

Novel Findings in Treatment of Massive Pontine Hemorrhage: A Short Commentary

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Commentary

One of the most common sites of spontaneous intracranial bleeding is the pons. Lesion at the pons may cause significant neurological deficits as you can see at the ER department or Stroke unit. As a part of the brainstem, the pons relays neural signal from cerebrum and cerebellum to organs all over the body. It connects with the reticular formation, cardiovascular and respiratory centers, which play important roles necessary for life [1]. Until now, there are no standard treatment guidelines for the Primary Pontine Hemorrhage (PPH). Yet, there are many retrospective studies about the correlation between the mortality rate and the functional score at the onset of stroke which can be used to imply the prognosis of patients and also to plan for a treatment.

The following are the two examples of the studies about factors that affecting the PPH outcomes. Huang et al [2] used two independent factors, Glasgow Coma Score (GCS) scale and hematoma volume, to predict 30-day mortality and 90-day functional outcomes. Chung and Park [3] had classified types of PPH into small unilateral tegmental type, basal tegmental type, bilateral tegmental type, and massive type in order to predict survival rate of the patients. Most of previous retrospective studies about PPH, they have revealed that the patients presented with low level of consciousness, high volume, and massive type of PPH would have a very poor prognosis which were not valuable for surgery [2-9].

According to these studies, the patients with poor prognostic factors may not get the intensive care or monitoring as good as the patients would possibly receive from physician which may cause the unstable vital signs, cardiopulmonary compromise and further secondary brain damage that might worsen the outcomes. The point we should deeply concern is these conditions are not mentioned as they might affect the outcomes.

Based on my experiences as a neurosurgeon, I believe that the most important factor that can truly predict the prognosis of patient with PPH is whether he has a secondary brain injury or not. Without the secondary brain damage, the patients might turn to nearly full recovery along with adequate

treatments. Refer to my case report "Good outcome in a patient with massive pontine hemorrhage" [10], it was one of the case studies showing that good prognosis may occur even in a heavy condition patient who has been presented with a coma with GCS score of 4 with a large Primary Pontine Hematoma (PPH).

The results of patho-histological studies of massive pontine bleeding showed that striated branch of basilar artery is the main cause of bleeding which arises in the central area of brain, where the major motor and sensory tracts are not dense [11]. In contrast to ischemic stroke that pathology can be estimated by initial imaging, truly pathology in hemorrhagic stroke may be smaller than the initial size of hematoma seen in the CT scan [10,12]. Histologic damage from PPH occurs mainly in the immediate peri hemorrhage region [13]. In animal models, pontine hematoma was resolved focally within 3 weeks. They survived for 30 days as long as gustatory, cardiovascular and reticular-activating systems remained intact [12]. The Hindbrain ischemic model showed that respiratory-related cells and cardiovascular control were more resistant to ischemia than other cells [14]. Hence, pathology seen in the first CT scan may not be good enough for precise prognosis prediction.

In nature of traumatic and non-traumatic brain injury, there are two main processes. The first one is primary brain injury, defined as the immediate structural damage caused by the mechanical force or loss of blood supply. The second one is secondary brain injury (SBI), which there is many of neuropathological processes including excitotoxicity, neuroinflammation, oxidative stress, and apoptosis. SBI processes start within minutes and persist for months to years, and are considered to promote to the expansion of tissue damage [15,16]. The manifestation and severity of SBI processes may differ depending on injury type, severity, and individual factors [17]. An extension of disease may depend on volume of SBI that occurs after onset of the primary injury to the end of a treatment.

As mentioned above, if we can protect the brain by decreasing probability of SBI processes, while waiting for resolving of the hematoma, the results may be better than we

have predicted. The functional status evaluation on first admission is beneficial in an aspect of a treatment planning which you should thoroughly consider. Yet, it is the only suggestive way of treatment but not a definitive one.

In conclusion, there are confounding factors which cause poor outcomes in the treatment of massive PPH in many research studies. Firstly, it is due to the basic knowledge of brainstem functions. The thought that the massive lesion must end up in poor outcomes causes the trend of treatment in a conservative way. Secondly, in many retrospective studies, they did not mention about the baseline of cardiopulmonary functions and complications that occurred during treatments that would disturb the outcomes. However, to confirm the hypothesis that the massive PPH can be resolved by itself and the affected brain and body function can regain to nearly normal function, the future selective prospective studies needed.

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