Case Report

Natural Intracranial Hemorrhage and Its Forensic Implications: A Case Review

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Abstract

An aneurysm is an abnormal, weak spot in a blood vessel that causes an outward bulging or ballooning of the arterial wall. An aneurysm confined to the head cause a serious medical condition, like a hemorrhagic stroke, which leads to brain damage and death. Berry aneurysms are the most common kind of aneurysm in the brain. The most common site of berry aneurysm is the anterior cerebral artery. These aneurysms remain asymptomatic for a long time or may rupture and cause intracranial hemorrhage and sudden death, there by arising suspicion in the eyes of his near and dear ones. In cases of trivial trauma to head leading on to brain hemorrhage causing the death of the individual the defense counsel takes the advantage of the aneurysm to be the cause of brain hemorrhage. This is a case, report where deceased was found dead in bathroom, following rupture of berry aneurysm and we have reviewed the literature regarding the berry aneurysm and tried to corroborate with the legal scenario.

Key Words: Berry aneurysm, Circle of wills, Subarachnoid hemorrhage, Sudden death

Introduction:

An aneurysm is the dilatation of a localized segment of the arterial system. Morphologically, it can be saccular (also known as Berry aneurysm), fusiform or dissecting. [1]

This localized dilatation is due to deficiency in the tunica media leading to weakness of the vessel wall. The Subarachnoid hemorrhage (SAH) could be either traumatic or non-traumatic. The most common cause for non-traumatic SAH is the rupture of aneurysm in the brain. The incidence of berry aneurysm is reported to be 2% and the incidence of subarachnoid hemorrhage is 6-8/100000 person years. [2] Aneurysms occur most commonly at the junction of two arteries in the circle of Willis.

Aneurysms are most commonly saccular also called as berry aneurysm, and is caused by head trauma in 1% of cases. [3] They usually remain asymptomatic for a long time or may rupture and cause intracranial hemorrhage and sudden death. Aneurysms are associated with a high mortality rate.

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The presence of berry aneurysm in a case of head injury carries significance as to the origin of intracranial hemorrhage.

This case report highlights a similar situation where an elderly female died due to rupture of aneurysm suddenly.

Case History:

We received a dead body of female aged 45 years for post-mortem examination. According to the investigating officer she was found in an unconscious state in the bathroom and was taken to hospital, where she was declared as dead on arrival. Relatives of the deceased did not have any knowledge regarding the past medical history.

Autopsy Findings:

The deceased was moderately built & nourished. Rigor noted throughout the dead body. Post-mortem lividity noted over the back surfaces of the body. Remaining external appearance was normal and unremarkable. No external injuries were found over the body.

On internal examination, the scalp was intact. Brain showed subdural hematoma & diffuse subarachnoid hemorrhage. Subdural hematoma was noted over base of brain. (Fig 1)

A partial capsule of ruptured aneurysm was present at junction of anterior cerebral & anterior communicating artery on left side. (Fig. 2) No atherosclerotic changes noted in the remaining part of cerebral vessels. Heart walls, valves and chambers were normal. Coronaries were patent. Aorta showed mild atherosclerotic

plaques. All the other organs were intact & unremarkable.

Discussion:

Berry aneurysms, also known as saccular aneurysms, are sac-like out-pouching in the cerebral blood vessels, which appear berry-shape on external examination, hence the name. Aneurysms usually reside in the Circle of Willis. [4] Rupture of aneurysm leads to sudden death due to intracranial hemorrhage. [5]

There are four main types of intracranial aneurysms**: saccular, fusiform, dissecting, and mycotic type.** Saccular aneurysms occur when there is collagen deficiency in the internal elastic lamina and breakdown of the tunica media and accounts for 90% of intracranial aneurysms. An out pouching, consisting of only tunica intima and adventitia, protrudes through the defect in the internal elastic lamina and tunica media to produce the aneurismal sac. [6]

All studies to date show peaks at various ages in the 40-70 year range, which is consistent with our case where the age of the deceased is 45yrs. [7] however a case of death due to a ruptured berry aneurysm has been reported in a 3.5 year old child. [8, 9]

With regard to sex, studies showed that men have a lower average age at time of rupture than women, with the difference between men and women ranging from 2 to 4 years. It is slightly more common in females, with the male: female ratio being 2: 3. [10]

Rupture of these aneurysms leads to hemorrhage in subarachnoid space and sometimes in brain parenchyma. The most common pattern noted is subarachnoid hemorrhage alone, but hemorrhages in other areas are fairly common. [11]

But occasionally, an aneurysm may also rupture into the subdural space, resulting in a subdural hematoma [12] Most of the studies report that approximately 85% of cerebral aneurysms develop in the anterior part of the Circle of Willis at the junction of anterior cerebral & anterior communicating artery which is consistent with our case. [4] Few studies also suggest that the middle cerebral artery was cited as the location of most aneurysms. [13]

The exception was the study by Inagawa and Hirano, who named the internal carotid artery as the most common location. [7] Aneurysms in the posterior half of the circle of Willis tend to have a significantly worse prognosis than those in the anterior half.

