencing stroke. Next day he was given CT-guided radiofrequency ablation of the thoracic and lumbar sympathetic nerves, which effectively alleviated post-stroke peripheral circulation disorders, improves limb temperature, and enhanced collateral circulation.

Details of the Procedure as Seen by this Author

Radiotherapy specialist used CT-guided radiofrequency ablation of the thoracic sympathetic nerve to treat post-stroke peripheral circulation disorders in the patient. After the patient’s and attendants informed consent, the patient was positioned prone on the CT table, and a scan was performed to identify the T3-4 vertebral space on the left side and the L3 vertebral body. He then designed an optimal puncture line targeting the gap between the left fourth rib head and the vertebral body. He located the lumbar sympathetic nerve at the level of the third lumbar vertebra using a scan with a 3-mm layer thickness. The calculated injection depth and angle allowed for precise targeting of the injection point, ensuring avoidance of the lungs, kidneys, small intestine, as well as surrounding nerves and blood vessels (Figure 1B). Following the designed trajectory, the needle was advanced through the T3-4 paravertebral space, crossing the costotransverse joint to reach the posterolateral edge of the T4 rib on the vertebral body (Figure 1C). This report underscores the importance of awareness and early intervention for such post-stroke complications in patients [5].

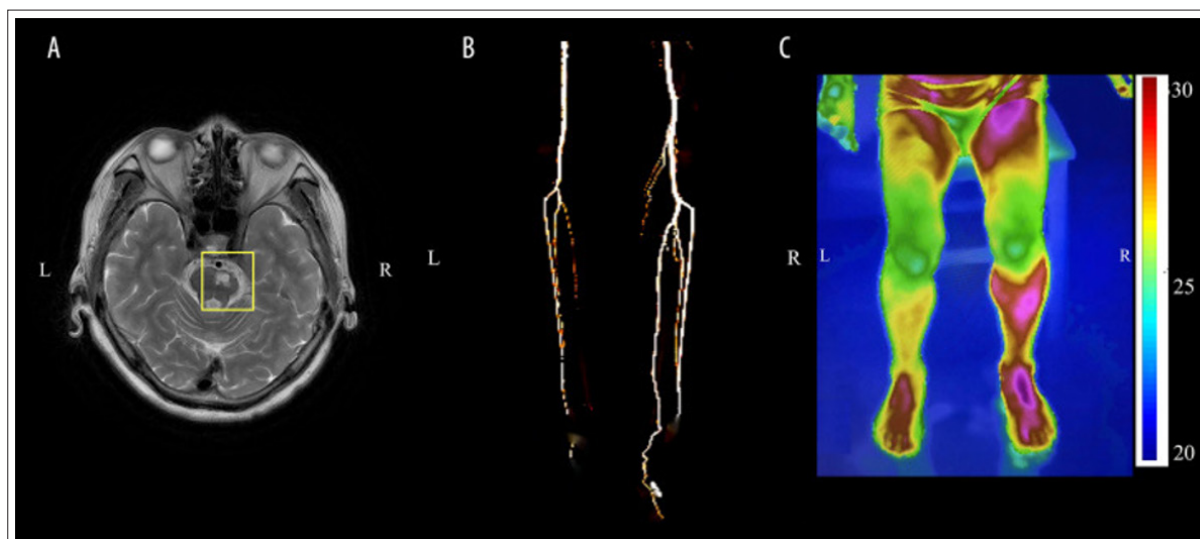


Figure1: Preoperative examination of patient: (A) The yellow box on the MRI highlights pontine Malacia foci on the right side of the brain in the patient after stroke. (B) CT angiography demonstrates arteriosclerotic changes in the artery of the left lower extremity. (C) Infrared thermography reveals that the temperature of the left lower extremity is lower than that of the right.

