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Traumatic Basal Subarachnoid Hemorrhage Due to Rupture of the Posterior Inferior Cerebellar Artery

—Case Report—

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Abstract

A 20-year-old male presented with traumatic basal subarachnoid hemorrhage after being involved in a fight. Antemortem clinical examinations could not exclude the possibility of rupture of abnormal blood vessels because of the absence of external injuries. Careful postmortem examination of the head and neck regions and histological examination of the intracranial arteries demonstrated traumatic rupture of the left posterior inferior cerebellar artery due to a fist blow to the jaw. This case indicates the need for careful autopsy examination for the differentiation of traumatic and non-traumatic basal subarachnoid hemorrhages.

Key words: traumatic basal subarachnoid hemorrhage, posterior inferior cerebellar artery, head trauma, neuropathology, forensic autopsy

Introduction

Subarachnoid hemorrhage (SAH) at the base of the brain usually results from a non-traumatic cause such as aneurysm rupture or vascular malformation. However, trauma is also a cause of basal SAH.[7] Differentiation of traumatic and non-traumatic basal SAH is a crucial medico-legal issue. Postmortem diagnostic criteria were proposed for traumatic basal SAH as follows: History of trauma; correlation in time between trauma and collapse and/or death; pathological evidence of injury to a blood vessel which may be the source of SAH, and the injury appearance consistent with infliction at the time of trauma; and absence of pre-existing natural disease within the blood vessel.[8]

We report an autopsy case of traumatic basal SAH caused by rupture of the posterior inferior cerebellar artery (PICA).

Case Report

A 20-year-old male was unresponsive after being involved in a fight with two men. On admission, he was comatose and required respirator support. He had no external injuries. Computed tomography

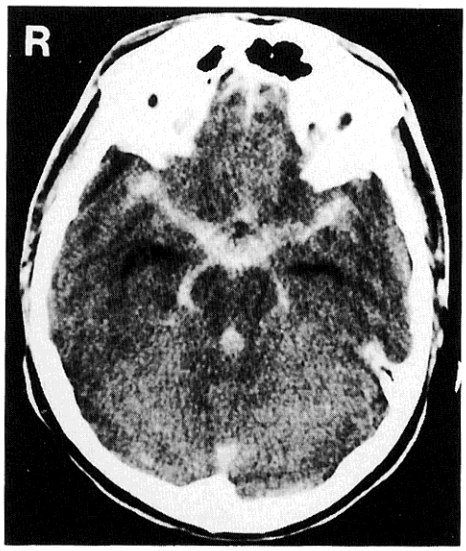

Fig. 1 Computed tomography scan on admission showing subarachnoid hemorrhage at the base of the brain.

