Suicide or Homicide: Instantaneous or Sudden Death ?

By

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ABSTRACT: The forensic dilemma, *instantaneous death*, is addressed in an analysis of the autopsy findings, skull x-rays and investigative reports associated with the death of a United States Marine colonel. Understanding the difference between *instantaneous* and *sudden* death can be critical in determining the manner of death. The wound inflicted on the colonel by the shotgun would have resulted in an instantaneous death, but the autopsy and X-ray evidence show that the victim received a powerful external blunt force to the back of his head, resulting in a large depressed right occipital skull fracture showing that he died a sudden death. A sudden death that was followed by the intraoral shotgun wound. We discuss the distinction between instantaneous and sudden death in the context of the homicide of the colonel.

KEYWORDS: forensic science, forensic pathology, instantaneous death, sudden death, brainstem, depressed skull fracture, aspirated (inhaled) blood, staged suicide, homicide,

The Events:

In 1991, the body of a United States Marine colonel was found by his wife in the backyard of their home (Fig. 1) on the El Toro Marine Corps Air Station in California. He was lying on his right side, dressed in a white terrycloth bathrobe, white undershirt, light blue pajama bottoms, white underpants, white socks and black slippers. The victim's Ithaca double barrel 12gauge shotgun was in front of him with the stock under his legs and feet. A lawn chair was on top of him. Two small blood stains measuring less than five inches in diameter were observed in the grass about 8 to 10 inches in front of the victim's mouth. The only other blood on the ground was under the victim's right shoulder with an origin visible from the victim's right ear, nose and mouth. No blood was present on the ground below or above these three areas (1). A base physician arrived at the scene and pronounced the victim dead. The victim had sustained an intraoral shotgun wound with contact to his soft palate. There was no exit wound. The death scene was processed by Naval Investigative Service criminalists. An autopsy was performed by the Medical Examiner for the Orange County Sheriff/Coroner's Office (California). There was extensive photographic documentation of both the death scene and the autopsy. Two theories as to the victim's death are considered in this study:

Figure 1. *The body in the backyard of his home. Note that the bathrobe is tucked between his legs. The shotgun is in front of him with his legs over the stock of the shotgun. A lawn chair is on top of the body. Both hands are in front of the victim's mouth.*

Theory 1: The victim committed suicide by sitting in a lawn chair while holding a 12gauge shotgun in his mouth with his left hand. The muzzle of the shotgun was in contact with the soft palate. This would place the muzzle immediately anterior to the pons and medulla of the brainstem (2). He pushed the trigger of the shotgun with a finger or thumb of his right hand. The position of the body suggests that in this scenario, while he was sitting in the lawn chair, the butt of the shotgun had to be on the ground adjacent to the lateral side of his right ankle (Fig. 2A). The victim somehow fell to his right from the chair after the shotgun discharge.

