Brainstem hemorrhage

**Brainstem** hemorrhage, is a *intracranial hemorrhage* in the brainstem.

It may occur in **pons**, **pontomedullary junction**, **pontomesencephalic junction**, **midbrain**, and **medulla**. Most of the hematomas in brainstem originate from the branches of the **basilar artery** supplying the pons. Midbrain and **medulla oblongata** are practically less common sites of origin of brainstem hemorrhage.

Results are consistent with the fact that the hypertensive brainstem hemorrhage predominantly occur in the **pons** and primary bleedings in the other parts of the brainstem are rare.¹

**Classification**

**Mesencephalic hemorrhage**.

**Pontine hemorrhage**.

**Etiology**

see **Traumatic brainstem hemorrhage**

see **Pontine cavernous malformation**.

Polster et al. reported 2 post-Chiari decompression surgery brainstem hemorrhage cases with 2-yr follow-up.

Two cases were reviewed in which patients underwent uncomplicated suboccipital craniectomy with expansive autologous pericranium duraplasty for Chiari decompression. Postoperatively, both patients awoke with hemibody sensory and motor deficits. Immediate postoperative magnetic resonance imaging revealed a small hemorrhage within the dorsal medulla in both cases. Follow-up imaging shows resolution along with near complete clinical recovery of deficits.

These cases demonstrated a rare postdecompression surgery-related complication in Chiari malformation. We hypothesize that these hemorrhages may occur from the rapid drainage of cerebrospinal fluid resulting in a loss of positive pressure, allowing a low-pressure hemorrhage to occur. Given that these hemorrhages are of low pressure, recovery is excellent.²

Hydrogel-coated coils may cause a marked inflammatory response that may result in intracerebral hemorrhage.³
Secondary to evacuation of chronic subdural hematoma.

A case report of an unusual complication of dengue fever.

Lumbar drainage.

After decompressive craniectomy.

During transvenous embolization of a cavernous dural arteriovenous fistula.

After neural therapy.

After surgical removal of arachnoid cyst of the Sylvian fissure.

**Clinical features**

Primary brainstem hemorrhage (PBH) frequently causes severe disturbances of consciousness, papillary abnormalities, as well as respiratory and motor disturbances.

Holmes tremor secondary to brainstem hemorrhage.

Shiokawa Y, Saito I, Segawa H, Sano K. [Clinical analysis of brainstem hemorrhage; review]. Nihon Rinsho. 1993 Dec;51 Suppl:199-205. Review. Japanese. PubMed PMID: 8120985.

Shiokawa Y, Yazaki H, Tamura A, Saito I. [Clinical analysis of brainstem hemorrhage; review]. Nihon Rinsho. 2006 Nov 28;64 Suppl 8:442-8. Review. Japanese. PubMed PMID: 17469592.

**Diagnosis**

Before the advent of computerized tomography (CT), the diagnosis of brainstem hemorrhage was usually made based on the clinical picture or by autopsy.

15 patients were examined with a 0.5-T MR scanner with inversion-recovery (IR) and T2-weighted spin-echo (SE) images. In the acute stage (up to the sixth day), hematomas were hypo- or isointense on IR images and isointense and then hypointense on SE images. In the subacute stages (the seventh day to 2 months), hematomas changed from hypo- or isointensity to hyperintensity centripetally on IR images and to hyperintensity on SE images. Parenchymal reactions were hypointense first on SE.
images and then on IR images. In the chronic stage (over 2 months), hematomas “disappeared” and the parenchyma was hypointense on both IR and SE images. The superior clinical efficacy of MR imaging relative to CT for the detection of hemorrhage was obvious except in the acute stage, when hematomas had an intensity similar to that of the adjacent brainstem, and the patients usually were in serious condition.

**Treatment**

**Brainstem hemorrhage treatment.**

**Outcome**

The prognosis has been reported to be highly dependent on the clinical severity at presentation and the presence of certain radiological markers. However, the number of PBH patients enrolled in previous reports tended to be small, and precise statistical analyses were also lacking.

Takeuchi et al. retrospectively reviewed 212 consecutive patients with PBH and analyzed the impact of the clinical or radiological parameters on the outcome of patients with PBH.

Of the 212 patients, 134 (63.2%) were male and 78 (36.8%) were female, with an age range of 17-97 years (mean, 60.3 years). The median admission GCS score was 4. The outcomes included a good recovery in 13 patients (6.1%), moderate disability in 27 (12.7%), severe disability in 27 (12.7%), a vegetative state in 23 (10.8%), and death in 122 (57.5%). A multivariate analysis demonstrated bilateral hematoma extension, a GCS score ≤8, the presence of hydrocephalus, gender, and the hematoma volume to all be significantly associated with the 3-month mortality, while the GCS score ≤8, the presence of a pupillary abnormality, and the hematoma volume were found to be associated with the 3-month poor outcome.

The identification of these factors is therefore considered to be useful for managing patients with PBH.

Neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), and admission blood glucose level (ABG), can be used to independently predict 90-day functional outcome in patients after PBH. When combined, they have better predictive power in identifying PBH patients with a poor prognosis. This study is the first to reveal the associations between NLR, PLR, and hyperglycemia and the functional outcomes of patient with PBH. In associating with previously studies on hemorrhage site, the results provide a good opportunity to elucidate the underlying mechanisms of PBH.

