

Silent Progression: Delayed Cerebral Ischemia After Post-Traumatic Subarachnoid Haemorrhage

Dr. Anushka Goyal¹, Dr. Ambika Juwarkar²

¹Junior Resident, Department of Radiodiagnosis, Goa Medical College

Corresponding Author Email: [anushka2679\[at\]gmail.com](mailto:anushka2679[at]gmail.com)

²Associate Professor, Department of Radiodiagnosis, Goa Medical College

Corresponding Author Email: [ambika_juwarkar\[at\]yahoo.com](mailto:ambika_juwarkar[at]yahoo.com)

Abstract: Delayed cerebral ischemia (DCI) is a well-recognized complication of aneurysmal subarachnoid haemorrhage but is rarely described following traumatic subarachnoid haemorrhage (tSAH). Its occurrence after head injury may be overlooked, potentially delaying diagnosis and treatment. We report the case of a 42-year-old female who developed multiple supratentorial acute infarcts after 12 days of traumatic SAH.

Keywords: subarachnoid haemorrhage, delayed cerebral ischemia

1. Introduction

Subarachnoid haemorrhage (SAH) is a neurological emergency characterized by the extravasation of blood into subarachnoid spaces. SAH can occur due to traumatic brain injury and non-traumatic brain injury (ruptured aneurysm). The dreaded complication of SAH is delayed cerebral ischemia which is the leading cause of morbidity in patients.

Unfortunately, the exact mechanisms of DCI pathophysiology remain poorly understood. The current consensus suggests that the origin of DCI is a multifactorial and complex process.

2. Case Presentation

A 42-year old female presented to the emergency department with a history of trauma and head injury. The GCS at arrival was 14 (E3V5M6) and she had a history of headache and a scalp hematoma. The neurologic examination demonstrated no focal neurologic deficits.

Initial CT of the brain disclosed diffuse SAH in the basal cistern. Patient was admitted under the neurosurgery department for a few days and discharged. She followed up in OPD after 3 days of discharge with complain of headache. Repeat CT brain was performed and scan revealed complete resolution of SAH. Patient was re-admitted and observed for 2 days following which she was discharged with GCS 15/15.

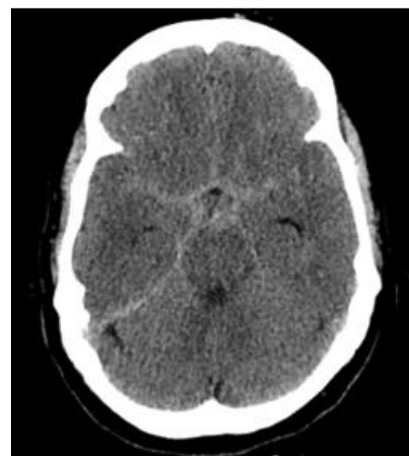


Figure 1: Plain CT Brain on 11/04/2026 – diffuse subarachnoid haemorrhage in basal cisterns.

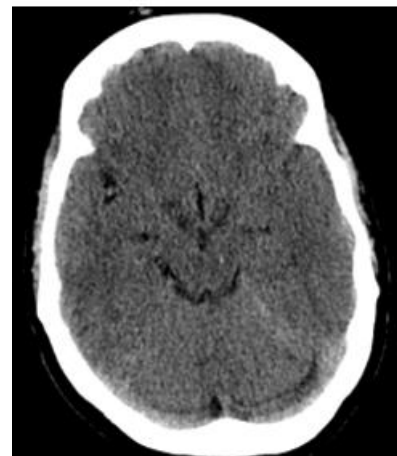


Figure 2: Plain CT Brain on 14/04/2026 (3 days after accident)– Complete resolution of subarachnoid haemorrhage

The day after discharge, the patient was referred back to the hospital with a history of low mood, decreased appetite and generalised weakness, with a drop in GCS (E3V2M5). Subsequently performed CT brain revealed multiple hypodense lesions scattered in the supratentorial parenchyma, involving the grey white matter interface suggestive of acute ischemic etiology. She was admitted under the General medicine department for further management. On

subsequently performed MRI Brain revealed – Multiple T2/FLAIR hyperintensities in bilateral cerebral hemisphere showing restriction on DWI suggestive of acute infarcts. Foci of blooming was noted on SWI suggestive of haemorrhagic transformation.