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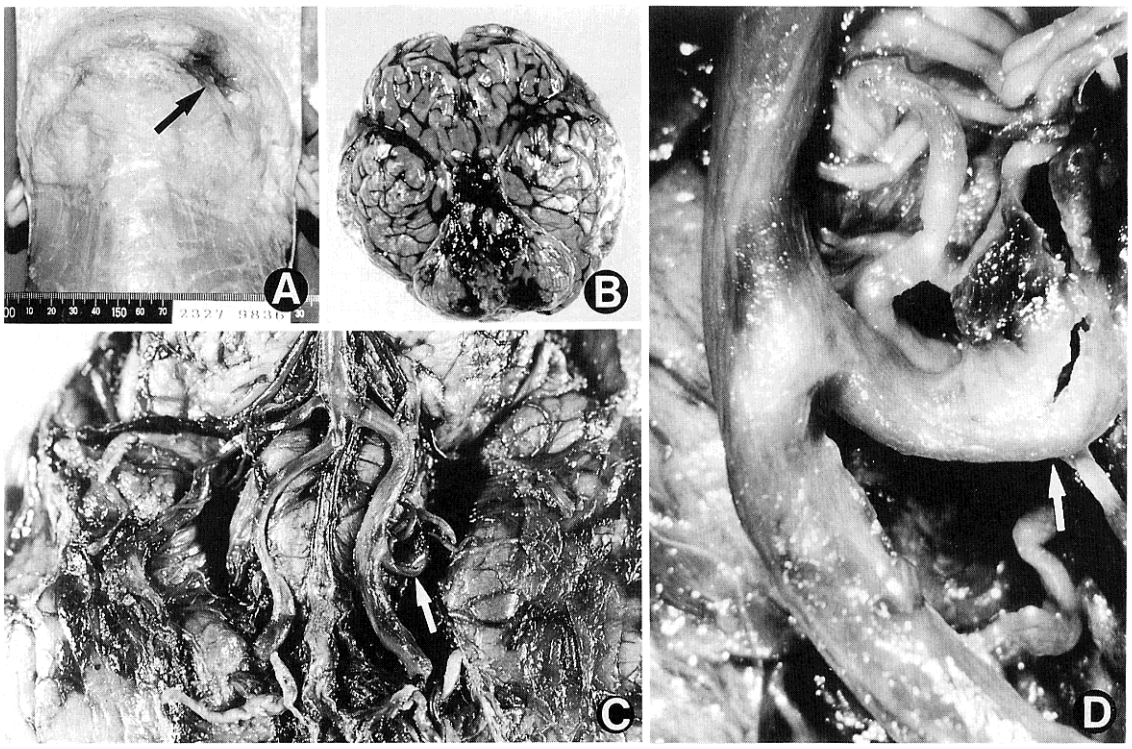

Fig. 2 Autopsy findings of the victim. A: Photograph showing a subcutaneous hemorrhage on the left side of the jaw (*arrow*). B: Photograph showing massive subarachnoid hemorrhage on the base of the brain. C: Photograph showing a laceration on the left posterior inferior cerebellar artery (PICA) after removal of the blood clots (*arrow*). D: Photograph of the laceration on the left PICA (*arrow*).

showed massive basal SAH (Fig. 1). The origin of the SAH appeared to be traumatic, but we could not exclude the possibility of rupture of abnormal blood vessels because of the absence of external injuries. We examined the patient on day 3 but could not find any external injuries. He died on day 6.

Autopsy examination demonstrated a 4 × 5 × 2 cm subcutaneous hemorrhage on the left side of the jaw. No vertebral or other injuries were found. The brain was markedly edematous and soft. Massive SAH was confirmed at the base of the brain. Because of severe softening, the brain was further examined after formalin fixation for 2 weeks. Careful removal of the blood clots at the base of the brain revealed a 3 mm laceration of the left PICA 1 cm from the origin (Fig. 2). Histological examination of the left PICA showed fibrin deposits and stretching of the elastic lamina at the edge of laceration, with no evidence of aneurysm or atherosclerosis (Fig. 3). The death was certified as traumatic basal SAH. A fist blow to the left side of the jaw was the cause of rupture of the left PICA.

Samples of urine and the stomach contents of the patient at the time of admission were retrieved for alcohol analysis. Blood samples were unavailable. The urine ethanol level was 1.7 mg/ml, and the stomach content ethanol level was 0.41 mg/ml.

Discussion

Traumatic basal SAH is uncommon in forensic autopsy, accounting for only 0.12% of all cases, 0.9% of cases of blunt-force head injuries, and 1.8% of all cases of SAH.[4,6] Traumatic basal SAH predominantly occurs in young men of age 20–30 years who received fist blows to the head or neck. The victims uniformly suffer immediate unconsciousness and death.[8] Falls from height and traffic accidents are also rare causes.[9,11] Trauma in the victims is usually mild to moderate and may not leave any external injuries as in our case. As many as four of 34 (12%) cases of traumatic basal SAH had no external injuries.[13] In such cases, the SAH and death may be erroneously attributed to natural causes. Therefore, careful autopsy examinations of the head and neck regions to find the evidence of trauma are necessary in suspicious cases.