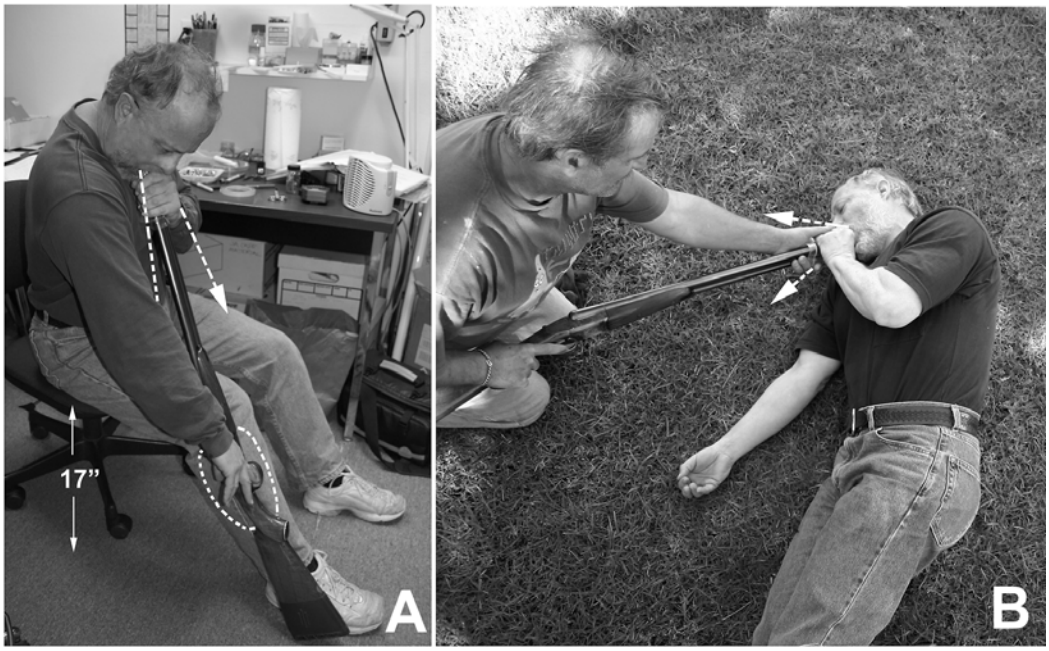

Figure 2. A: *Reenactment of the suicide scenario with the victim sitting in a chair and inserting the shotgun into his mouth. The muzzle is gripped by the left hand while the right hand reaches down to depress the trigger. The shotgun was found close to the body, partly under the right leg (Fig. 1). This would place the shotgun in the reenactment on the outside of the right leg. In this scenario, gas escape from the mouth would spray the thighs (red arrows) with GSR, BSR and blood/tissue on the front of the bathrobe and/or the thighs of the pajama bottoms. The red dashed line on the lower right leg outlines the probable area of GSR deposition if there were breech and trigger housing gas leakage by the shotgun.* ***B:*** *Reenactment of the homicide scenario where the shotgun is inserted into the mouth of the victim by the assailant. In order for the muzzle to remain in the mouth when the shotgun is fired, the butt of the shotgun would have to be supported. Evidence for a rapid exit of the muzzle of the shotgun in this scenario is the rotation and drop to the grass of the left hand before the palm received blowback blood (see text). The right hand was not exposed to detectable GSR. However, blood spatter is on the right hand (Fig. 18) which would also place this hand close to the mouth (the position shown of the right hand in this image is not correct). The crime scene photographs (e.g., Fig. 1A) show the victim's right hand near the mouth. Red arrows: route of the gas expellation (early blowback) when the shotgun muzzle is in the mouth.*

Theory 2: The victim received an external blow to the back of his head, which caused a large depressed skull fracture and severe brain and brainstem injury. The bludgeoning was fatal. However, it likely took five to ten minutes for death to have occurred. Following the victim's death, an assailant thrust a shotgun into the victim's mouth and discharged the left barrel of the shotgun (Fig. 2B). A lawn chair was then placed on top of the victim to complete the suicide appearance.

The evidence supports theory 2. Autopsy findings and photographs, as well as autopsy x-rays support this conclusion.

In every suspicious or unexpected death or when disease or natural causes are ruled out, a criminal investigation must occur. In the case of a serviceman where the death occurred on a military base, the decedent would be transferred to the nearest military medical facility where an autopsy is to be performed by a *military* medical examiner (3). The El Toro Marine Corps Air Station (MCAS) is only one hour distant from the Balboa Naval Hospital in San Diego, CA where an AFIP Medical Examiner was in residence at that time (personal communication, Dr. Richard Froede, Chief Medical Examiner AFIP 1991). However, in this case, the base commander ordered the body to be transferred to the Sheriff/Coroner of Orange County.

The Autopsy:

The autopsy was performed at the Orange County CA. Medical Examiner's facility on 01/22/1991(4).

The following observations were made from the autopsy report of the victim :

