



HOMICIDE PREVENTION: UNDERSTANDING THE POTENTIAL CONSEQUENCES OF STRANGULATION

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Strangulation carries a high risk of lethality and is not usually an isolated event. Every exposure to strangulation raises the chance a victim will suffer a life-ending or life-changing medical event. It is of the utmost importance that healthcare providers understand the physical and medical dynamics of strangulation, and follow guidelines that address treatment and evidence collection.

Asking about a history of or symptoms of strangulation must be a routine part in any assessment by health care professionals of a patient who reports interpersonal violence/domestic violence (IPV/DV). Patients who have experienced a strangulation event may have no visible injuries, yet may have brain damage due to the lack of oxygen, or serious internal injury to the delicate structures of the neck that could lead to death days later. Even in homicidal strangulation, there may be few or no external signs of trauma. The lack of visible injuries results in a minimization and complacency by health care and investigatory professionals in regards to the serious acute and chronic medical and neurological consequences, the potential for future abuse, and the potential for death.

Studies indicate that many women report strangulation: 34% of women in a primary care setting reported at least one episode of “choking” or strangulation (half of them more than once); 47% of abused women in an emergency department study; 50% of women killed or almost killed by their partners reported at least one episode of strangulation from that partner in their past. If a woman has had episodes of prior strangulation, her risk of being killed by her partner is 7 times greater than women without such episodes (Glass et al., 2008). A recent study on non-fatal strangulation among sexual assault victims showed that they were 8 times more likely to experience strangulation if they were assaulted by



an intimate partner, compared to being assaulted by an acquaintance or friend, and yet few showed external signs of strangulation (Zilkens et al., 2016). Interviews with women who were in IPV/DV relationships describe strangulation as a terrifying abusive event that caused them to feel as if they were going to die and leaving them with an ongoing sense of vulnerability and fear.

There are four mechanisms involved in injury resulting from strangulation. First, pressure on the carotid artery nerve ganglion may result in cardiac dysrhythmia and cardiac arrest. This is suspected to be uncommon, since force must be applied over a very localized and specific anatomic area. Second, pressure on the carotid arteries can obstruct blood flow to the brain. Third, pressure on the jugular veins prevents venous blood return from the brain, gradually backing up the blood, which in turn causes stagnant hypoxia and results in unconsciousness, depressed respiratory effort, and asphyxia. Fourth, pressure obstructs the larynx, cutting off airflow to the lungs and resulting in asphyxia (Hawley, 2002, Hawley et al., 2001, Wilbur et al., 2001). It is estimated that only 11 pounds of pressure on both carotid arteries for 10 seconds will result in loss of consciousness. If pressure is immediately released, consciousness may be regained in 10 seconds. Only 4 pounds of pressure is required to obstruct the jugular veins. To completely close off the trachea, 33 pounds of pressure is necessary. The actual amount of force in a given incident, however, varies tremendously depending on the size of the victim and perpetrator, as well as the surface area on which force is applied. The victim will first experience severe pain, then survival instincts will lead to a vigorous struggle to preserve life. Continuing pressure will cause loss of consciousness followed by brain death (Baden, 2003, Downing, 2006, Hawley et al., 2001, Hawley, 2002, Funk & Schuppel, 2003, McClane et al., 2001).

The clinical presentation of victims of strangulation is a spectrum of physical, neurological and psychological signs and symptoms, some of which are listed below. These may occur concurrently or shortly after a strangulation event:

Symptoms

Location and Type of Findings



Breathing

- Difficulty breathing
- Hyperventilation
- Coughing
- Unable to breathe

Voice

- Unable to speak
- Raspy voice
- Hoarseness
- Pain with speaking

Swallowing

- Difficulty swallowing
- Pain with swallowing
- Neck pain
- Nausea or vomiting

Behavioral

- Restlessness
- Panic
- Agitation
- Combativeness
- Memory loss
- Hallucinations
- Acute post-traumatic stress syndrome

Other

- Vision changes
- Hearing changes; loss; tinnitus
- Dizziness
- Headaches
- Fainting
- Incontinence of urine
- Incontinence of stool

Face

- Red, flushed
- Petechiae
- Bruising
- Abrasions
- Bloody nose
- Facial droop; unilateral weakness

Mouth

- Bruising/petechiae
- Swelling of tongue/lips

Neck

- Redness/petechiae
- Bruising
- Abrasions
- Fingernail marks
- Swelling
- Ligature mark

Eyes/Eyelids

- Petechiae
- Subconjunctival hemorrhage (blood red eyes)
- Ptosis (eyelid droop)

Under chin

- Redness/petechiae
- Bruising
- Abrasions

Ear

- Petechiae
- Bleeding
- Bruising behind ear
- Ruptured ear drum

Head

- Petechiae
- Bruising



- Traumatic alopecia (pulled hair)
- Swelling/tenderness

Chest/Shoulders

- Redness
- Bruising
- Abrasions

In addition to possible long term impairment of the patient's cognitive function, potential life-threatening internal injuries may occur. These include hyoid bone injury, laryngeal injuries with hemorrhage, severe tongue hemorrhage, anoxic encephalopathy, carotid dissections and occlusions that have been reported to result in transient ischemic events or stroke (Hawley, McClane, & Strack, 2001).

