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# Medicolegal Problems of Evaluating the Origin of a Ruptured Berry Aneurysm

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A major cause of medicolegal problems is the association of trauma and subarachnoid haemorrhage from a ruptured “berry” aneurysm. Most commonly, an assault is rapidly followed by the signs of subarachnoid bleeding (severe headache, neck stiffness and vomiting) and subsequently by death. A second possibility is that a person with an already spontaneously leaking aneurysm may have a rapidly developing neurological or even behavioural abnormality that leads him into conflict with another person, or into a dangerous physical position such as a fall or traffic accident. If all this occurs over a short period of time, autopsy may not be able to distinguish the sequence of events and answer the question of causation.

We herein describe the case of an intoxicated 36-year-old man (blood alcohol 2.66‰) who was involved in an altercation and received blows and kicks to the head. Soon after that he was pronounced to be dead at the scene. The autopsy revealed a laceration in the right fronto-parietal area, several scalp bruising, no evidence of skull fracture, and a ruptured berry aneurysm in the right middle cerebral artery. There was extensive basal subarachnoid and intraventricular haemorrhage. Histologic aging of contusions and areas adjacent to the area of the source of bleeding provided valuable information. After thorough consideration of the medical and social history, the autopsy and literature data, we made an attempt to evaluate the coexistence of trauma and aneurysm as a consequence or coincidence.

**Key words:** subarachnoid hemorrhage, ruptured berry aneurysm, head injury

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## INTRODUCTION

A major cause of medicolegal problems is the association of trauma and subarachnoid haemorrhage from a ruptured “berry” aneurysm. In the usual forensic case the victim is either found dead with no available history, or has died rapidly and inexplicably, or has expired after suggestive symptoms like severe headache and rapid coma. Many die after physical or emotional exertion, especially sexual intercourse or strenuous sporting activity. Those that occur during or soon after some assault or altercation can pose a major forensic problem concerning causation (1–3).

We herein report the case of ruptured berry aneurysm and after thorough consideration of the medical and social history, the autopsy and literature data, we made an attempt to evaluate the coexistence

of trauma and disease – consequence or coincidence.

## CASE REPORT

The victim, a 36-year-old man, was involved in an altercation and received many punches and kicks to the head. According to a witness, he immediately lost his consciousness. Soon after that he was pronounced to be dead at the scene.

At autopsy the body was that of a well-nourished man. There was a linear laceration 1.3 cm long localized in the right fronto-parietal region. The inner aspect of the scalp disclosed several small bruising scattered on both the temporal and parietal areas. The removing of the fascial soft tissues showed a deep bruising measuring 3 × 4 cm, confined to the left angulus of the mandible. The dura mater seemed intact. The brain weighed 1240 g. The cerebral gyri were diffusely swollen. Massive basal subarachnoid hemorrhage was found with maximal involvement of the posterior fossa and with minimal

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extension over the cerebral convexities. Recent massive hemorrhage was present in the ventricular system. There was no signs of cerebral contusion either in the cortex or in the white matter. The skull and the cervical part of the spine were unfractured. A thorough examination of the circle of Willis revealed an aneurysm with a berry appearance that measured 3 mm in diameter on one projection in the right middle cerebral artery (Fig. 1). The rest of the arteries at the base of the brain were normal.