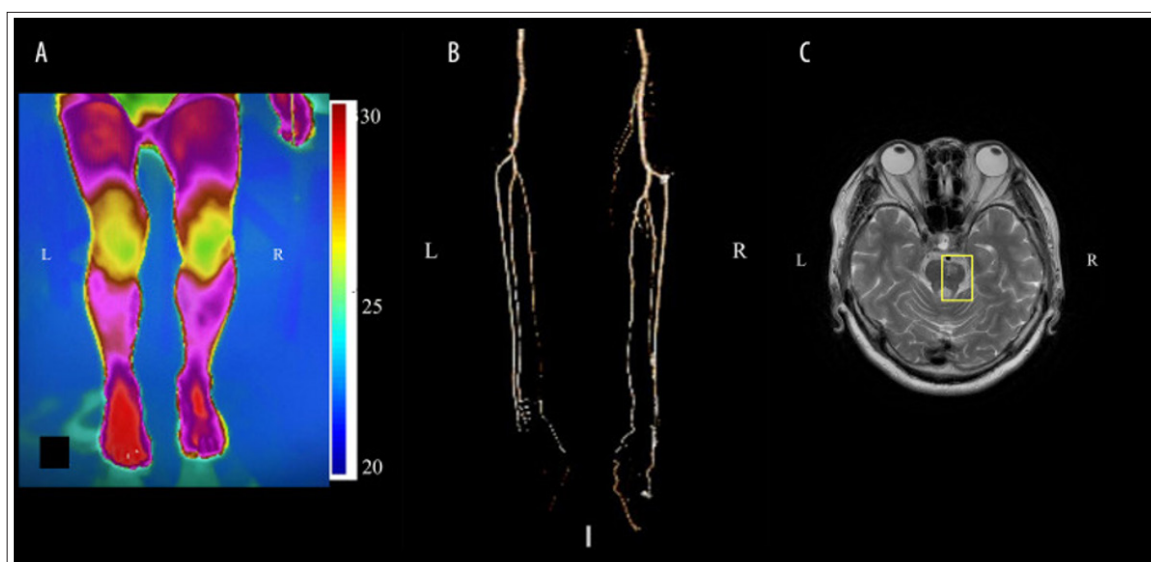


Figure 2: Postoperative examination findings. (A) Increased temperature in the left lower extremity 24 hrs after CT-guided radiofrequency ablation of the sympathetic nerve. (B) Postoperative CT angiography showing improved collateral circulation, compared with 1 week prior. (C) MRI revealing a significant reduction in pontine oedema 1 week after CTFRA Source: Ref 1

As the needle approached the anterior aspect of the L3 vertebral body, it was carefully guided into the space between the abdominal aorta and the vertebral body under CT guidance (Figure 1C). After confirming the needle's correct position via CT scan, he performed tests using a radiofrequency electrode to prevent unintended nerve damage. The resistance of the nerve tissue at the needle tip was maintained between 200 and 400 Ω . Electrical stimulation was applied at 0.8 mA, 0.3V, and 100 Hz, with no additional sensory responses observed. Further stimulation at 1 V and 2 Hz, and the absence of muscle twitches in the lower extremities and buttocks, confirmed that no motor responses were present, indicating that the needle tips were safely distanced from the spinal nerve. He then initiated standard radiofrequency therapy, setting the temperature to 75°C. Thermocoagulation was maintained for 300 s, concluding the procedure. Throughout the operation, the team continuously monitored vital signs, pulse oxygen saturation, peripheral perfusion index (PI), and palm temperature using a monitor [6].

The Outcome: The patient improved within next 24 hrs noting the initial improvement after 4 hrs. Interrupting this nerve activity causes blood vessels to open, which improved blood flow, raises skin temperature, and relieves cold allodynia within next few hours.

Studies show immediate improvement in the peripheral perfusion index, increased limb temperature, and reduced pain scores without major lasting complications as was done in our reported case.

As a result, our monitoring indicated a significant increase in the peripheral perfusion index (PI) in the patient's left palm and feet immediately after the intervention. The temperature of the left hand rose from 28°C to 33°C, while the temperature of the left foot increased from 27°C to 32°C. At 24 h after surgery, the temperature of the left limb continued to rise, surpassing that of the healthy side (Figure 3A). Additionally, the perfusion index increased from 0.7 to 3.4 in the palm and from 0.6 to 2.5 in the feet, further confirming the procedure's success.

Further significant clinical improvement was observed during the follow-up visit on 18th August 2026 after the sympathetic nerve

radiofrequency ablation. The patient reported a subjective increase in warmth in the arms and legs, reduction in cold-induced pain, and visual analog scale score of 1.

Postoperative CT angiography showed improved collateral circulation, compared with that of the preoperative state (Figure 2B). An MRI is scheduled to be performed 1 month after intervention to know the reduction in pontine oedema in the right side of the brain, indicating a positive change in the pontine Malacia foci.

Discussions

Stroke is a leading cause of mortality worldwide and often results in complex sequelae. Peripheral circulation disorders in paralyzed limbs are particularly challenging, presenting as persistent cold sensations and cold-induced pain that severely impair patients' quality of life.