Delayed devastating medical complications following initial mild symptoms have rarely been reported, occurring hours, days or weeks later: pneumonia or aspiration pneumonitis; edema of airway tissues; progressive, irreversible encephalopathy; carotid artery dissection and cerebral infarction. (McClane et al., 2001; Faugno et al., 2013)

Even in the absence of visible physical injury, a history by the patient of strangulation is a clear medical indication for comprehensive assessment and diagnostic evaluation of head and neck injury.

Diagnostic recommendations for evaluating patients who have been strangled include pulse oximetry to measure oxygen saturation and chest x-ray to diagnose pulmonary edema, pneumonia, or aspiration. Other recommendations are soft tissue neck x-ray to evaluate for subcutaneous emphysema or tracheal deviation from edema or hematoma. Cervical spine x-ray may reveal a fractured hyoid bone and computed axial tomography (CT) scan can evaluate neck structures. A magnetic resonance imaging (MRI) scan of the neck will evaluate the soft tissues, with necessary consideration for follow up MRI due to the progressive edema and airway narrowing. Magnetic resonance angiography (MRA) and/or carotid doppler ultrasound is necessary in patients with signs of stroke.



Pharyngoscopy may reveal pharyngeal petechiae, edema, or other findings, and fiberoptic laryngobronchoscopy may be necessary in evaluating the vocal cords and trachea in patients with dyspnea or voice changes. Recommended treatment of these patients is to admit for continuous monitoring of their airway, breathing, and circulation along with neurologic checks (McClane et al., 2001). Progression of symptoms may warrant consultation from otolaryngology, pulmonology, or neurology (McClane et al., 2001).

Table: Imaging Modalities Useful in Strangulation Injuries*

Modality	Advantages	Disadvantages
Plain radiography (bone technique)	Readily available in the ED Visualization of cervical vertebral fractures	Cervical vertebral fractures rare in strangulation injuries
Plain radiography (soft-tissue technique)	Readily available in the ED Visualization of laryngeal injuries (subcutaneous emphysema, tracheal deviation from edema and hemorrhage) Visualization of hyoid bone fractures	Low sensitivity for detecting these uncommon secondary signs of deep soft-tissue or laryngeal injuries in survivors
Computed tomography (CT)	Routinely available in most U.S. EDs Higher sensitivity for soft-tissue injuries	Intravenous contrast needed for highest sensitivity
Computed tomographic angiography (CTA)	Routinely available in most U.S. EDs Visualization of carotid artery injury and thrombosis	Need for intravenous contrast
Magnetic resonance imaging (MRI)	Highest sensitivity for deep soft-tissue injury	Less availability in U.S. EDs
Doppler ultrasound	Visualization of intimal injury to carotid arteries and/or intraluminal thrombosis Can be brought to the bedside of unstable patients	Less availability in U.S. EDs Lower resolution and presumably less sensitive for carotid artery injury and intraluminal thrombosis



Fiberoptic laryngoscopy	Visualization of vocal cords and adjacent structures	Not readily available in the emergency department
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*(Adapted from Stapczynski JS. 2010)

It is imperative that non-fatal strangulation patients receive a thorough evaluation with careful written documentation of the patient's description of the event, symptoms, and examination findings.

Medical care of these patients should also include photo-documentation of any visible injuries, and swabs for the perpetrator's DNA from areas of the patient's body where aggressive handling has occurred. George McClane, MD, and attorney Gael Strack of the National Training Institute on Strangulation and Prevention developed a strangulation documentation form for use in the emergency department setting (see attached).

Readers are referred to the excellent review article 'Strangulation Injuries' (Stapczynski JS. *Emergency Medicine Reports*, 31(17):193-204) for more detailed discussion of the medical assessment of patients for whom there is a concern for strangulation.

Understanding the lethality of strangulation will assist health care providers in improving procedures and practices that will result in every strangulation patient being evaluated, diagnosed and treated. This will prevent delayed deaths and provide law enforcement professionals with the tools necessary to hold the perpetrators accountable for their actions.

Note: Documentation is an important aspect of strangulation assessment. However, as a complicated topic in and of itself, documentation is outside of the scope of this paper and will be addressed in depth in an upcoming companion piece.

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