1. Gunshot wound (entry type) in roof of mouth. No exit wound. Contact wound to soft palate.
2. There is a large amount of aspirated blood in the right lung.
3. The left lung weighs 440 grams, the right weighs 970 grams [normal adult male is 400 to 450 grams (5].
4. Section of the lung tissue shows congested, atelectactic, edematous, hemorrhagic lung with extrusion of hemorrhagic frothy fluid.
5. Pharynx shows a superficial laceration of the right side of the pharyngeal wall.
6. All brain tissue is massively lacerated.
7. No intact brainstem could be identified including medulla, cerebellar tissue, midbrain, pons, cerebral peduncles. A remnant of medulla appeared in the foramen at the base of the skull that was contiguous with spinal cord. Upper portion of spinal cord shows evidence of disintegration
8. Cerebral cortex is massively lacerated
9. Ecchymosis around both eyes [Fig. 5]. Ecchymosis behind right ear [Fig. 7B see also Fig. 3A].
10. Superficial contusions and lacerations of the lips [Fig. 6B]. Laceration of the anterior [ventral] surface of the tongue and mid tongue area [Fig. 7B].
11. Skull X-rays obtained at the autopsy show a large depressed occipital skull fracture
Large subcutaneous and subgaleal hematoma over the depressed occipital skull fracture. The hematoma was devoid of any bone fragments or shotgun pellets.

After examining the victim and the ground around him, the base physician estimated that the EBL (estimated blood loss) of the victim was 50 cc (6).

Skull Fracture. A 2.5 cm diameter, depressed (approximately 2 cm) occipital skull fracture was demonstrated on autopsy X-rays (Figs. 3A and 3B). A photograph taken prior to the autopsy (Figs. 3C) demonstrates massive swelling of the right posterior head and neck. A large blood clot (hematoma) was discovered immediately under that swollen area (Fig. 3D). The hematoma was located immediately over the depressed skull fracture. All the shotgun pellets were located within the confines of the skull. There were no bone fragments or shotgun pellets within the hematoma. The x-ray (Fig. 3B) shows the fractured bone protruding inwardly not outwardly as would occur if the fracture was the result of the intraoral shotgun wound. Furthermore, there is an increased concentration and a linear appearance of the pellets under the depressed fragment that seems to imply that the pellets met increased resistance well within the skull's normal concavity. Additionally, there is a few millimeter gap between the pellets and the inner surface of the bone fragment which indicates that the force of the pellets moved the depressed fragment outwards but not completely due to the tension of the subgaleal hemorrhage. The large subcutaneous and subgaleal hematomas would require time to develop because circulation must be sus-

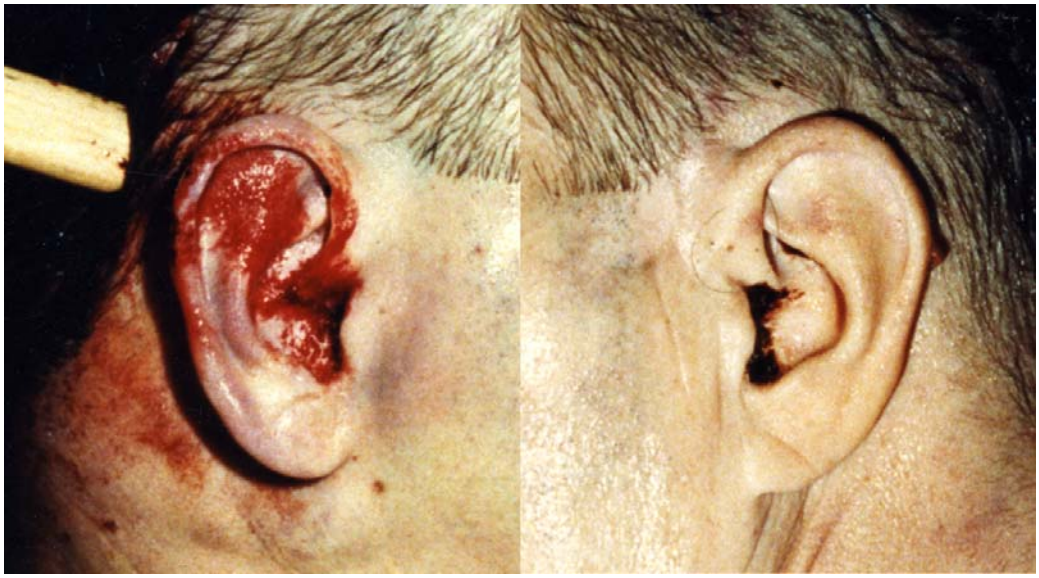

Figure 3 . A: *Ecchymosis of the right pinna and a small area anterior to the pinna is shown at arrows.* ***B:*** *The left ear has normal coloration.*

