Article published online: 2024-06-04

Case Report

Brain Stem Hemorrhage after Insertion of a Lumbar Drain: An Extremely Rare but Fatal Complication of a Routine Procedure

Vikrant Yadav[1] Nityanand Pandey[1]

[1] Department of Neurosurgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Indian J Neurotrauma

Address for correspondence Vikrant Yadav, MBBS, MS, MCh, Department of Neurosurgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi 221005, Uttar Pradesh, India (e-mail: Vikrantyadav473@gmail.com).

Abstract

Decompressive craniectomy (DC) is a life-saving procedure to control refractory intracranial pressure after traumatic brain injury. Postdecompressive craniectomy hydrocephalus (PDCH) is debilitating complication following DCs. Lumbar drainage (LD) is a temporary measure that is helpful in the assessment of PDCH and its functioning can predict the risks and benefits of definitive cerebrospinal fluid (CSF) diversion procedures. LD is associated with multiple complications. Intracranial hemorrhage is a rare but devastating complication following LD. Here, the authors report a case in which LD was performed as a temporary measure to assess PDCH, resulting in brain stem hemorrhage (BSH). A 45-year-old male underwent DC for severe traumatic brain injury. Patient developed PDCH in postoperative period. LD was done as a bridging procedure for definitive CSF diversion procedure, which resulted in fatal BSH. Authors conclude that although a simple procedure, LD can be associated with fatal BSH. Since drainage of CSF after LD is unpredictable in patients of PDCH, a close monitoring of the functioning of the LD system is required to avoid overdrainage and brain herniations.

Keywords

- brain stem hemorrhage
- decompressive craniectomy
- hydrocephalus
- lumbar drainage
- traumatic brain injury

Introduction

Decompressive craniectomy (DC) is a life-saving procedure to control refractory intracranial pressure after traumatic brain injury, in which a portion of the skull bone is removed and the dura mater is opened.[1] DCs are associated with numerous complications that increase patient morbidity and hospitalization.[2,3] Postdecompressive craniectomy hydrocephalus (PDCH), which ranges from 0.7 to 86%, is a debilitating complication that predicts an unfavorable outcome.[4,5] Several predisposing factors are responsible for the development of PDCH, such as intraventricular hemorrhage, subdural effusions, craniectomy margins near the midline, cerebral edema, and delayed cranioplasty.[2–6] Patients whose neurological condition deteriorates after the development of PDCH are usually treated with a ventriculoperitoneal (VP) shunt, external ventricular drainage, or lumbar drainage (LD) of the cerebrospinal fluid (CSF). LD is a temporary measure that is helpful in the assessment of PDCH and its functioning can predict the risks and benefits of definitive CSF diversion procedures.[7] Although it is a temporary measure, LD is associated with multiple complications. Intracranial hemorrhage (ICH) is a rare but devastating complication following LD.[7,8]

Here, the authors report a case in which LD was performed as a temporary measure to assess PDCH, resulting in brain stem hemorrhage (BSH). The authors also provide insights into the mechanism of development of BSH after LD, prognosis, and preventive measures.

DOI https://doi.org/10.1055/s-0044-1787113.
ISSN 0973-0508.

Thieme Medical and Scientific Publishers Pvt. Ltd., A-12, 2nd Floor, Sector 2, Noida-201301 UP, India

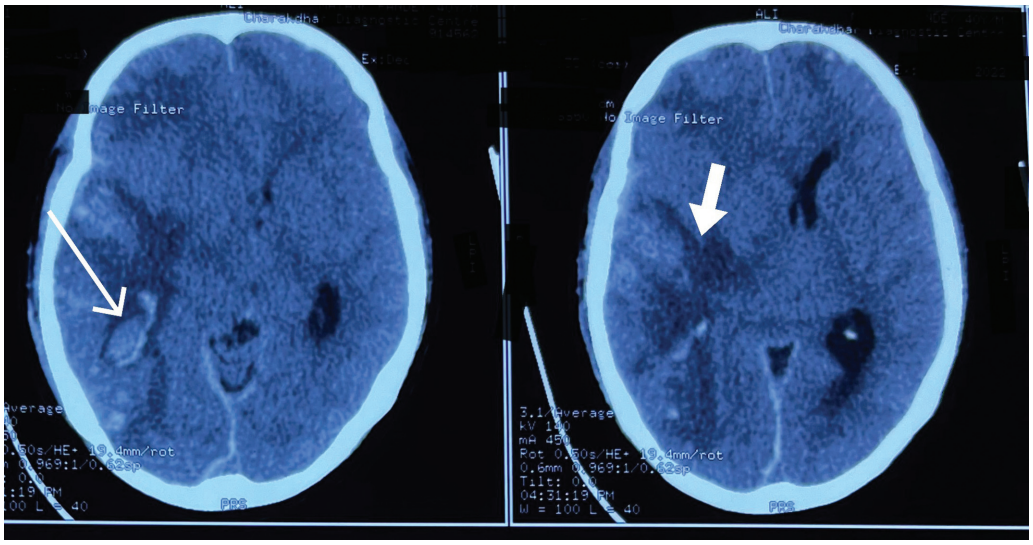

Fig. 1 Preoperative axial computed tomography scan of the head showing intraparenchymal hematoma (thin arrow) with perilesional edema (thick arrow) along with midline shift.