The patient was not a known case of any co – morbidities. In view of history of recent SAH, a probable diagnosis of delayed cerebral ischemia was opined.

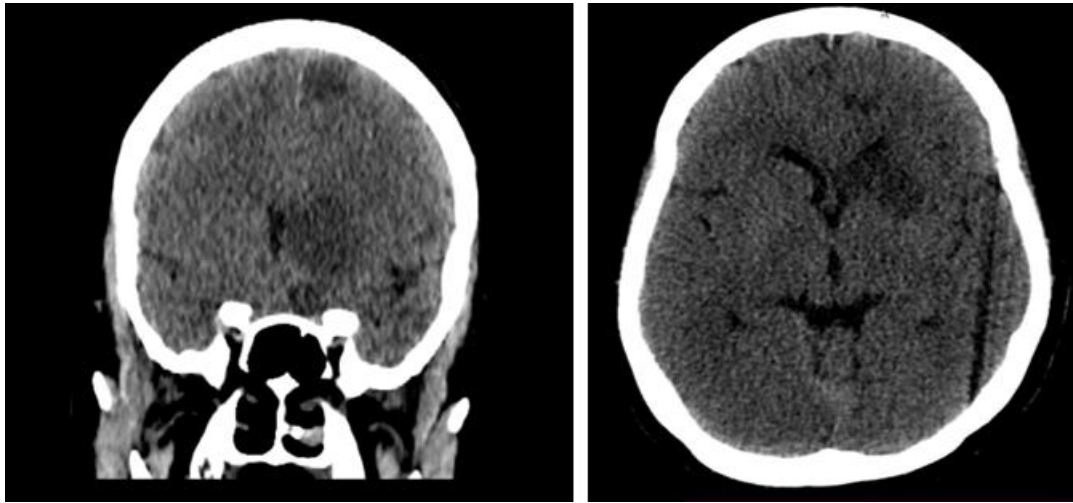


Figure 3: Axial and coronal section of Plain CT brain on 23/04/2026 (12 days after accident) – Multiple infarcts in supratentorial neuroparenchyma

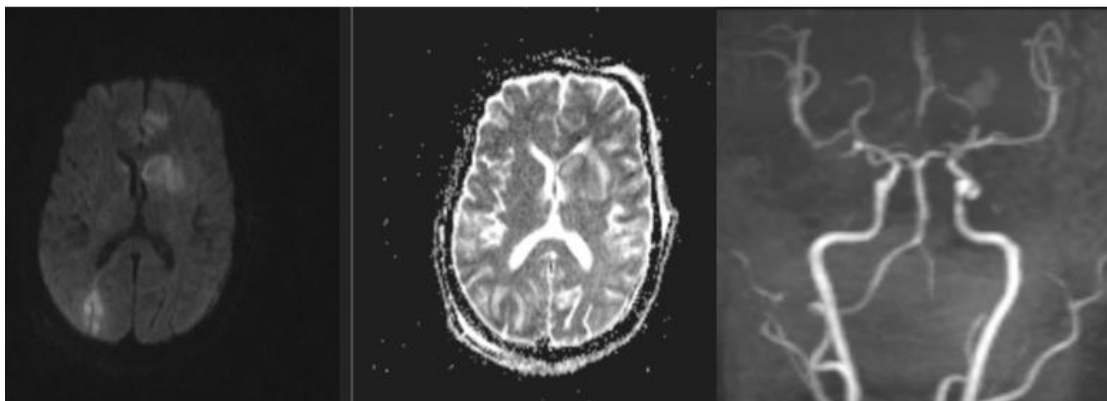


Figure 4: MRI Brain on 27/04/2026 – Axial sections of DWi and ADC sequence reveal focal restriction diffusion in the supratentorial neuroparenchyma. MRI Brain angiography coronal section appears normal.