Figure 4. *Face of the colonel showing ecchymosis of the eyes or "raccoon eyes" typical of basilar skull fracture. Extensive swelling on the right side of the face is also apparent.*

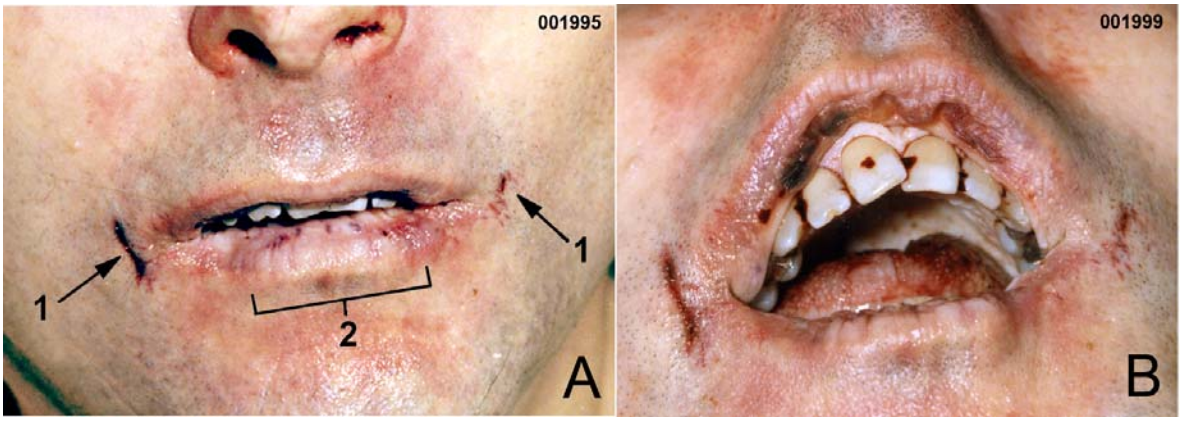

Figure 5. *Evidence of the victim biting his lips, likely in decorticate/decerebrate rigidity before the shotgun blast.* ***A:*** *Frontal view 1: Linear abrasions at the angles of the mouth resulted from the stretch of facial tissues at moment of intraoral shotgun discharge. 2: The linear bruising and abrasions coincide with the upper middle and lateral incisors.* ***B:*** *A more inferior aspect image that better shows the swelling of the lower lip, and bruising/laceration of the upper lip by the lower front teeth.*

tained and the perfusion pressure high enough for blood to dissect into these tissue planes. Therefore, if the victim's death was instantaneous, this massive hematoma could not have developed.

Basilar skull fracture. There is evidence that the victim also sustained basilar skull (bones at the skull base) fractures in addition to the depressed occipital skull fracture of the cranial vault. A clinical indicator of the presence of a basilar skull fracture is a purplish discoloration of the skin (ecchymosis) behind the ear which extends into the skin mostly covering the back of the right pinna cartilage (Fig. 3C) as well as portions of the anterior aspect of the right pinna (Fig. 4A). Compare with the normal coloration of the left pinna (Fig. 4B). This is characteristic of a basilar skull fracture of the temporal pyramids at the skull base and is known as Battle's sign