Survival following rupture was poorer in anterior circle aneurysms compared to posterior circle aneurysms; although the ratio was reversed in rate of survival 30 days post rupture. [14] About 60% of patients die immediately after rupture which was found in our case. [13]

But few studies suggest that survival after rupture lasted either less than one day or longer than one week. [15]

In most of the studies home is the common location at the onset of symptoms, and presence of associated physical exertion. [16] Patients with berry aneurysms more frequently have histories of persistent headache, pregnancy-induced hypertension, long-term use of analgesics, and a family history of stroke. [17]

The pathogenesis of berry aneurysm formation is multi-factorial. [18] The risk factors for developing berry aneurysms include any condition that causes hypertension, including atherosclerosis, renal disease or weakening of blood vessel walls such as connective tissue disorders, infections, family history, smoking and polycystic kidney disease. [19, 20]

However, some controversy exists about the roles of underlying disease in the rupture of cerebral artery aneurysms, particularly hypertension and atherosclerosis.

The prevalence of aneurysms is increased in certain genetic diseases; the classic example is autosomal dominant polycystic kidney disease (ADPKD), but other diseases such as Ehlers-Danlos syndrome, neurofibromatosis, and a1-antitrypsin deficiency also demonstrate a link. [4] But in our case the past medical history was not available and therefore cannot be correlated.

Specific genes have also had reported association with the development of intracranial aneurysms, including perlecan, elastin, collagen type 1A2, endothelial nitric oxide synthase, endothelin receptor A and cyclin dependent kinase inhibitor. Recently, several genetic loci have been identified as relevant to the development of intracranial aneurysms. These include 1p34-36, 2p14-15, 7q11, 11q25, and 19q13.1-13.3. [21]

Forensic Significance:

A thorough autopsy is an essential part in the diagnosis of berry aneurysm. In cases, where the death of the individual is due to intracranial hemorrhage, the question of natural or unnatural causes has to be ruled out.

During autopsy the presence of intracranial hemorrhage accompanied by evidence of trauma like scalp contusion/fracture of skull bone rules out the natural causes.

The common cause of berry aneurysm is hypertension, atherosclerosis etc., makes the vessel prone for rupture. In such a scenario,

even the minor trauma to the head causes bleeding leading to death of the individual. If the head is protected by a turban or hair, one may not find scalp contusion or fracture. It becomes a challenge for the Forensic pathologist to rule out unnatural causes for intracranial hemorrhage.

The defense counsel takes advantage of such cases and makes the expert evidence of medical witness biased, so that his/her client can be acquitted from the clutches of law.

In court of law defense counsel often takes the plea of natural disease as cause of death or injury as contributory factor or injury aggravates disease process leading to death and may be convicted under S 299 IPC.

The fact that the death of a human being is caused is not enough. Unless one of the mental states mentioned in ingredient (Sec 299 IPC) is present, an act causing death cannot amount to culpable homicide.

In cases of death of the person as a result of intracranial hemorrhage due to an impact over head, and if it is proved in the court that the intention and act of the accused at that material time is important to decide, whether it is merely an act of applying criminal force (Sec 350 IPC) / causing grievous hurt (320 IPC) / causing grievous hurt on provocation (335 IPC).

So as a Forensic expert one should be careful in giving such opinion and before opine evaluate medical history, thorough autopsy findings and histopathology report.

Conclusion:

Ruptured aneurysms must be considered as a possible cause of death in bodies brought for autopsy where internal findings show SAH/SDH with no external trauma. Autopsy and dissection of the cerebral vessels is vital to diagnosis, particularly when deaths are unexpected in nature. This is vital both for the family to understand the cause for their loved ones demise and also for any legal or insurance purposes that may follow.

