Dramatic recovery after severe descending transtentorial herniation-induced Duret haemorrhage: A case report and review of literature

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Abstract

Background: Although Duret haemorrhage of the brainstem caused by descending transtentorial herniation is considered fatal, a few cases have been reported to have good outcome. Moreover, most patients with Duret haemorrhage have severe primary brain injury and the potential outcome of those with mild primary brain injury remains unknown.

Case report: This study reports the case of a patient presenting with Duret haemorrhage caused by an idiopathic subdural haematoma who demonstrated dramatic recovery. The patient presented with a low Glasgow Coma Scale score and bilateral oculomotor palsy on admission. Pre-operative CT revealed a large subdural haematoma and Duret haemorrhage of the mid-brain. The subdural haematoma was immediately evacuated under local anaesthesia and the patient demonstrated dramatic post-operative recovery, with no residual quadriparesis and minimal cognitive dysfunction. Interestingly, only bilateral oculomotor palsy persisted. This indicates that Duret haemorrhage restricted to the central portion of the mid-brain without severe primary brain injury has good prognosis.

Conclusion: Therefore, patients with Duret haemorrhage of the mid-brain caused by simple subdural haematoma presenting with bilateral oculomotor palsy, including bilateral pupillary dilation, may not always have a poor prognosis.

Keywords

Brain stem haemorrhage, bilateral oculomotor palsy, subdural haematoma, trauma

Introduction

Duret haemorrhage is a secondary brainstem haemorrhage that occurs in the setting of severe descending transtentorial herniation and is considered a fatal sign that indicates irreversible brain damage [1–4]. However, some reported Duret haemorrhage cases have demonstrated dramatic recovery [5–9]. Therefore, patients who may have a good prognosis should be identified and treated. This study presents a patient with Duret haemorrhage, caused by an idiopathic subdural haematoma, who achieved a significant recovery. In addition, it reviews the characteristics of reported Duret haemorrhage cases with good outcomes.

Case report

A 58-year-old Japanese man who experienced sudden onset of headache and progressive loss of consciousness was admitted to the emergency room within 30 minutes of symptom onset. On arrival, he had a Glasgow Coma Scale (GCS) score of 5 (E1, V1, M3) with fixed 5-mm and 4-mm dilations of the left and right pupils, respectively, agonal respiration and quadriparesis. Initial head computed tomography (CT) revealed a large left subdural haematoma with a severe left-to-right mid-line shift and a slit-like haemorrhage in the central portion of the midbrain, which was diagnosed as a Duret haemorrhage (Figure 1). However, no parenchymal brain damage other than the Duret haemorrhage was observed. The subdural haematoma was evacuated following a small craniotomy under local anaesthesia. Active bleeding was found from a cortical branch of the middle cerebral artery and it was coagulated. No aneurysms or other vascular abnormalities were observed in the surgical field. All surgical procedures were completed within 3 hours of symptom onset. This case was diagnosed as an idiopathic subdural haematoma. Post-operative magnetic resonance images ruled out other parenchymal haemorrhages and other vascular diseases (Figure 2). The patient had a dramatic post-operative recovery with minimal cognitive dysfunction, although persistent mild quadriparesis was obvious within 2 weeks of symptom onset (Figure 3). One month after symptom onset, the patient was able to walk without assistance. Interestingly, bilateral oculomotor palsy, including fixed and dilated pupils, ptosis

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and ophthalmoplegia, thought to be due to nuclear oculo-motor palsy, persisted.