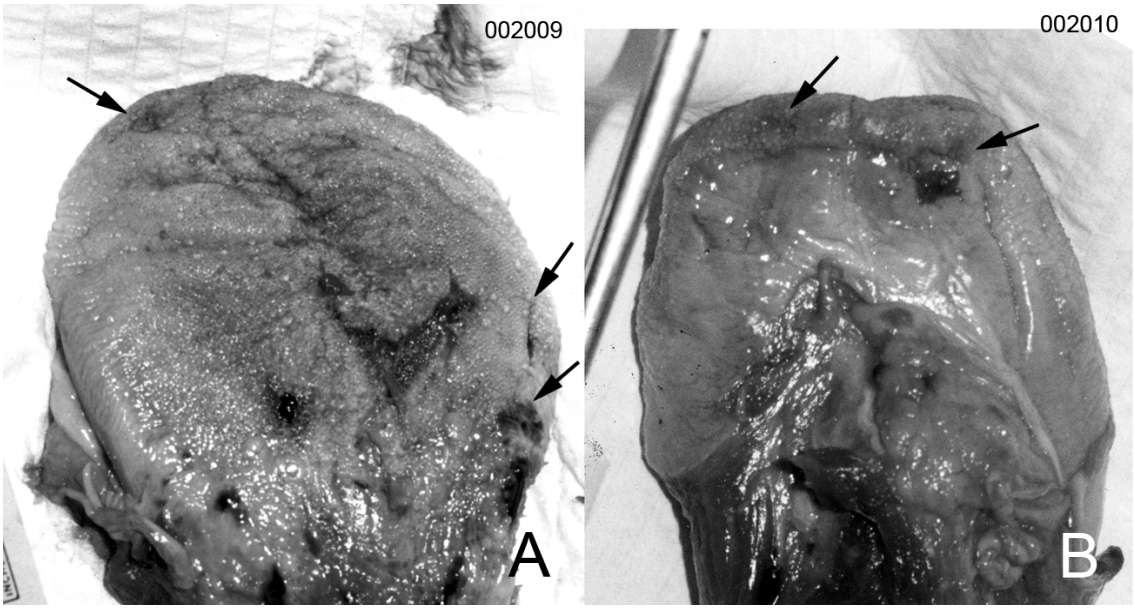

Figure 6. *Autopsy images of the tongue. Arrows point to bruising and lacerations made by the victim's teeth.* ***A:*** *Dorsal tongue.* ***B:*** *Ventral tongue.*

(7). Figure 5 shows another classic clinical sign of a basilar skull fracture, ecchymosis around the eyes, the so-called raccoon eyes. This fracture is more anterior and involves the sphenoid bone (8). Both of these signs are the result of bleeding from the fracture sites with enough perfusion pressure to dissect through adjacent tissues to produce these visible subcutaneous hematomas (9). The presence of these signs indicates that the basilar fractures occurred while the victim maintained a significant systolic blood pressure high enough and long enough to perfuse through these tissues. If the victim's death was instantaneous, these classical sign of basilar skull fractures could not have developed.

Respiratory System (Trachea, Bronchi, Lungs). The autopsy report states that the victim not only had blood in his large breathing passages, but the blood filled his alveoli, producing hemorrhagic frothy fluid. This was discovered when the lung tissue was sectioned at autopsy. The right lung weighed 970 grams while the left lung 440 grams. The average normal male adult lung weights are 450g (R) and 375g (L) (10). Therefore, there was an excess of approximately 545g in the right lung. The autopsy report concluded that the extra weight was blood. The specific gravity of blood is 1.058 (11), which means that there was slightly more than 500 ml of aspirated blood in the right lung. The left lung weighed 440 grams indicating that there was very little aspirated blood in that lung. The excess lung weight could not be a result of terminal pulmonary edema, for if that was the case, the excess weight would be evenly distributed to both lungs. This is further proof that the excess weight of the right lung was aspirated blood that resulted from a forceful respiratory effort while the victim lay unconscious on his right side. The condition known as *Cheyne-Stokes respiration* or *central neurogenic hyperventilation* are classic respiratory patterns seen in severe brain stem injuries where the victim is near death (12).

If the victim's death was instantaneous, he could not have breathed, not even a single breath. Therefore, he could not have aspirated any blood whatsoever, let alone one-half liter into his right lung.

Oral Mucous Membranes and Tongue. The autopsy photos document tooth lacerations of both the upper and lower lips, as well of the anterior [ventral] surface of the tongue and mid tongue area (Fig. 6, 7). Vertical tears occurred at both sides of the mouth which would caused by the volume of rapidly expanding gas within the cranial vault but decompressing through the entrance wound. These lacerations are quite distinct from the horizontal cuts that are present on the lips. These cuts correspond to the upper and lower incisors and are commonly seen in persons after they have suffered a major convulsive epileptic seizure (13). They are also in trauma victims who develop decerebrate posturing. In head trauma the brainstem may suffer severe injury. A dramatic reflexive posturing known as decerebration frequently occurs. The legs assume a rigid extension, the back arches, the arms extend with the hands making tight fists, the neck arches back and the jaws clench shut. There may be periods of relaxation interrupting the profound reflexive activity giving the appearance of a convulsive seizure.