Case Presentation

A 45-year-old male presented to the emergency room in an unconscious state following a high velocity road traffic accident. On arrival, Glasgow Coma Scale (GCS) score was 4, blood pressure was 148/96 mm Hg, pulse rate was 65/minute, respiratory rare was 24/minute, and pupils were mid-dilated bilaterally with sluggish response to light. Initial computed tomography (CT) scans of the head revealed a right-sided intraparenchymal hematoma with massive perilesional edema with midline shift (►**Fig. 1**). Right DC was performed, the patient was tracheostomized and kept on a ventilator postoperatively. The patient was gradually weaned off and discharged on postoperative day 31 in e4v1m5 status. At the time of discharge, a CT scan of the head revealed interhemispheric hygroma with subdural effusion (►**Fig. 2**). The patient was brought to emergency room again, on 56th postoperative day, with a GCS score of 8 (E2V1M5). A CT scan of the head revealed massive ventriculomegaly with transependymal edema and brain bulge on the right side (►**Fig. 3**). A LD was done to measure the ICP and to assess the CSF. The opening pressure was 18 cm H_2O. The LD was opened intermittently every 2 hours to drain 15 to 20 mL of CSF. This measure was temporary, as a VP shunt was planned after 3 days. Forty-eight hours after of LD was inserted, the patient's condition deteriorated further and the GCS score dropped to E1V1M3. The CSF in the LD bag was bloody, tinged and amount of CSF drained was 190 mL in last 24 hours. CT scans of the head showed a BSH with ventricular extension (►**Fig. 4A, B**). The brain was collapsed on the DC side (►**Fig. 4B**) and ventricles

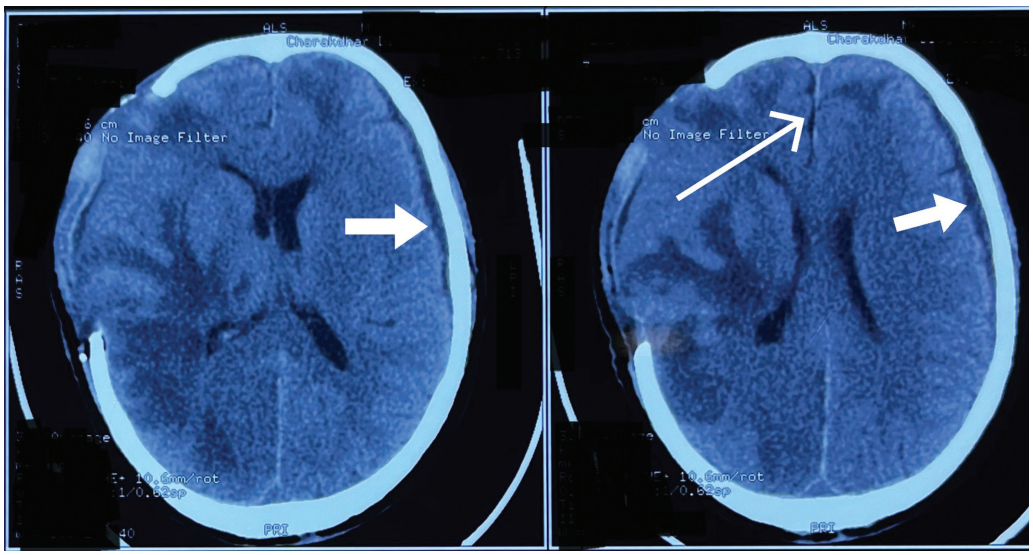

Fig. 2 Postoperative (day 31) axial computed tomography scan of the head showing subdural effusion (thick arrows) with interhemispheric hygroma (thin arrow).

