

Stroke in Hanging: Ischemic or Thrombotic?

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ABSTRACT

Hanging is among the most common methods of committing suicide in India, as reported in recent data published by National Crime Records Bureau. Neurological injury in such cases occurs due to compression of the neck. We present the case of a 52-year-old male who presented to the emergency with an alleged history of attempted suicide by hanging with nylon thread. Patient was started on supportive therapy, and 24 hours following admission, he became stable with normal blood pressure without any antihypertensive medications. However, on Day 3 of admission, he developed weakness of left upper limb and lower limb and deviation of angle of mouth to the left side. Repeat CT imaging of brain showed two hypodense foci in right caudate nucleus, head of adjacent internal capsule and a focus in right lentiform nucleus and posterior limb of internal capsule. MRI of brain, including MRA, showed an acute infarct with restricted diffusion in right lentiform nucleus, caudate nucleus, with filling defect in proximal M1 segment of right middle cerebral artery (MCA) suggestive of thrombus and attenuated signal was also noted in distal branches of right MCA. This case highlights the neurological complication following suicidal hanging and a structured approach to it.

Keywords: Suicidal hanging, neuroimaging, CT, MRI, stroke, hypoxia, thrombosis

Suicidal hanging is among the most common methods of committing suicide in India according to recent data published by National Crime Records Bureau, where neurological injury occurs due to compression of the neck. The neck is the target organ for hanging. Easy accessibility, rounded contours, minimum bony shields, the small diameter and unsafe location of the airway, vital blood vessels and spinal cord make it susceptible to life-threatening injuries by hanging, which has been practiced as a popular method of committing suicide since ancient times.

The jugular veins are the first structures to get compressed (force of 2 kg) followed by the carotid arteries (5 kg), causing cerebral edema and hypoxic brain damage, respectively. Compression of the airways needs greater force (15 kg), which can lead to severe hypoxia and death. Neurological outcomes in hanging

vary from death, permanent hypoxic brain damage to complete recovery.

In the reviewed literature, the neuroimaging findings in hanging have consistently been described as bilateral hemorrhagic and/or ischemic lesions in the thalamus, cerebellum and other areas of the basal nuclei. Unilateral lesions seem to be a very rare event and to the best of our knowledge, very few cases have been reported.

We report a case of suicidal hanging where the patient survived an initial brain insult, but later developed a neurological deficit in the form of hemiplegia due to an infarct in the right lentiform nucleus, caudate nucleus and corona radiata. Patient recovered with supportive treatment. This case highlights the neurological complication following suicidal hanging and a structured approach to it.

CASE REPORT

A 52-year-old male presented to the emergency with an alleged history of attempted suicide by hanging with nylon thread. After few seconds of suspension, he fell down, and was rushed to the hospital. There was no history of seizure, bleeding from nostrils, eyes and mouth. There were no pre-existing comorbid conditions.

At the time of admission, patient was conscious and oriented. The pulse rate was 110/min, blood pressure

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was 170/100 mmHg, respiratory rate was 18/min and oxygen saturation by pulse oximeter was 98%. Local examination revealed one circumferential shallow abraded ligature mark over anterior aspect of the neck. There was no cyanosis or subconjunctival hemorrhages. Nasal mucosa, post pharyngeal wall and bilateral tympanic membrane were not congested. Neurological examination was normal except for bilateral extensor Babinski response. Fundus was normal. Both pupils were mid-dilated and responding to light. All biochemical investigations and baseline computed tomography (CT) imaging of brain was normal, and there were no fractures of the cervical spine. Patient was started on supportive therapy, and 24 hours following admission, patient became stable with normal blood pressure without any antihypertensive medications.

On Day 3 of admission, patient developed weakness of left upper limb and lower limb and deviation of angle of mouth to the left side. Neurological examination revealed hemiparesis of left upper limb and lower limb with a power of 3/5. Tone was increased, reflexes were diminished on both left upper limb and lower limb. Extensor plantar was present on the left side and right side plantar was not elicitable; left upper motor neuron (UMN) type of facial nerve palsy was also present.

Urgent repeat CT imaging of brain (Fig. 1a) showed two hypodense foci in right caudate nucleus, head of adjacent internal capsule and a focus in right lentiform nucleus and posterior limb of internal capsule.

Magnetic resonance imaging (MRI) of brain (Fig. 1b), including magnetic resonance angiography (MRA), showed an acute infarct with restricted diffusion in right lentiform nucleus, caudate nucleus, with filling defect in proximal M1 segment of right middle cerebral artery (MCA) suggestive of thrombus and attenuated signal was also noted in distal branches of right MCA. Magnetic resonance venography (MRV) had no evidence of venous thrombosis. Cardiac evaluation including echocardiogram was found to be normal.

Patient was treated with fluid restriction, mannitol, intravenous antibiotics, low molecular weight heparin, physiotherapy and other supportive measures. Patient gradually improved and was discharged on Day 9, with advice to continue physiotherapy.