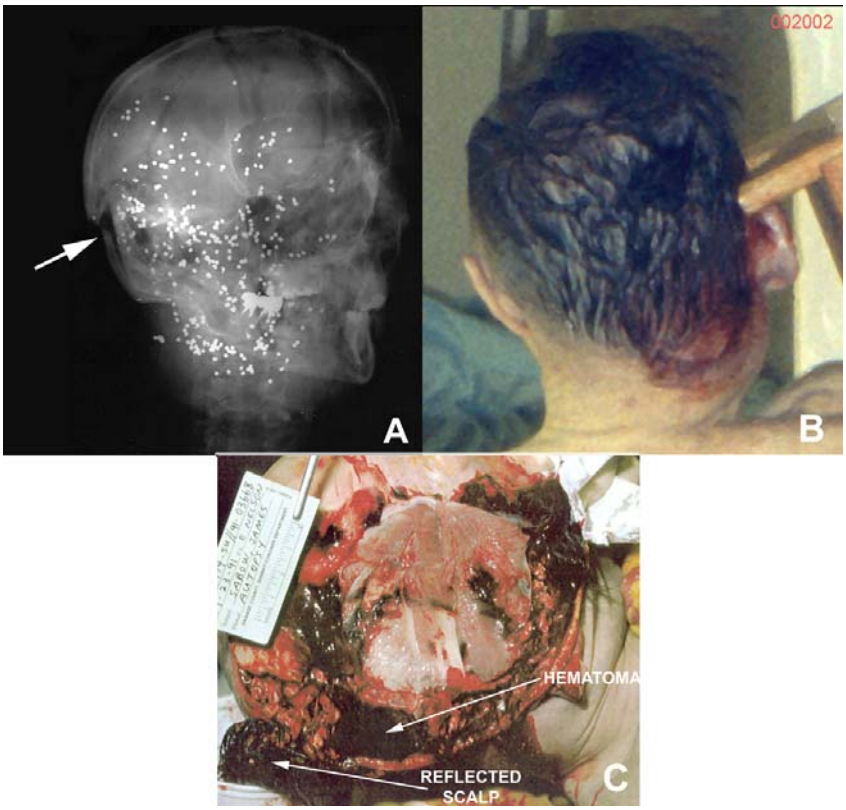

Figure 7. ***A:*** *X-ray of the victim's skull from the right side showing a depressed right occipital fracture. Arrow points to the depressed fracture of the occipital region of the skull behind the right ear. The small bright objects are the shotgun pellets.* ***B****: The back of the head prior to cleaning, The dark red pattern on the back of the head is blood. The blood came mainly from the mouth and nose and flowed to the back of the head during transport of the body for autopsy at the Orange County Coroner's & Sheriff's Office. The swollen area on the back of the head and neck is outlined by blood. Note that the posterior of the right pinna not covered by blood shows ecchymosis typical of "Battle's sign" (see text).* ***C:*** *Autopsy image with the victim's reflected scalp revealing part of the hematoma that had formed over the depressed skull fracture. Images enhanced by Adobe® Photoshop.*

(Hence the name *brainstem epilepsy* and *cerebellar fits* have been applied). Lip and tongue lacerations frequently result. The area of severe dysfunction that results in decerebration is the midbrain or upper pons that are rostral parts of the brainstem. When the brainstem is destroyed below the upper pontine level, flaccid paralysis of the entire musculo-skeletal occurs. Therefore, if death was instantaneous and all skeletal muscles were rendered instantly flaccid, it follows that the lips and tongue lacerations had to have occurred before the shooting (14).

Blood Loss. Intraoral gunshot wounds are the most mutilating wounds that can be sustained. When there is no exit wound, the mutilation is even more severe due to rapidly expanding gases within the confines of the skull. This results in evisceration and pulpification of the brain (15). Consequently, one would expect an extremely bloody crime scene in the case of a self-inflicted intraoral shotgun wound in contact with the soft palate. However, the Naval medical officer that was called to the scene, estimated that the blood loss was approximately 50 cc (7), hardly more than the volume of a shot glass. Moreover, in the suicide theory, the victim was alleged to have been seated in a patio chair while holding the shotgun barrel in his mouth with his left hand, and with the butt of the gun placed on the ground next to his right foot. This would place the victim's mouth over his torso and thighs. Yet there were no blood stains, except for several small drops, on the front of the victim.