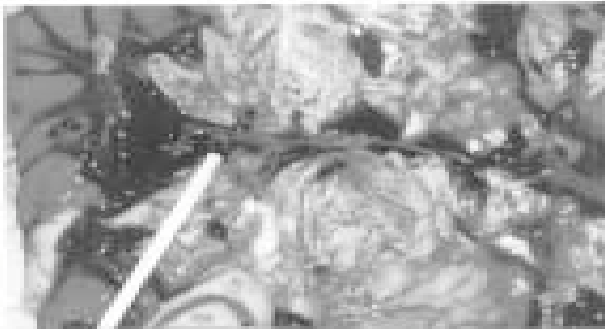


Fig. 1. An aneurysm with a berry appearance in the right middle cerebral artery



Fig. 2. Hemorrhage from the area of aneurysm

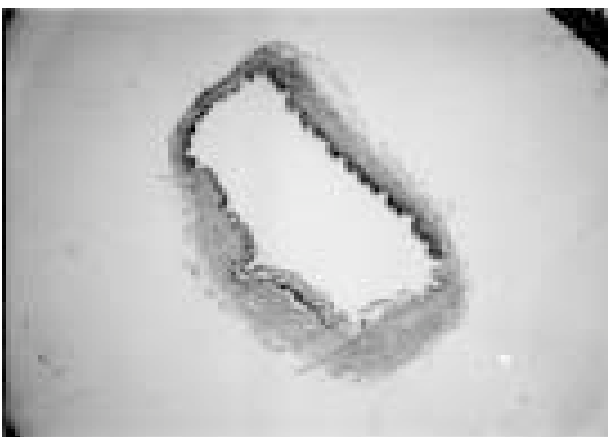


Fig. 3. Spasmodic changes of the cerebral artery wall

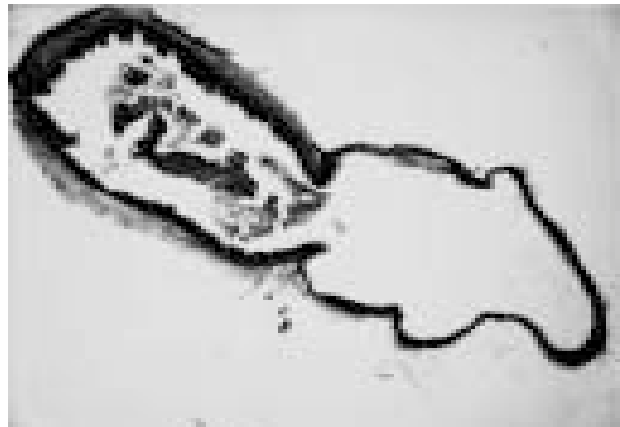


Fig. 4. An elastic sac comparable in size with the lumen of the artery

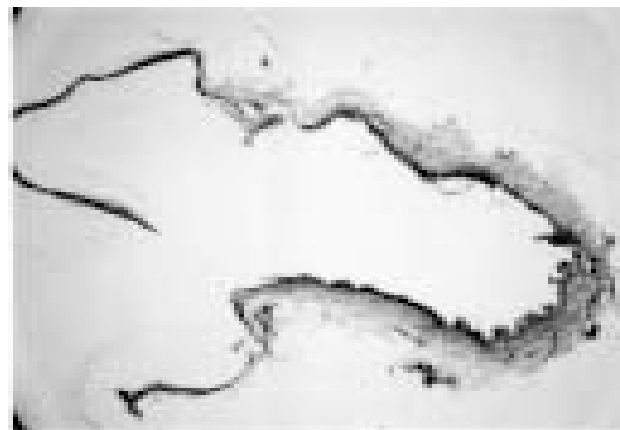


Fig. 5. A defect of the sac wall

Histology showed no inflammatory response to the hemorrhages. This finding was in keeping with the known short survival interval (Fig. 2). Multiple sections from the area of aneurysm showed hemorrhage with an inflammatory response consisting of small congregations of leukocytes and fibrin.

Multiple histological slides showed spasmodic changes of the cerebral artery wall, others disclosed a thinned artery wall forming an elastic sac comparable in size with the lumen of the artery (Fig. 3, 4). Further series of slides presented a defect of the sac wall. The lesions were best observed with the hematoxylin-eosin stain (Fig. 5). There was an elevated blood alcohol concentration (2.66‰).

## DISCUSSION

The case we report pose a major forensic problem concerning the association of trauma and subarachnoid haemorrhage from the ruptured 'berry' aneurysm. In our cases the deceased was a young alcohol-intoxicated man and received blows to the head. Soon after that he collapsed and was pronounced dead at the scene. The determined at the

autopsy and histologically confirmed ruptured 'berry' aneurysm induced the question: How should head injuries be interpreted, could the received blows be considered as the direct cause of the lethal subarachnoid hemorrhage?

According to the Knight's (4) approach to this medicolegal problem several variations of this scenario exist. Most commonly, an assault is rapidly followed by the signs of subarachnoid bleeding and subsequently by death. Occasionally death may be extremely rapid, as previously described. Aneurysms of the circle of Willis are remote from the skull surface and lie deeply protected under the buffer provided by the mass of the brain. However, it is hard to deny that a heavy blow to the head, jaw or neck could rupture, split or weaken the fragile wall of a large, thin-walled aneurysm, but when the bleeding comes from a tiny sessile bulge the evidence is not so convincing.

The complicating factor is that most assaults occur in 'fight or flight' conditions in which both the aggressor and the victim are physically and emotionally active, so that the adrenal response is likely to be present. Muscle tone, heart rate and blood pressure are increased by catecholamines, and it is likely that the raised internal blood pressure in a weak aneurysm is a far more potent reason for rupture than a blow on the head.