DISCUSSION

The factors that contribute to death after suicidal hanging include pulmonary complications and neurological complications. *Pulmonary complications*

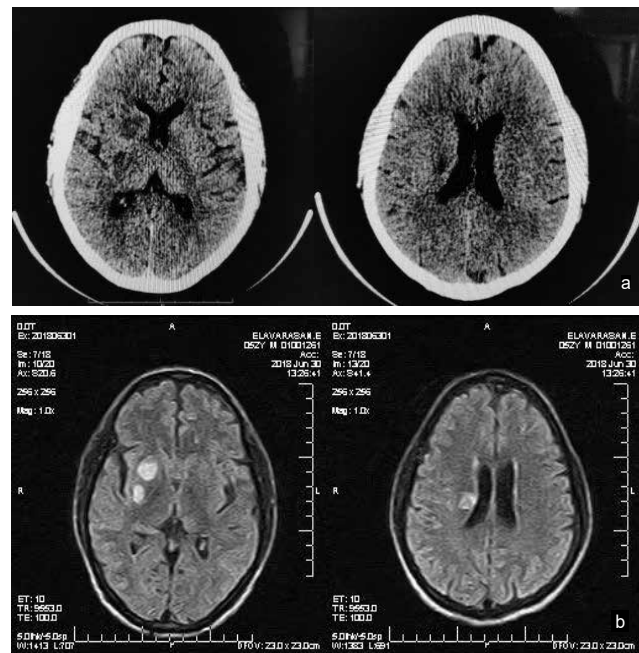


Figure 1 a and b. CT imaging of brain showing two hypodense foci in right caudate nucleus, head of adjacent internal capsule and a focus in right lentiform nucleus and posterior limb of internal capsule (a). MRI showing acute infarct with restricted diffusion in right lentiform nucleus and caudate nucleus (b).

include pulmonary edema and bronchopneumonia, secondary to aspiration. The edema may be due to a centrally mediated sympathetic discharge or due to negative intrathoracic pressure, which is generated as the person attempts to inspire through an obstructed airway. *Neurological complications* include transient hemiparesis, spinal cord syndromes, focal cerebral deficits, cerebral edema, various nerve palsies and larger infarctions. Other complications like hyperthermia, subarachnoid hemorrhage, pneumoperitoneum, ruptured esophagus may also occur. Some factors such as systolic blood pressure <90, Glasgow coma scale score ≤ 8 , anoxic brain injury on CT scan and injury severity score >15 have been found to be significantly associated with mortality in hanging.

In suicidal hanging, there is slower development of *cerebral hypoxia and ischemia*, with both the events being strongly dependent on the materials, location and the method of suicide attempt. This cerebral hypoxia and ischemia can be attributed to the mechanical compression and obstruction of the airway and vasculature of the neck. Further, airway can be compromised by the upward displacement of the tongue and epiglottis, jugular vein occlusion by mild neck closure and vertebral artery occlusion by spinal

injury. These combined factors can easily lead to acute cerebral hypoxia. In rare instances, direct injury to the spinal cord and brainstem can also occur.

The most sensitive areas of hypoxic and ischemic damage are the cerebral cortex, border zones between arterial territories, Ammon's horn, Purkinje cells, particularly the basal ganglia. In the early stages, ischemic neuronal changes are demonstrated by cytotoxic edema (swelling of neurons, glia and endothelial cells) and failure of the sodium ion exchange pump. Sodium accumulates within the cell and water follows this movement to maintain the osmotic equilibrium. The venous hypertension and stasis of blood flow caused by the acute bilateral compression of the internal jugular veins result in hydrostatic transudation of intravascular contents and subsequently rapid occurrence of hypoxia and infarction.

Bilateral involvement is the common finding in hypoxic ischemic injury in suicidal hanging. However, unilateral involvement of brain in the form of hemiplegia due to thrombotic stroke can occur rarely. Traumatic thrombosis of internal carotid artery is reported as being caused by one of the four mechanisms:

- Injury to intrapetrous or cavernous part of the carotid artery during the basal skull fracture
- Injury to point of emergence of carotid artery from the cavernous sinus as a result of strain
- A direct blow to the neck or trauma to peritonsillar area by a foreign object carried in the mouth
- Stretching of the carotid artery by hyperextension and lateral flexion of neck.

The pathophysiology of thrombosis is due to adherence of platelets to the endothelium with subsequent aggregation, which releases thromboplastin leading to initiation of coagulation cascade.

The neuroimaging in hypoxic ischemic brain injury is often symmetrical, diffuse, low-density lesions found in the watershed areas of the brain. However, in thrombotic injury, the CT and MRI findings are consistent with the vascular territory of the vessels involved. MRA and MRV may show filling defects with attenuated signals.

CONCLUSION

The mechanism of injury, pathophysiology, clinical features and neuroimaging are distinct and different in both cerebral hypoxic ischemic injury and traumatic thrombotic injury to the brain in patients with suicidal hanging. Detailed neurological examination daily to look for subtle changes in clinical features in the patient, repeated neuroimaging studies including MRA and MRV, would help in early diagnosis of thrombotic episodes in suicidal hanging and for early medical management, and if required, surgical management.

SUGGESTED READING

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