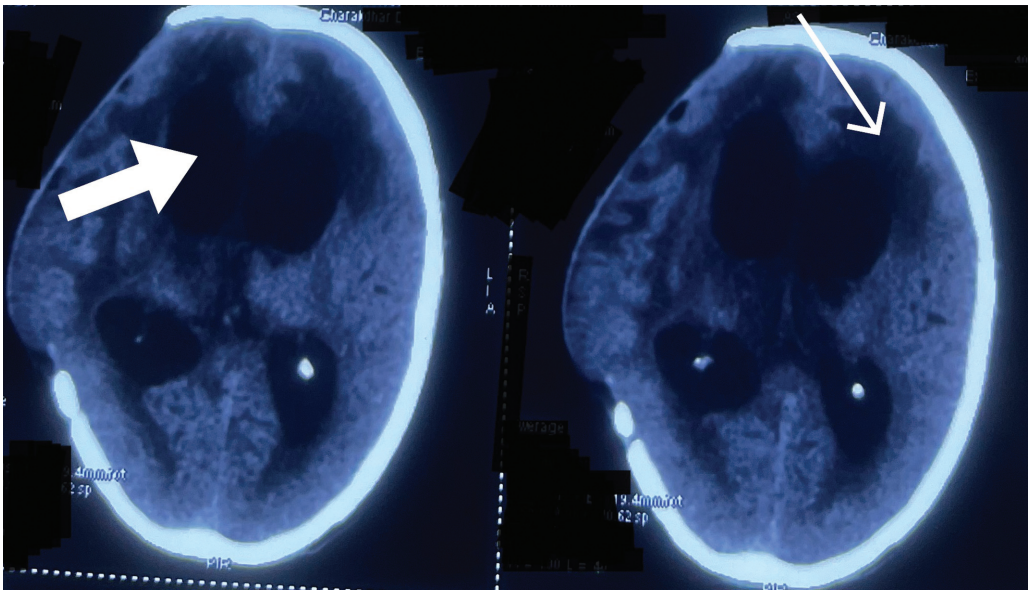

Fig. 3 Postoperative (day 56) axial computed tomography scan of the head showing massive hydrocephalus (thick arrow) with transependymal edema (thin arrow).