Positioning of Victim at Crime Scene. When the victim was discovered in the backyard of his base housing, he was laying on his right side with his lower extremities symmetrically extended, one on top of the other and his arms symmetrically flexed in front of his mouth (Fig. 2B). His bathrobe neatly covered his body. All in all, the appearance was rather tidy, as if the victim was asleep on his right side. If the decedent had shot himself while sitting in the patio chair, destroying his entire brainstem, his musculature would immediately be flaccid and he would have been collapsed from the sitting position like a "rag doll". He would have been found with a dishevveled bathrobe and his extremities in disarray.

Discussion:

Official examinations (*the two Nordby reports, NIS Reports, DOD Inspector General Reports, FBI Reports and the Autopsy Report*) of this case have claimed that the victim died by suicide after placing the muzzle of a 12gauge shotgun intraorally and against his soft palate and shooting himself. These conclusions demonstrated a lack of understanding of basic concepts of brain physiology that are necessary to distinguish between "instantaneous death" and "sudden or immediate death".

> " 'Instantaneous' means occurring in an instant without any perceptible period of time, much as the passage of electricity appears to be instantaneous. It is so defined in Webster's International Dictionary. When we say that death is immediate or sudden, it does not mean that the death must follow the injury without allowing a period of time that is perceptible, although that period may be very brief. If an injury severs some of the principle blood vessels and causes the person injured to bleed to death, his death may be regarded as sudden or immediate, though not instantaneous. As used in reference to the death of a person caused by an injury, the words 'sudden' and 'instantaneous' do not mean precisely the same things, but the word 'sudden' is more comprehensive and elastic in its meaning. An instantaneous death is an immediate or sudden death but an immediate or sudden death is not necessarily in all cases, an instantaneous death" (16).

The term "sudden cardiac" or "immediate death" refers to natural death from cardiac causes, respiratory arrest (such as due to airway obstruction, which may be seen in cases of choking or asphyxiation), toxicity or poisoning, anaphylaxis, or trauma. In all these cases, there remains some body and neurological function, such as gasping, musculo-skeletal posturing, blinking, etc. These terminal events indicate that death is imminent but that death has yet not occurred. These events require at least some elemental brainstem function. Conversely, when death is instantaneous, the event that resulted in death caused the person to loose **all** brainstem function with no perceptible time from the event until death. Obviously, "instantaneous" death is quite rare but from a forensic standpoint and in this case in particular, its recognition and understanding are critical.

The following physiological principles must be understood in delineating sudden or immediate from instantaneous death:

The brainstem is the upper continuation of the spinal cord. All impulses descending from the brain cortex and upper areas of the brainstem must pass through the medulla, which is the lowest portion of the brainstem. All information from the periphery must traverse the medulla before it reaches higher brain centers (17).

The respiratory and cardiac centers are located in the medulla (17).

Deep within the brainstem, there is a nerve fiber complex known as the ascending reticular activating system (RAS). This fiber complex, among other things, is necessary to maintain consciousness. Disease or injury results in varying degrees of impairment of consciousness (17).

Within and surrounding the RAS are the nerve fibers that constitute the autonomic nervous system, including the sympathetic and parasympathetic. These systems are necessary for vascular tone and cardiac regulation (17).

The muscles involved with breathing are the diaphragm and the intercostals or chest muscles. Some muscles in the neck aid breathing in certain situations. All of these muscles receive their peripheral nerve supply from cells originating in the spinal cord. These cell groups in themselves are dependant on impulses descending from the brain and brainstem in order to function (17). There is no respiratory center in the spinal cord but only these cellular groups that depend on centers within the brain and brainstem where impulses originate and then descend in the spinal cord in a column of nerve tracts called the corticopyramidal tracts (18).

The abrupt transection of the spinal cord in which resides the corticopyramidal system results in instant and total flaccid paralysis of the body's entire musculo-skeletal system (spinal shock) (17). Not a gasp can occur under these circumstances. In contrast, clinicians may observe *agonal* respirations after cardiac arrest (18). But this still requires intact neural continuity between the brainstem and spinal cord.