References:

1. **Williams NS, Bulstrode CJK, O'Connell PR.** Bailey & Love's-Short Practice of Surgery. Edward Arnold, UK. 25th ed. 2008:918.
2. **Wardlaw JM, White PM.** The detection and management of un-ruptured intracranial aneurysms. Oxford journal.2000; 123(2): 205-221.
3. **Larson PS, Reisner A, Morassutti DJ, Abdulhadi B, Harpring JE.** Traumatic intracranial aneurysms. Journal of Neurosurgical Focus.2000; 8(1): 1-9.
4. **Gasparotti R, Liserre R.** Intracranial aneurysms. Journal of European Radiology. 2005; 15: 441–447
5. **Shkrum MJ, Ramsay DA.** Forensic Pathology of Trauma. Humane Press, New Jersey.1st edition; 2007:607-622.
6. **Austin G, Fisher S, Dickson D, Anderson D, Richardson S.** The significance of the extracellular matrix in intracranial aneurysms. Annals of Clinical Lab Sci. 1993; 23(2): 97–105.
7. **Inagawa T, Hirano A.** Ruptured intracranial aneurysms: An autopsy study of 133 patients. Surgical Neurology.1990; 33(2):117–123.
8. **Stehbens W.E.** Intracranial berry aneurysms in infancy. Journal of Surgical Neurology.1982; 18(1):58–60. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7051385 assessed on 09/10/2013.
9. **Prahlow JA, Rushing EJ, Barnard JJ.** Death due to ruptured berry aneurysm in a 3.5 year old child. American Journal of Forensic Medicine & Pathology.1998; 19(4):391- 394.
10. **Brisman, JL, Song JK, Newell DW.** Cerebral aneurysms. The New England Journal of Medicine. 2006; 355 (9): 928–939
11. **Freytag E.** Fatal rupture of intracranial aneurysms: Survey of 250 medico legal cases. Archives Pathology.1966; 81(5): 418–24. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/5933816 assessed on 09/10/2013.
12. **Blake, Garfield O, James, Michael V, Ramjit, Chunilal,Char Gurendra, Hunter R, Crandon, Ivor W.** Acute Subdural Hematoma Without Subarachnoid Hemorrhage Caused by Rupture of an Intracranial Aneurysm.West Indian Medical Journal.2003; 52:80-81.
13. **Bowen DA.** Ruptured berry aneurysms: A clinical, pathological and forensic review. Forensic Sci International.1984; 26:227–34.
14. **Wouter I. Schievink, Eelco FM, Wijdicks, David G, Piepgras, Chu-Pin Chu, Michael O'Fallon, Jack P, Whisnant.** The poor prognosis of ruptured intracranial aneurysms of the posterior circulation. Journal of Neurosurgery. 1995; 82(5):791-795.
15. **McCormick WF, Acosta-Rua GJ.** The size of intracranial saccular aneurysms. An autopsy study. J Neurosurgery. 1970; 33(4):422–427. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/5471931. assessed on 09/10/2013
16. **Crompton MR.** The coroner's cerebral aneurysm. Journal of Forensic Science Society. 1975;15(1):57–65. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/1159388. Assessed on 09/10/2013.
17. **De la Monte SM, Moore GW, Monk MA, Hutchins GM.** Risk factors for the development and rupture of intracranial berry aneurysms. Am J Med. 1985; 78(6): 957-964.
18. **Wiebers DO, Piepgras DG, Meyer FB, Kallmes DF, Meissner I, Atkinson JL, Link MJ, Brown RD.** Pathogenesis, natural history and treatment of un-ruptured intracranial aneurysms. Mayo Clinic Proceedings.2004; 79(12): 1572-1583.
19. **Teunissen LL, Rinkel GJ, Algra A, van Gijn J.** Risk factors for subarachnoid hemorrhage.A systematic review. Stroke a journal of cerebral circulation.1996; 27(3):544-549.
20. **Bonita R.** Cigarette smoking, hypertension and the risk of subarachnoid hemorrhage. A population-based case-control study. Stroke a journal of cerebral circulation.1986; 17(5):831-835.
21. **Vandervoet M, Olson J, Kuivaniemi H, Dudek D, Skunca M, Ronkainen, Jaaskelainen, Hernesniemi.** Intracranial Aneurysms in Finnish Families: Confirmation of Linkage and Refinement of the Interval to Chromosome 19q13.3. The American Journal of Human Genetics.2004. 74 (3): 564–571.
22. **Ranchhoddas R, Thakore D K.** Ratanlal and Dhrajlal's The Indian Penal Code. Wadhwa and company, Nagpur. 13th ed. 2004.

Fig. 1: Hemorrhage over Brain Surface

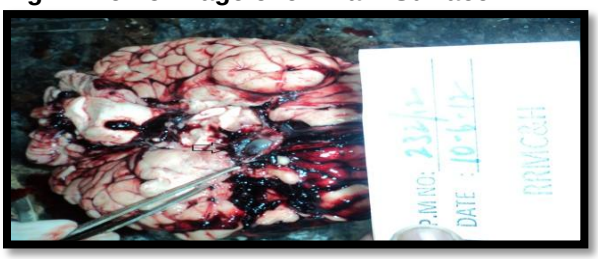

Fig. 2: Ruptured Giant Berry Aneurysm