

# Head Injury due to Lightning: A Rare Phenomenon

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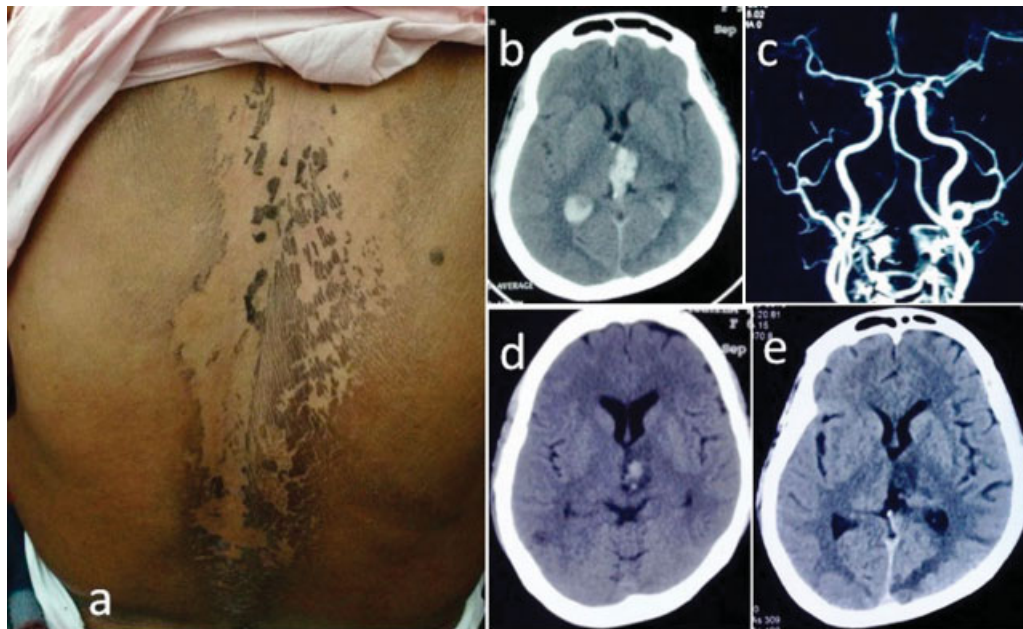
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Injuries secondary to lightning strike are fortunately rare and the nervous system is commonly involved.<sup>1</sup> Cerebral hemorrhage following lightning injuries has been described and usually seen in the basal ganglia.<sup>2</sup> Immediate neurologic effects range from transient deficits such as loss of consciousness, weakness, amnesia, and paresthesias to devastating long-term deficits.

A 60-year-old woman was struck by lightning while standing on roadside. Her family members found her unconscious. She had no history of diabetes mellitus or hypertension. She was

hospitalized in All India Institute of Medical Sciences (AIIMS). Examination revealed that lood pressure was normal with upper back burn in ferning pattern (►Fig. 1a). The electrocardiogram (ECG) was normal. Neurologically, her Glasgow coma scale (GCS) was E4V1M5 with motor aphasia and right hemiplegia. Computed tomography (CT) of the head showed bleed in left thalamus with extension into the ventricular system with no hydrocephalus (►Fig. 1b). There was no coagulation abnormality detected. CT angiogram was also done, which showed no evidence of arteriovenous



**Fig. 1** (a) Burn scar in ferning pattern over upper back of patient. (b) Initial CT of the head showing bleed in left thalamus with extension into ventricular system with no hydrocephalus. (c) CT angiogram of the brain showed no evidence of arteriovenous malformation or aneurysm. (d, e) Follow-up CT of the head showed resolving hematoma with no evidence of hydrocephalus.

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malformation or aneurysm (►Fig. 1c). The patient was managed with intravenous fluid, antibiotics, and antiepileptic. She improved in sensorium to E4V3M6 with improved right-sided weakness (up to MRC grade = 3/5) till last follow-up. Follow-up CT of the head showed resolving hematoma with no evidence of hydrocephalus (►Fig. 1d, e).

Lightning injuries to the central nervous system are second only to acute cardiovascular injuries as the principal cause of death. In lightning, the strength of electric current is enormous, even though of brief duration, and causes intense thermal injury to tissues. Electric fields can damage the structural integrity of the lipid bilayer present in the membrane of nerve and muscle tissues, termed as *electroporation*. The intense heating of the air surrounding the lightning flash can generate an explosive thunderous blast causing barotrauma.<sup>1</sup>

The pathophysiology of basal ganglia hemorrhage after a lightning strike remains unclear, but the following mechanisms have been proposed: a direct heating effect of the current; a direct electrolytic effect of the electrical charge; the actual mechanical trauma of the lightning strike; and intense peripheral vasoconstriction resulting in acute hypertension.<sup>3</sup> It is more likely that intracranial hemorrhage is caused directly by electric current passing through the brain. It has been shown experimentally that limb-to-limb electrical discharges will create no current in the brain, so for direct brain injury to occur, lightning must strike the head.<sup>4</sup> Electricity deposited will naturally take the path of least resistance, which in the erect victim will be through the body

and legs to the ground. Electrical conductivity is highest in the cerebrospinal fluid. Blood vessels and neural tissue have been found to carry more current per unit area than other tissues and to become damaged before surrounding tissues in an animal model.<sup>4</sup> Most likely, preferential conduction along Virchow-Robin spaces in the anterior perforated substance plays a major role in the production of basal ganglia injury after a lightning strike. Usually victims of lightning who have not had a cardiac arrest do survive. Many of these patients are young, and with aggressive management, these patients survive to have a productive life.

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#### Conflict of Interest

None.

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