G16 Homicidal Cerebral Artery Aneurysm Rupture

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After attending this presentation, attendees will understand that, in the correct setting, a natural disease cause/mechanism of death may be considered a homicide, and to learn a set of proposed criteria for such deaths involving ruptured cerebral artery aneurysms.

This presentation will impact the forensic community and/or humanity by addressing the difficult question of whether or not minor head trauma, or even the threat of trauma, can be implicated in a death due to ruptured cerebral artery aneurysm. If trauma (or threats of trauma) can be considered a contributory cause in such deaths, "homicide" may be a reasonable manner of death, given the proper circumstances. The paper proposes a set of criteria to help forensic pathologists determine whether or not a given case represents a "homicide by ruptured berry aneurysm."

In 1978, Davis published his classic work, "Can sudden cardiac death be murder?"[1] In Davis' paper, a logical, well-reasoned argument is made for certifying certain cardiac deaths as homicides, so long as a set of specific criteria are met. Using Davis' criteria, a mugging victim who suddenly collapses and dies from underlying severe coronary artery disease can be appropriately ruled a homicide. While some forensic pathologists may not agree with such a ruling, the phrase "homicide by heart attack" remains well-known to many within the forensic community.

Cardiac disease is not the only natural disease process that can be considered the underlying mechanism of death in homicide. Subarachnoid hemorrhage related to traumatic ruptured cerebral artery berry aneurysm or arteriovenous malformation has received some attention in the medical and forensic literature. In this paper, we present a case of "minor" head trauma causing the rupture of a cerebral artery aneurysm. The MOD was considered "homicide." The ensuing discussion will address this controversial topic and present a proposed set of criteria useful in making such a determination.

An intoxicated, 46-year-old man, his wife, and their female friend returned to the friend's home late one night, after having been out for dinner and drinks. The man was reportedly loud and boistrous. Upon hearing the commotion, the friend's adult daughter, who had been sleeping, got-up, came-out of the bedroom, and asked them to be quiet, since her live-in boyfriend needed to get-up early for work. She then stated that she was going back to bed. The 46-year-old man then proposed to the daughter that he might join her in bed. The daughter's livein boyfriend then emerged from the bedroom and confronted the intoxicated man. A short verbal altercation ensued, followed by a single punch, thrown by the boyfriend, that landed on the other man's face. The man immediately collapsed to the floor, totally unresponsive. Emergency resuscitation was initiated by the owner of the home. Emergency medical services responded to a 911 call and transported the victim to the hospital, where work-up and imaging studies revealed diffuse basilar subarachnoid hemorrhage and a ruptured berry aneurysm in the basilar artery. He died approximately 36 hours after the initial collapse.

Autopsy confirmed the presence of diffuse, basilar subarachnoid hemorrhage, as well as a ruptured, 9 mm basilar artery aneurysm. Brain examination was consistent with global ischemia. The remainder of the autopsy was significant for cardiomegaly (500 gm), with concentric left ventricular hypertrophy, as well as mild to moderate atherosclerotic cardiovascular disease involving the aorta and coronary arteries. There were no facial injuries identified at autopsy. A blood ethanol level from the time of hospital admission was 153 mg/dL.

Police investigation confirmed the story as presented above. The victim's wife, the homeowner, her daughter, and the boyfriend all related similar scenarios as they recalled the events. The cause of death was ruled "subarachnoid hemorrhage due to ruptured basilar artery aneurysm following blunt head trauma." The manner of death was ruled "homicide."

Whether or not "minor" head trauma may cause the rupture of a cerebral artery aneurysm (or arteriovenous malformation) remains a controversial topic. Some claim that "significant" or "severe" head trauma is necessary, with concomitant skull fractures or brain contusions/lacerations. Others feel that minor head injury is sufficient, in certain instances, to cause aneurysm rupture. A careful review of the literature suggests that minor head trauma may, in fact, contribute to or cause the rupture of an intracerebral aneurysm or arteriovenous malformation. This appears to be true particularly when the traumatic event (or threatened traumatic event) is associated with intense emotion, with a rise in blood pressure. Another factor that increases a person's risk for cerebral aneurysm rupture (traumatic or spontaneous) is ethanol intoxication, due most probably to the considerable intracranial blood vessel dilatation known to occur in association with ethanol intoxication.

The following represent a proposed set of criteria for ruling a ruptured cerebral artery aneurysm (or arteriovenous malformation) as a homicide: 1) Head trauma (and/or extreme emotional stress) must immediately precede the onset of symptoms related to ruptured aneurysm (or arteriovenous malformation). 2) Autopsy findings must confirm the presence of a ruptured aneurysm (or arteriovenous malformation), with no findings indicating that the rupture occurred prior to the trauma/emotional stress. 3) When head trauma

is implicated, autopsy evidence of physical injury of the face/head may or may not be present. 4) Head trauma (and/or extreme emotional stress) must have occurred during or as a result of an event that would normally be considered a form of criminal activity. 5) In order to implicate the emotional stress of an event as a cause or contributing cause of the intracranial hemorrhage, the victim should have realized that the threat to personal safety was implicit, and the circumstances should be of such a nature as to be commonly accepted as highly emotional.

It is important to remember that each case must be evaluated on its own. Death scene investigation and witness statements are often of paramount importance, particularly when attempting to address criteria #1, #4, and #5. If the criteria are not met, it is prudent *not* to rule such a death as a homicide. In such an instance, an "undetermined" ruling is acceptable, with or without a statement suggesting that the case may represent a homicide. As a corollary, a modified form of the criteria may be utilized in an attempt to determine whether accidental trauma can be implicated in deaths related to ruptured cerebral aneurysms or arteriovenous malformations; criteria #4 would not apply in such accidental trauma cases.

Reference:

1. J.H. Davis. Can sudden cardiac death be murder? *Journal of Forensic Sciences* 23(2):384-7,1978.

Homicide, Natural Disease, Cerebral Aneurysm

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