Stroke, frequently results in a complex array of sequelae, including limb stiffness, spasms, presenting as persistent cold sensations and pain. The spasticity in the muscles can lead to circulatory disorders in the affected limbs, contributing to cold-induced allodynia and pain. Joint or soft tissue pain is often caused by abnormal muscle tone, spasticity, or prolonged immobility due to paralysis, significantly impacting the lower limbs. Post-stroke cold allodynia pain is common, reported in 8% to 30% patients after stroke globally. These symptoms are largely attributed to disruptions in peripheral circulation following a stroke. However, conventional treatments such as physical exercise, hyperbaric oxygen therapy, and pharmacological treatments have demonstrated limited efficacy in alleviating persistent limb coldness and associated symptoms caused by peripheral circulation disorders

Epidemiology

Clinical Context of Temperature Variations like Hypothermia, accidental or spontaneous at presentation or in next 2-3 days is rare in acute ischemic stroke and is generally not tracked as a standard metric in large Indian hospital registries. When it does occur, it is linked to severe underlying systemic illness, hypothalamic damage, or severe sepsis. Controlled or targeted temperature management (cooling the body to 32°C–34°C) has been studied experimentally

and via clinical trials as a neuroprotective strategy to reduce metabolic demand during acute ischemic stroke, but it is not a routine standard-of-care baseline finding. Elevated temperature or Hyperthermia (fever) is heavily documented because it worsens ischemic brain injury, whereas baseline hypothermia is an atypical finding outside of specialized intensive care or targeted cooling protocols.

Causes of Peripheral Hypothermia in Stroke, include

- i) Sympathetic Dysregulation- Brain damage alters the central nervous system's control over blood vessels, causing abnormal constriction in the limbs
- ii) Lack of movement in hemiplegic or paretic limbs reduces local muscle contraction, which normally helps pump blood and generate heat
- iii) Local circulatory disorders & endothelial damage restrict warm blood flow reaching extremities.
- iv) Patients also experience a distorted perception of temperature, feeling extreme cold even when tissue temperature is only mildly reduced
- v) Disturbances in peripheral circulation and cold sensations in the limbs have been linked to functional changes in specific brain regions, including the insular cortex, anterior cingulate cortex, thalamus, primary somatosensory cortex, and prefrontal cortex

Management Strategies

1. *Passive Rewarming* by using warm blankets, socks, or appropriate ambient room adjustments to comfort the patient. Intense heat sources (like heating pads) must be avoided lest they burn the skin on insensate limbs.
2. *Gentle Positioning & Massage*: Regularly change the patient's position and gently massage unaffected areas near the limbs to encourage blood circulation.
3. *Physical and Occupational Therapy*: Early mobilization and passive or active range-of-motion exercises help stimulate muscular blood flow in affected extremities.
4. *Treating Underlying Conditions*: Monitoring and managing systemic vascular risk factors, hydration, and cardiac output under medical supervision may be needed in few cases.
5. Computed tomography (CT)-guided sympathetic radiofrequency ablation has been proven to effectively regulate peripheral circulation, offering therapeutic benefits for conditions such as palmar and plantar hyperhidrosis, cold and clammy extremities.

Computed tomography (CT)-guided sympathetic nerve radiofrequency ablation (CTRFA) is a minimally invasive medical procedure. It uses a CT scan to guide a thin needle precisely to specific sympathetic nerves. Radiofrequency energy heats the needle tip to safely turn off pain or control signals from those nerves. Commonly used to treat i) severe back, neck, or visceral pain by blocking nerve signals, ii) Improve blood flow to help manage cold limbs, Raynaud's phenomenon, or post-stroke circulation issues iii) Reduce sweating as it controls severe palm or foot sweating (hyperhidrosis).

Summary: Some stroke survivors as reported in our case report experience severe cold sensations, temperature drops, and pain in paralyzed or hemiplegic limbs due to autonomic nervous system dysfunction and high sympathetic tone.

Temperature Variations like Hypothermia, accidental or spontaneous at presentation or in short period after an acute ischemic stroke is rare and is generally not tracked as a standard metric in large Indian hospital registries. When it does occur, it is linked to severe underlying systemic illness, hypothalamic damage, or severe sepsis.

Traditional management involves passive rewarming, gentle positioning and massaging, passive or active range-of-motion exercises and treating underlying causes. Of late Computed tomography (CT)-guided sympathetic radiofrequency ablation has been proven to effectively regulate peripheral circulation, offering therapeutic benefits.

The Procedure: Doctors usually trained Radiologist specialized in radiotherapy takes a CT Step Step 1: scan to map the exact path, depth, and angle to the target nerve

Step 2: The skin and tissue area get a local anaesthetic, to make the patient comfortable.

Step 3: A special needle probe slides carefully into position under live CT guidance. CT- RFA was targeted to thoracic sympathetic nerves (T4 for upper limbs) and lumbar sympathetic nerves (L3 for lower limbs) to lower sympathetic tone.

Step 4: Ablation: Radio waves heat the targeted nerve tissue to block unwanted signals permanently or for a long time. CTRFA Thermal ablation is often applied (around 75°C for 3 minutes) under precise CT guidance.

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