Traumatic basal SAH can originate from both ex-

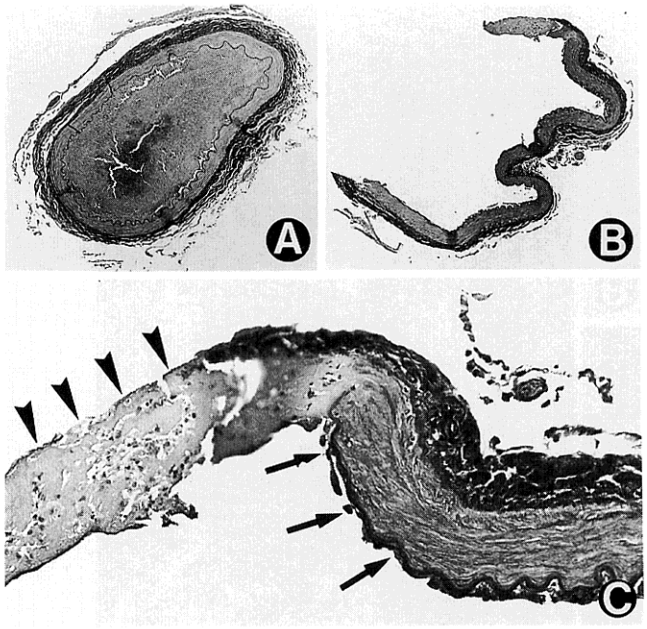

Fig. 3 Photomicrographs of the left posterior inferior cerebellar artery showing a normal portion (A: Elastica-Van Gieson stain, ×10), the lacerated portion (B: ×10), and stretching of the elastic lamina (*arrows*) and fibrin deposits (*arrowheads*) at the edge of the laceration (C: ×25).

tra- and intracranial arteries. Rupture of the extracranial vertebral arteries may occur at the level of the first cervical vertebra and may be associated with fracture of the transverse process. Rupture of intracranial arteries can occur in the carotid as well as vertebral arteries and their branches, but more often in the vertebral arteries.[12] Identification of the source of bleeding is difficult because of the massive blood clots over the arteries. Lacerations on the vertebral arteries often occur close to the origin of the PICA.[4] The proximal portion of PICA is not an uncommon site of rupture, as at least 10 cases of traumatic rupture of the proximal portion of PICA including our case have been reported.[1-4,13] These findings indicate that careful examination of the origin and proximal portion of the PICAs may facilitate location of the source of bleeding.

Histological examination is necessary to show whether the arterial lesion is intravital or not. Confirmation of whether the artery is normal or pathologically changed is also necessary. Rupture of saccular aneurysms as a result of head trauma has been reported.[10,12] The purely traumatic nature of our case was confirmed by the presence of fibrin deposits and stretching of elastic lamina at the laceration of the left PICA. In addition, the left PICA had no evidence of intimal thickening, attenuation of the elastic lamina, or degeneration of the media, which are the usual pathological manifestations of saccular and fusiform aneurysms.[14,15]

Stretching of the vertebrobasilar system during hyperextension of the neck due to head and face trauma is a well-recognized mechanism of rupture of the arteries at the base of the brain. Drinking alcohol is a precipitating risk factor for the development of traumatic basal SAH. Alcohol intoxication weakens the physical defenses against trauma and exaggerates hyperextension of the neck, which generates greater stretching forces on the arteries.[4] Transient vertebral artery occlusion resulting from rotatory movements of the neck may lead to reversed blood flow from the basilar artery to the occluded vertebral artery which subsequently leads to rupture at the origin of PICA.[5] The branch of the proximal portion of PICA has several anatomical variations.[1] The most common variation is a branch with a circumflex course before entering the medulla which is displaced at the moment of trauma. However, the variation with a branch which goes directly to the medulla anchors the PICA and creates the anatomic prerequisite for rupture at the proximal portion of the PICA.

Postmortem diagnosis of traumatic basal SAH requires complete autopsy of the head and neck regions and histological examination of the ruptured arteries. Examination of the origin and proximal PICAs is particularly recommended.

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