The heart is regulated through the autonomic nervous system with nerve tracts that originate in the medulla. The heart muscle has the ability to beat without extrinsic neural input. However, its rhythm (chronotropic effect) is aberrant and its contraction (ionotropic effect) is weak, due to the loss of sympathetic input. Hence, the cardiac muscle looses its contractile force as well as effective rhythms (18, 19).

The sympathetic nervous system is responsible for maintaining vascular tone. Sudden loss of the body's entire sympathetic input results in vasomotor paralysis and "shock" (19).

In view of these fundamental physiological principles, it follows that "instantaneous death" will inevitably result from the "instantaneous" destruction of the brainstem. Therefore, in theory 1, the victim's death would have had to have been *instantaneous*, because the autopsy documented the destruction of the entire brainstem. The victim's body was completely separated from his brain cortex. Destruction of the entire brain stem destroys the ascending reticular grey (RAS, reticular activating system) that would result in immediate loss of consciousness (12). All descending neural pathways originating in the cerebral cortex, subcortical areas and in the brainstem would be destroyed. All specialized areas in the brainstem including the cardiac and respiratory centers, vestibular nuclei and autonomic pathways would be obliterated. The victim would be instantly deprived of all neural influence that would result in *instantaneous* flaccid paralysis of all skeletal muscles and paralysis of all vegetative functions. Cardiac arrest would be most probable. However, since the heart contains its' own intrinsic specialized conduction system, electrical activity could theoretically be recorded for a short time. However, with the heart's sympathetic autonomic neural loss, it would be deprived of its *ionotropic* (cardiac muscle contractility) and *chronotropic* (cardiac rhythm and rate) sympathetic effects. The cardiac muscle may contract but it would have no force. And since the vascular system likewise looses its sympathetic stimulation, the arteries dilate and circulatory collapse occurs (20). More likely, in the suicide scenario of the victim, cardiac asystole, ventricular fibrillation or complete heart block would occur. The bottom line is that cardiovascular collapse would result. Not one breath, not a gasp could have taken place. (There is no respiratory center in the spinal cord at C-2,3, as some mistakenly contend. The cells of origin of the phrenic nerve originate at C 3-4-5, whose axons innervate the diaphragm, but without connection from higher neural pathways, it is of no use (17).

Consequently, since theory 1 would have resulted in instantaneous death, there must be another explanation for the autopsy and crime scene evidence:

- Aspiration of approximately 500 cc of blood into the right lung
- Depressed occipital skull fracture

- Large subcutaneous and subgaleal hemorrhage seen exclusively above the depressed skull fracture
- Basilar skull fractures associated with both *Battle's* and *Raccoon* Signs
- Lacerations of the tongue and lips that correspond with the upper and lower incisors
- The estimated crime scene blood loss of approximately 50 cc
- Positioning of victim at death scene

After considering the medical forensic evidence and, not taking into account other compelling factors such as gunshot residue and blood spatter factors, it must be concluded that the first assault on the decedent was a blow to the back of his head that caused a large depressed skull fracture. This caused his death but it was not *instantaneous*. After being struck, he was rendered unconscious and he fell to the ground on his right side. Due to the severity of the trauma, a fatal brainstem injury followed. He exhibited the classic signs and symptoms of this injury, which included decerebrate and decorticate posturing. As this took place, there were violent contractions of all extensor muscles of the body and clenching of the jaws. During these severe muscular contractions, biting and laceration of the tongue and lips took place. With this epileptic-like muscular activity, the victim's respirations became irregular and were followed by hyperventilation with extreme force and resulted in aspiration of blood. Because he was lying on his right side, the blood went primarily into the right lung. Death soon followed. Because he had already expired and was devoid of blood circulation, only a small amount of blood was part of the gunshot effluent. Therefore, essentially no blood was present on the front of the victim.

In view of this evidence, the decedent could not have shot himself. He had to have been murdered and there was a botched attempt to make it look like a suicide.

These basic scientific facts of brainstem physiology when applied to certain death investigations will aid in ascertaining whether the manner of death was by suicide or by homicide.

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