**Case series**

**Brainstem hemorrhage case series.**

**Case reports**

**Brainstem hemorrhage case reports.**
References

1) Kanai H, Yamada K, Yoshida Y. [Histological and morphometrical studies on small arteries in normal brainstems with special reference to the pathogenesis of the hypertensive brainstem hemorrhage]. No To Shinkei. 1998 Jul;50(7):637-42. Japanese. PubMed PMID: 9739522.

2) Polster SP, Dougherty MC, Zeineddine HA, Lee SK, Frim D. A Report of 2 Cases of Brainstem Hemorrhage After Suboccipital Craniectomy for Chiari Decompression. Oper Neurosurg (Hagerstown). 2018 May 1;14(5):598. doi: 10.1093/ons/opx146. PubMed PMID: 28973347.

3) Furuichi M, Shimoda K, Kano T, Satoh S, Yoshino A. [A Case of Brainstem Hemorrhage Following Embolization of a Large Basilar Aneurysm with Hydrogel-Coated Coils]. No Shinkei Geka. 2015 Sep;43(9):835-42. doi: 10.11477/mf.1436203130. Japanese. PubMed PMID: 26321698.

4) Rojas-Medina LM, Goel A. Brainstem hemorrhage secondary to evacuation of chronic subdural hematoma. Neurol India. 2014 Jul-Aug;62(4):435-7. doi: 10.4103/0028-3886.141222. PubMed PMID: 25237953.

5) Singh M, Garg K, Bisht A, Sharma BS, Singh PK, Pandia M, Mahapatra A. Spinal epidural hematoma with myelitis and brainstem hemorrhage: an unusual complication of dengue fever. Neurol India. 2013 Sep-Oct;61(5):541-3. doi: 10.4103/0028-3886.121946. PubMed PMID: 24262469.

6) Kakati A, Shukla D, Mahadevan A, Pandey P. Brainstem hemorrhage following clipping of anterior communicating aneurysm: Is lumbar drain responsible? Neurol India. 2012 Jul-Aug;60(4):419-22. doi: 10.4103/0028-3886.100707. PubMed PMID: 22954979.

7) Lonjaret L, Ros M, Boetto S, Fourcade O, Geeraerts T. Brainstem hemorrhage following decompressive craniectomy. J Clin Neurosci. 2012 Sep;19(9):1293-5. doi: 10.1016/j.jocn.2012.01.014. Epub 2012 Jun 19. PubMed PMID: 22721886.

8) Nakagawa I, Wada T, Nakagawa H, Hironaka Y, Kichikawa K, Nakase H. A rare brainstem hemorrhage during transvenous embolization of a cavernous dural arteriovenous fistula. J Clin Neurosci. 2012 Apr;19(4):589-92. doi: 10.1016/j.jocn.2011.07.038. Epub 2012 Feb 1. PubMed PMID: 22300793.

9) Schmittinger CA, Schär R, Fung C, Z’graggen WJ, Nauer C, Dünser MW, Jung S. Brainstem hemorrhage after neural therapy for decreased libido in a 31-year-old woman. J Neurol. 2011 Jul;258(7):1354-5. doi: 10.1007/s00415-011-5921-4. Epub 2011 Feb 1. PubMed PMID: 21286741.

10) Borges G, Fernandes YB, Gallani NR. [Brainstem hemorrhage after surgical removal of arachnoid cyst of the Sylvian fissure: a case report]. Arq Neuropsiquiatr. 1995 Dec;53(4):825-30. Portuguese. PubMed PMID: 8729782.

11) Yuk CD, Ahn JH, Oh JK, Chang IB, Song JH, Kim JH. Deep brain stimulation of the ventralis intermedius nucleus of the thalamus and posterior subthalamic area for Holmes’ tremor secondary to brainstem hemorrhage: A case report. J Clin Neurosci. 2019 Feb;60:160-164. doi: 10.1016/j.jocn.2018.10.041. Epub 2018 Oct 16. PubMed PMID: 30340967.

12) Komiyama M, Baba M, Hakuba A, Nishimura S, Inoue Y. MR imaging of brainstem hemorrhage. AJNR Am J Neuroradiol. 1988 Mar-Apr;9(2):261-8. PubMed PMID: 3128075.

13) Takeuchi S, Suzuki G, Takasato Y, Masaoka H, Hayakawa T, Otani N, Yatsushige H, Shigeta K, Momose T, Wada K, Nawashiro H. Prognostic factors in patients with primary brainstem hemorrhage. Clin
Neurol Neurosurg. 2013 Jun;115(6):732-5. doi: 10.1016/j.clineuro.2012.08.022. Epub 2012 Sep 1. PubMed PMID: 22944466.

14) Fan Z, Hao L, Chuanyuan T, Jun Z, Xin H, Sen L, Juan Q, Cao Y, Mu Y. Neutrophil and Platelet to Lymphocyte Ratios in Associating with Blood Glucose Admission Predict the Functional Outcomes of Patients with Primary Brainstem Hemorrhage. World Neurosurg. 2018 Aug;116:e100-e107. doi: 10.1016/j.wneu.2018.04.089. Epub 2018 Apr 22. PubMed PMID: 29689388.