3. Case Discussion

Patient with no previous co- morbidities presented to the casualty with history of fall and diagnosed with traumatic subarachnoid haemorrhage and admitted under neurosurgery department. She showed improvement within a few days of admission and subsequently performed CT brain reports were normal and the patient was discharged and advised follow up. The patient was apparently alright for a week post discharge following which her GCS dropped from 15/15 to 10/10. The CT brain revealed multiple areas of supratentorial infarct with haemorrhagic transformation. Based on the clinical history and radiological findings, diagnosis of delayed cerebral ischemia was opined.

Delayed cerebral ischemia is defined as features of ischemia on imaging study within 6 weeks of acute subarachnoid haemorrhage, or on the latest scan before death within that 6-week period (or confirmed by autopsy)

The following exclusion criteria also apply –

- Ischemia should not be visible on scans taken between 24 and 48 hours after early aneurysm occlusion
- Ischemia should not be caused by other factors (e.g. surgical clipping or endovascular treatment)
- Hypodensities on CT scans due to ventricular catheters or intraparenchymal hematomas (bleeding within the brain tissue) are not considered cerebral infarctions from delayed cerebral ischemia

Delayed cerebral ischemia is a multifactorial process and a major predictor of poor outcomes in patients who suffer subarachnoid haemorrhage. Initially it was believed that DCI occurs due to cerebral arteries vasospasm, now there has been a paradigm shift suggesting it is not a singular cause, but a compilation of pathophysiological and neuroinflammatory reaction that promote perfusion mismatch with neuro vascular uncoupling. All these local and systemic inflammatory responses are involved in the genesis and development of DCI.

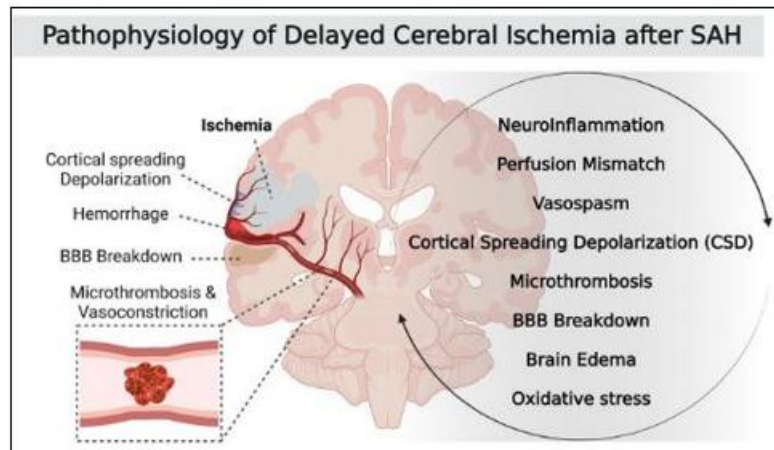


Figure 5: Pathophysiology of delayed cerebral ischemia

In order to provide optimal care, clinicians must grasp the underlying concepts behind DCI. Evidence-based interventions can be implemented to reduce the risk of developing DCI, adequate monitoring and timely intervention must be offered to allow to reverse DCI as rapidly as possible before the ischemic process progresses to infarction.

References

- [1] Dodd WS, Laurent D, Dumont AS, Hasan DM, Jabbour PM, Starke RM, Hosaka K, Polifka AJ, Hoh BL, Chalouhi N. Pathophysiology of delayed cerebral ischemia after subarachnoid hemorrhage: a review. *Journal of the American Heart Association*. 2021 Aug 3;10(15):e021845.
- [2] Goursaud S, Martinez de Lizarrondo S, Grolleau F, et al. Delayed Cerebral Ischemia After Subarachnoid Hemorrhage: Is There a Relevant Experimental Model? A Systematic Review of Preclinical Literature. *Front Cardiovasc Med*. 2021; 8: 752769. Published 2021 Nov 15. doi:10.3389/fcvm.2021.752769
- [3] Hoh BL, Ko NU, Amin-Hanjani S, Chou SH, Cruz-Flores S, Dangayach NS, Derdeyn CP, Du R, Hänggi D, Hetsch SW, Ifejika NL. 2023 guideline for the management of patients with aneurysmal subarachnoid hemorrhage: a guideline from the American Heart Association/American Stroke Association. *Stroke*. 2023 Jul; 54(7): e314-70.