



Pathology/Biology Section - 2015

H136 Sudden Death in an 11-Year-Old Child With Epilepsy

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After attending this presentation, attendees will appreciate the potential value of examining the cardiac conduction system in Sudden Unexplained Death in Epilepsy (SUDEP) and will have a better understanding of proposed mechanisms of death in SUDEP.

This presentation will impact the forensic science community by calling attention to a seizure-related death where a cardiac conduction system examination was critical for revealing a pathologic abnormality that explained the likely mechanism of death and by suggesting that routine cardiac conduction system examination may be warranted in unexplained deaths associated with seizures.

SUDEP is the most common cause of death related to epilepsy, yet the precise mechanism of death remains poorly understood. Cardiac arrhythmia induced by seizure, possibly in combination with a genetic predisposition for arrhythmia, is the most commonly proposed mechanism of death in SUDEP. Other proposed mechanisms include asphyxia due to external obstruction of airway and unwitnessed status epilepticus. Notably, each of these mechanisms of death is likely to have minimal abnormal findings at autopsy. As a cause of death, SUDEP essentially remains a diagnosis of exclusion based on a history of epilepsy, findings or witness accounts indicative of a peri-mortem seizure, and lack of another cause of death revealed through complete autopsy, scene investigation, and ancillary studies.

A case of an 11-year-old girl with a history of seizures and attention-deficit-hyperactivity disorder, who first developed seizures approximately 1½ years prior to death is reported. A detailed neurologic evaluation did not reveal the etiology of the seizures, although magnetic resonance imaging of the brain suggested the presence of mesial temporal sclerosis. She was diagnosed with epilepsy and started on levetiracetam, which was effective in controlling her seizures; however, approximately six months later, she suffered a prolonged witnessed seizure followed by cardiac arrest. She was successfully resuscitated without any neurological deficits and was admitted for comprehensive neurologic and cardiology evaluations. No notable abnormalities were found and she was discharged home. Approximately two weeks later, she suffered another witnessed seizure followed again by cardiac arrest. This time resuscitation was not successful and she was pronounced dead.

Postmortem examination, including cardiac conduction system examination, revealed a focal recent, but healing, myocardial infarct of the summit of the ventricular septum abutting the AV bundle. There was granulation tissue reaction within the infarct, compatible with the infarct occurring around the time of the initial cardiac arrest two weeks prior. The remaining histologic sections of the heart were normal. There were no other infarcts of other organs in the body with a similar histologic age. Neuropathologic examination was notable for a remote 0.3cm cerebellar infarct, subpial gliosis consistent with prior seizure activity, and changes consistent with acute hypoxia. Mesial temporal sclerosis was not identified.

The focal myocardial infarct explains the mechanism of the second cardiac arrest as probably a cardiac arrhythmia. The histologic age of the myocardial infarct suggests the infarct occurred around the time of the initial cardiac arrest two weeks prior to death, perhaps due to inadequate circulatory flow and subsequent ischemic injury; however, there were no other organizing infarcts in other regions of the heart or in other organs and the region of the AV node is not known to be particularly prone to ischemic injury; therefore, this explanation is not entirely adequate. Furthermore, the presence of the infarct does not explain the seizures that preceded both episodes of cardiac arrest since witnesses provided compelling testimony that the seizure preceded cardiac arrest rather than vice versa.

A remarkable aspect of this case report is that the only pathologic abnormality in the heart was found in the cardiac conduction system. The cardiac conduction system is not routinely examined at autopsy. Even in cases of otherwise unexplained deaths, medical examiner/coroners will sporadically put through the conduction system for histologic examination as an exercise in completeness with little expectation of finding a significant abnormality; however, this case suggests that routine examination of the cardiac conduction system may be warranted in cases of sudden death associated with seizures.

Myocardial Infarction, Conduction System, SUDEP