

Educational Case: Subarachnoid Hemorrhage Related to Ruptured Berry Aneurysm

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The following fictional case is intended as a learning tool within the Pathology Competencies for Medical Education (PCME), a set of national standards for teaching pathology. These are divided into three basic competencies: Disease Mechanisms and Processes, Organ System Pathology, and Diagnostic Medicine and Therapeutic Pathology. For additional information, and a full list of learning objectives for all three competencies, see <http://journals.sagepub.com/doi/10.1177/2374289517715040>.

Keywords

pathology competencies, organ system pathology, diagnostic medicine, therapeutic pathology, central nervous system, berry aneurysm, death certificate, death investigation, intracranial hemorrhage, subarachnoid hemorrhage

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Primary Objective

Objective NSC7.3: Cranial Hemorrhage. Compare and contrast the etiologies and clinical presentations of epidural, subdural, subarachnoid, basal ganglionic, and lobar hemorrhages.

Competency 2: Organ System Pathology; Topic NSC: Nervous System–Central Nervous System; Learning Goal 7: Ischemia of the Brain.

Secondary Objective

Objective AU2.2: Components of the Death Certificate. Discuss the key components of the death certificate; differences among immediate, intermediate, and underlying (proximate) cause of death based on disease process; and the role of mechanisms of death on a death certificate.

Competency 3: Diagnostic Medicine and Therapeutic Pathology; Topic AU: Autopsy; Learning Goal 2: Death Certificate.

Clinical Case

A 47-year-old female with a medical history of migraine headaches, with migraine pain controlled by codeine, is found dead on the floor of her secured residence. No outward signs of trauma or foul play were identified at the scene of death. Given her relatively young age and minimal medical history, an

autopsy was requested and performed by the county medical examiner. Following resection of the skull and dura, the following intracranial finding was identified (Figure 1). The pathologist reports that this collection cannot be wiped from the surface of the brain. The hemorrhage appeared to be concentrated at the base of the brain. The circle of Willis was dissected and showed the abnormality identified by the arrow (Figure 2).

Questions/Discussion Points

Given the photograph and the description, what is the name of the finding featured in Figure 1? How would the gross description be different for other types of intracranial hemorrhage? If a CT was performed for this entity, how might the findings be reported?

The photograph shows subarachnoid hemorrhage. A subarachnoid hemorrhage is confined by the arachnoid layer and

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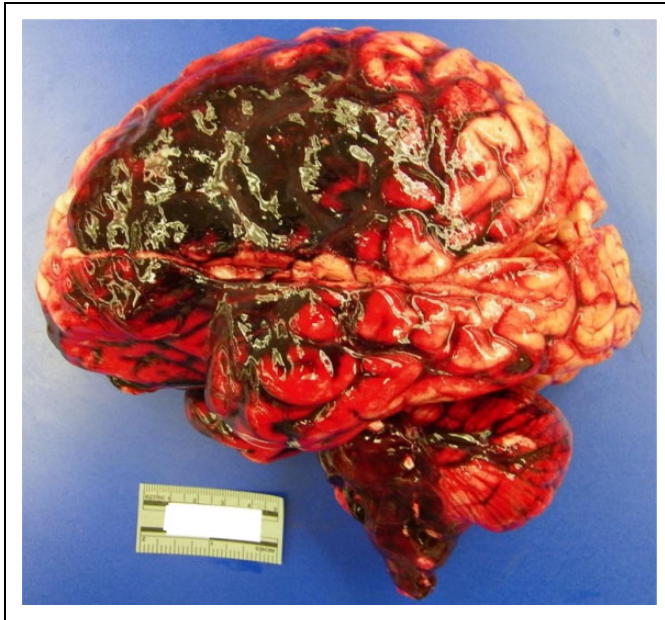


Figure 1. Brain with subarachnoid hemorrhage.

cannot be wiped or rinsed away from the brain. Radiographically, subarachnoid hemorrhage would be demonstrated by thin layers of blood overlying structures, such as the sylvian fissure, intrahemispheric fissure, or basal cisterns. Subdural hemorrhage consists of blood filling the potential space beneath the dura, but outside the subarachnoid space. At gross inspection, subdural blood would be able to be wiped or washed away from the surface of the brain and not retained within the cell layer of the subarachnoid space. CT imaging generally shows a crescentic shaped area of hemorrhage outside the brain parenchyma, beneath the skull. Intraparenchymal hemorrhages, such as those related to hypertension or tumors, would be centered within and usually surrounded by brain parenchyma; however, these areas of hemorrhage may expand to communicate with the subarachnoid, subdural, or intraventricular space. CT imaging of intraparenchymal hemorrhage demonstrates blood within the brain itself.

What is the differential diagnosis for the etiology of the finding demonstrated in Figure 1?

Ruptured berry (saccular) aneurysm, trauma, ruptured arteriovenous malformation, extension of intraparenchymal hemorrhage, hematologic disorders, and coagulopathies.¹ Of these entities, the most common cause of clinically significant subarachnoid hemorrhage is due to a ruptured berry aneurysm.¹

What is the cause of the hemorrhage based on the finding in Figure 2?

Ruptured berry (saccular) aneurysm.

What are the major complications associated with these autopsy findings?

Statistics vary, but up to 50% of patients die within 1 month of an intracerebral aneurysmal rupture and hemorrhage.¹ Similar to this patient, at least 10% of patients die prior to hospitalization for the first bleed.¹ If a patient survives, major morbidity manifests as delayed ischemic complications related to vasospasm, rebleeding, seizures, hydrocephalus, and hyponatremia.¹

Acting as the medical examiner, please list the cause (immediate and underlying) and manner of death.

The cause of death is the injury or disease process that resulted in a patient's death. Manner of death is defined by public health parameters and is a selection of natural, accident, suicide, homicide, or undetermined. A death certificate should tell the whole story of a patient's history and should work backward from the underlying cause of death to the immediate cause of death. Care should be taken to ensure that the death certificate is specific, concise, and avoids nonspecific mechanisms of death that are universal to all deaths, such as the phrase cardiorespiratory arrest. As such, the first disease process that



Figure 2. Dissected circle of Willis demonstrating ruptured berry aneurysm at the bifurcation of the anterior communicating artery and the anterior cerebral artery.

occurred in this patient's case was the rupture of the berry aneurysm leading to the subarachnoid hemorrhage. Both of these processes are natural diseases; therefore, the death certificate should be completed as follows:

Cause of death: Subarachnoid hemorrhage (immediate cause)

Due To: Ruptured berry aneurysm (underlying cause)

Manner of Death: Natural

Teaching Points

- Subarachnoid hemorrhage is demonstrated grossly by a layer of blood confined within the subarachnoid space.
- The differential diagnosis for subarachnoid hemorrhage includes a ruptured berry aneurysm, trauma, ruptured arteriovenous malformation, extension of intraparenchymal hemorrhage, hematologic disorders, and coagulopathies.

- Ruptured berry aneurysms have high morbidity and mortality related to short- and long-term complications related to subarachnoid hemorrhage.
- In completing a death certificate, the cause of death should be ascribed to the underlying disease or injury that set the sequence of events in motion to result in the immediate cause of death.

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