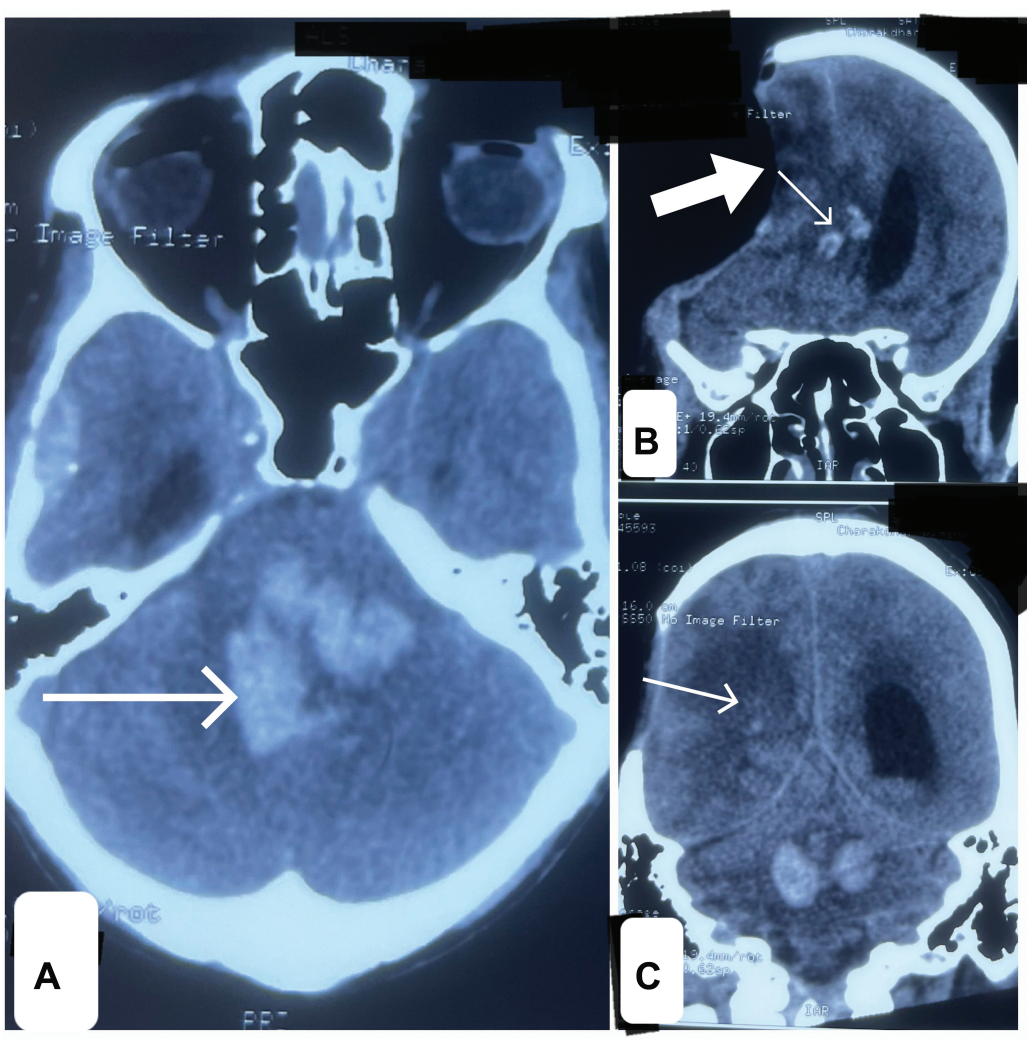

Fig. 4 (A) Axial computed tomography scan of the head after lumbar drain insertion showing brain stem hemorrhage (long arrow) with (B) ventricular extension (thin arrow) and brain parenchymal collapse (thick arrow) and (C) decreased size of ventricles (thin arrow).

were reduced in size (►**Fig. 4B, C**). The LD was clamped to prevent overdrainage. The patient was intubated and immediately transferred to the intensive care unit, where he died after 72 hours.

Discussion

LD is a temporary measure to assess opening pressure along with CSF evaluation and is very useful as an adjunct to permanent CSF diversion procedures. ICH is a fatal complication following LD. ICH can occur in various forms such as cerebellar hemorrhage, cerebral parenchymal hemorrhage, BSH, subarachnoid hemorrhage, and subdural hemorrhage.[7–12] Several cases of ICH after spinal surgery have been reported, probably due to CSF overdrainage.[9–12] To date, only a very small number of cases of BSH after LD have been reported in the literature. Kakati et al reported a case of BSH, in which LD was done intraoperatively to facilitate relaxation of the brain during aneurysmal clipping.[9] Yuan et al reported a case in which LD was done for intracerebral hemorrhage with ventricular involvement. Overdrainage of CSF resulted in BSH and transtentorial herniation.[13] Carr et al reported a case in which LD was done for PDCH that resulted in a fatal BSH.[14]

Several mechanisms for different types of ICH after LD have been hypothesized. Overdrainage of the CSF can lead rupture of the bridging veins due to the stretching effect. CSF hypovolemia leading to cerebellar collapse, stretching, and occlusion of cerebellar veins causes hemorrhagic infarction, and distortion of intraparenchymal vessels leads to rupture, which in turn results in hematoma formation.[9–13] The mechanism of the development of BSH is still under research and is subject to debate. Perforating pontine artery deformation occurs due to downward transtentorial herniation following overdrainage of the CSF, leading to rupture and hematoma formation.[8,9,14] CSF drainage after LD is unpredictable in patients with PDCH. The absence of bony flap leads to loss of the dicrotic pulse and creates negative intracranial pressure, which, along with LD, leads to expansion of the brain stem and makes it susceptible to the development of hemorrhage. In our case, the loss of bony flap and the sudden overdrainage probably led to stretching of vessels and deformation and expansion of the brain stem and subsequent rupture of the vessels led to the formation of BSH.

BSH is usually associated with poor outcomes and intraventricular extension makes it worse.[15] All cases reported to date have had a fatal outcome including our case. The GCS score, location, and size of the hemorrhage intraventricular extension, age, etc. are the factors that determine the prognosis of such patients.[15,16]

As the absence of a bony flap can be a decisive factor, early cranioplasty is an option for patients with PDCH. Early cranioplasty is even recommended to prevent the development of PDCH. After LD, the head end of the bed must be kept flat, and the LD system should be set at the level of the patient's ear or shoulder. Ten to fifteen mL of CSF per hour should be drained while closely monitoring the appearance of the CSF. Close monitoring is advisable to avoid overdrainage. Antibiotics, analgesics, and intravenous fluids were routinely administered to all patients. As LD is a temporary procedure to treat PDCH, definitive procedures for PDCH such as a VP shunt should performed as soon as possible.[2,3,5,15–17]

To the best knowledge, the authors add a second case report to the list of the cases of BSH after LD done as a temporary procedure for PDCH. The authors also provide important information on the mechanism of BSH after LD, prognosis, and preventive measures.

Conclusion

In this article, the authors illustrate a case of BSH after LD, which was done as a bridging procedure for definitive VP shunt. It is extremely essential to be aware of this hazardous complication, as LD is commonly required in neurosurgical practice. Although a simple procedure, LD can be associated with fatal BSH. Since drainage of CSF after LD is unpredictable in patients of PDCH, a close monitoring of the functioning of the LD system is required to avoid overdrainage and brain herniations.

Authors' Contributions

Both the authors contributed in concept and design of the article, manuscript preparation, and critical revision. Both authors read and approved the final manuscript.

Conflict of Interest

None declared.

Acknowledgment

Authors are grateful to Dr. Debabrata Deb for his immense help in collecting data and information regarding this case report.

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