



## H14 Only the Vagus Nerve: A Pair of Unusual Homicides

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**Learning Overview:** The goal of this presentation is to increase awareness of an uncommon potential cause of death in the setting of penetrating head and neck trauma without massive injury.

**Impact on the Forensic Science Community:** This presentation will impact the forensic science community by demonstrating a unique finding at autopsy and encouraging others to consider isolated vagal stimulation or injury as a precipitator of cardiac arrest and death.

The vagus nerve is the longest autonomic nerve in the body, providing parasympathetic control of the heart, lungs, and gastrointestinal tract. Running down the bilateral neck adjacent to the internal carotid arteries, it gives off a branch to the carotid body before entering the thorax and abdomen. Along with the glossopharyngeal nerve, it is responsible for regulating heart rate and blood pressure via the baroreflex, and thus can be implicated in instances of cardiac arrest due to neck trauma.<sup>1,2</sup>

Described here are two deaths in which violent actions (a gunshot and a stabbing) to the head and neck failed to illicit what would be considered “fatal” injuries; in each case, the vagus nerve was the only structure with any demonstrable trauma.

**Materials and Methods:** Case #1 is a 17-year-old African American male found lying in the street for an unknown interval with a gunshot wound to the head. Resuscitation efforts were unsuccessful, and the decedent was brought to the Allegheny County Medical Examiner's Office (ACMEO) as a homicide.

Case #2 is a 59-year-old Caucasian female who was stabbed twice in the neck with a knife by her husband. She was able to run to a neighboring home for help, but as Emergency Medical Services (EMS) was rendering aid, she went into cardiac arrest. Upon arrival at the hospital, emergent laryngoscopy and surgical wound exploration were performed, noting platysmal disruption, but all major vessels were intact. The patient never regained consciousness and after a short hospitalization was brought to the ACMEO as a homicide.

**Results:** Case #1—Examination of the head and neck revealed an indeterminate-range entrance gunshot wound to the right face, with the bullet lacerating only the skin, subcutaneous tissues and muscles of the face, and left lateral neck and contusing the left vagus nerve before exiting the left upper lateral neck. The vertebral bodies, mandible, skull base, and major blood vessels were undamaged.

Case #2—Examination of the head and neck revealed two stab wounds to the right lower anterior neck and left upper anterior neck, both lacerating only the skin, subcutaneous tissues, and muscles of the neck. All major blood vessels were spared; there was hemorrhage surrounding the right vagus nerve. Examination of the cervical spine, vertebral arteries, and spinal cord were unremarkable.

**Discussion:** A literature review for reports of violent deaths with only vagal trauma revealed a case of a screwdriver stab to the neck, which similarly spared all major neck structures, yet resulted in the patient's death.<sup>3</sup> Schrag et al.'s review of Cardioinhibitory Reflex Cardiac Arrest (or CiRCA) deaths found that of 48 potential CiRCA deaths reported between 1881 and 2009, only one death could not potentially be attributed to another cause.<sup>4</sup> While vagal stimulation is known in the anesthesia literature to be a potential cause of cardiac arrest, it is difficult to assign as a cause of death, as there are often many confounding factors.

If a thorough autopsy in a case of violence (e.g., shooting or stabbing) to the head and neck fails to reveal enough vascular, nervous, or bony trauma to account for death, the vagus nerve should be carefully examined for hemorrhage or contusion and considered as the cause of death.

### Reference(s):

1. Toorop R.J. et al. 2009. Anatomy of the Carotid Sinus Nerve and Surgical Implications in Carotid Sinus Syndrome. *J Vascular Surg.* 50 (1): 177 – 182.
2. Park J.Y. et al. 2006. Cardiac Arrest Due to a Vagal Reflex Potentiated by Thoracic Epidural Analgesia. *J Int Medical Research.* 34: 433–436.
3. Patel F. 1998. Vasovagal Death From Screwdriver Stabbing of the Neck. *J Clin Forensic Med.* 5: 205-206.
4. Schrag et al. 2010. Death by Cardioinhibitory Reflex Cardiac Arrest—A Systematic Review of Cases. *J Forensic Sci Int.* 207:77 – 83.

### Vagus Nerve, Homicide, Penetrating Head and Neck Trauma