**Discussion**

Duret haemorrhage is a secondary brainstem haemorrhage that usually occurs at the mid-line in the pons or midbrain as a result of descending transtentorial herniation [10, 11]. Previous reports have hypothesized that Duret haemorrhage are caused by the stretching and disruption of perforating branches of the basilar artery as a result of caudal brainstem movement, with venous infarction and reperfusion injuries following surgical decompression as other possible causes [8]. In the present case, the Duret haemorrhage was attributed to the disruption of the perforating branches of the basilar artery, according to the findings of the initial pre-operative CT scan, which was available within 1 hour after symptom onset, which was too early to consider a venous infarction. Generally, most reported Duret haemorrhage cases have had fatal outcomes [2, 11, 12]. However, as shown in Table I, some authors have reported Duret haemorrhage cases with good outcomes [5, 6, 8, 9]. Most patients with good outcomes showed relatively less primary parenchymal damage and intracranial pressure was immediately controlled after symptom onset in them. Therefore, primary damage appears to have a much greater impact on prognosis than Duret haemorrhages, suggesting that suspected Duret haemorrhage cases with relatively less primary damage are salvageable. It is believed that the present case showed significant recovery because the haematoma was evacuated sufficiently early after onset of the cerebral herniation and because of the absence of parenchymal damage other than the Duret haemorrhage.

It has been reported that Duret haemorrhage may lead to inter-nuclear ophthalmoplegia [9]. In the present case, Duret haemorrhage was considered to be caused by the disruption of the perforating branches of the upper portion of the basilar artery that penetrate the ventral wall of the midbrain, as reported previously [13–15]. In addition, it is believed that many cases of Duret haemorrhage of the central portion of the midbrain may selectively injure the oculomotor nucleus, but...
Figure 2. MRI images. Post-operative MRI images obtained 14 days after admission show no parenchymal damage other than the Duret haemorrhage in the central portion of midbrain (A and B, arrows). An MR angiogram clearly shows the location of the Duret haemorrhage and its relation with the basilar artery (C; top view, D; frontal view, arrow).

Figure 3. Photographs of the patient 21 days after admission. The patient demonstrated dramatic post-operative recovery with minimal cognitive dysfunction and no residual quadriplegia (A). However, bilateral internuclear oculomotor palsy, including dilated and fixed pupils, ptosis and ophthalmoplegia, were persistent (B).
not the reticular activating system or corticospinal tracts (Figure 4). Previous reports demonstrated that various patterns of ocular symptoms caused by Duret haemorrhages are similar to those caused by patients with transtentorial herniation [5–9]. Therefore, it should be noted that patients with Duret haemorrhage showing bilateral fixed dilated pupils, which is usually considered fatal, may recover with a good outcome if primary damages are not critical.

### Declaration of interest
The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

### References

### Table I. Cases with good outcomes following Duret haemorrhage.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Diagnosis</th>
<th>Initial GCS</th>
<th>DH location</th>
<th>Ocular symptoms</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fujimoto et al. [5]</td>
<td>44</td>
<td>F</td>
<td>Acute extradural haematoma</td>
<td>Coma</td>
<td>Midbrain and the upper pons</td>
<td>Ocular bobbing and internuclear ophthalmoplegia</td>
<td>Slightly confused mental state</td>
</tr>
<tr>
<td>Kamijo et al. [6]</td>
<td>30</td>
<td>M</td>
<td>Hyponatremia</td>
<td>3</td>
<td>Midbrain and the upper pons</td>
<td>Fully dilated and non-reactive pupils</td>
<td>Slight left paresis</td>
</tr>
<tr>
<td>Stiver et al. [8]</td>
<td>24</td>
<td>F</td>
<td>Acute extradural haematoma</td>
<td>6</td>
<td>Midbrain</td>
<td>Fixed 6-mm-dilated pupils</td>
<td>Mild left upper extremity weakness</td>
</tr>
<tr>
<td>Rouhl and Postma [9]</td>
<td>67</td>
<td>M</td>
<td>Chronic subdural haematoma</td>
<td>Coma</td>
<td>Midbrain</td>
<td>A left-sided anterior internuclear ophthalmoplegia</td>
<td>Not shown</td>
</tr>
<tr>
<td>Present case</td>
<td>58</td>
<td>M</td>
<td>Acute subdural haematoma</td>
<td>5</td>
<td>Midbrain</td>
<td>Fixed 5-mm dilatation in the left pupil and 4-mm dilation in the right pupil</td>
<td>Minimal cognitive dysfunction and slight paralysis</td>
</tr>
</tbody>
</table>

M, male; F, female.