A second possibility is that a person with an already spontaneously leaking aneurysm may have a rapidly developing neurological or even behavioral abnormality that leads him into conflict with another person, or into a dangerous physical position such as a fall or traffic accident. If all this occurs over a short period of time, autopsy may not be able to distinguish the sequence of events and the aneurysmal rupture may be blamed on the trauma instead of the reverse. This may have profound civil as well criminal legal consequences.

Another factor that is often said to increase the chance of rupture is alcohol. In our case the blood alcohol concentration was rather considerable. A high blood alcohol is said to facilitate bursting of an aneurysm because it dilates cerebral blood vessels, increases cerebral blood flow and raises blood pressure.

The latter is not true because alcohol does not raise systolic pressure, though the pulse pressure – the difference between systolic and diastolic – may widen. The fibrous wall of an aneurysm is incapable of dilating, neither can the major basal arteries do so to any appreciable degree, as they possess little muscle in their walls. The pharmacological evidence that alcohol has any significant effect on the cerebral circulation is extremely weak. There is no evidence that alcohol is associated with completely na-

tural subarachnoid haemorrhage from ruptured aneurysm, though intense physical activity such as sports or coitus certainly does predispose to rupture.

We believe that where alcohol and ruptured berry aneurysm are concerned, a more likely explanation is that the association is coincidental as most alterations resulting in 'flight, fight and fisticuffs' are catalyzed by alcohol. Many of the cases of aneurysm rupture and violence occur within and on bars and clubs, where high blood alcohol is virtually inevitable – but not necessarily causative.

The other aspect of alcohol is that it may cause or contribute to unsteadiness, a fall or some other traumatic event, which itself might lead to rupture of a fragile aneurysm. Ataxia and hypotonia are a feature of acute drunkenness and, together with the aggressive behavior and alcoholic environment of most physical violence, seem sufficient to account for their circumstantial association.

Finally, after a thorough consideration of the medical and social history, the autopsy and literature data and taking into account that in criminal cases the standard of proof is 'beyond reasonable doubt'; we assumed that in our case it is unsafe trying to confirm any cause-and-effect connection between the head trauma and the aneurysm rupture. Due to that the manner of death was ascribed as a natural.

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#### TEISMO MEDICININĖS PROBLEMOS VERTINANT PLYŠUSIOS SMEGENŲ PAMATO ARTERIJOS (ANEURIZMOS) KILMĘ

#### S a n t r a u k a

Priežastinio ryšio nustatymas tarp galvos traumos ir kraujavimo dėl plyšusios smegenų pamato arterijos (aneurizmos) yra žinoma problema teismo medicinoje. Tuoju galvos traumos nukentėjusiajam dažnai atsiranda ūmaus subarahnoidinio kraujavimo požymių: stiprūs galvos skausmai, sprando rigidiškumas, vėmimas ir greita mirtis. Galimas kitas priežastinio ryšio variantas, kai asmuo dėl spon-

taniškai plyšusios aneurizmos patiria ūmią neurologinę ir elgesio patologiją, todėl gali išsivelti į muštines ar tapti nelaimingo atsitikimo (griuvimo, automobilinės traumos) auka. Jeigu visa tai įvyksta per trumpą laiką, lavoną tyręs teismo medicinos ekspertas gali nepajėgti atsakyti į teisėsaugai rūpimus klausimus dėl įvykių eiliškumo ir priežastinio ryšio tarp traumos ir ligos.

Aprašomas 36-ių metų vyro mirties atvejis. Nukentėjusysis netrukus prieš mirtį dalyvavo muštynėse ir patyrė daugybinius smūgius rankomis ir kojomis į galvos sritį.

Tiriant lavoną nustatyta muštinė žaizda dešinėje frontoparietalinėje srityje, kelios kraujosruvos galvos minkštuosiuose audiniuose, didelis subarahnoidinis kraujo išsiliejimas smegenų bazaliniame paviršiuje bei plyšusi maišelinė aneurizma dešinėje, vidurinėje smegenų arterijoje. Kraujyje rasta 2.66 promilių etilo alkoholio. Išsamus sužalojimų bei kraujavimo šaltinio morfologinis ištyrimas, įvertinus katamnestinius bei literatūros duomenis, leido padaryti išvadą apie traumos ir smegenų pamato arterijos (aneurizmos) priežastinį ryšį.