The Medical-Forensic Evaluation of Strangulation

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Definition

- Strangulation is a form of asphyxia characterized by closure of the blood vessels and air passages of the neck as a result of external pressure on the neck.
- Differentiate from “choke” which means to have the trachea blocked partly or entirely by a foreign object (i.e. food).
Types of Strangulation

- Hanging
- Manual (most common)
  - Chokehold
- Ligature
Vessel Occlusion

- Carotid artery occlusion
  - Anterior neck
  - 11 lbs of pressure for 10 seconds

- Jugular vein occlusion
  - Lateral neck
  - 4.4 lbs of pressure for 10 seconds
Tracheal Occlusion

- Usually minor (if any) role in causing death (as opposed to fracture of the trachea)
- 33 pounds of pressure to completely occlude
- At least 33 pounds of pressure or more to fracture tracheal cartilage
Variables Required for Effective Strangulation

- Exact anatomic location of applied force
- Quantity of applied force
- Duration of applied force
- Surface area of applied force

Adapted from D. Hawley MD: Death by Strangulation
Fatality

- Death will occur in 4-5 minutes if strangulation persists.
- Immediate death from strangulation can occur from one of four mechanisms:
  - Cardiac arrhythmia provoked by pressure on the carotid artery nerve ganglion causing cardiac arrest.
  - Pressure obstruction of the carotid arteries prevents blood flow to the brain.
  - Pressure on the jugular veins prevents venous blood flow from the brain, backing up blood in the brain and leading to unconsciousness, depressed respirations and asphyxia.
  - Pressure obstruction of larynx cuts off air flow, producing asphyxia.
For clinicians, it is the potential for delayed fatality that is most concerning. Contributors include:

- Carotid artery dissection (delayed)
- Respiratory complications: aspiration pneumonia and ARDS
Wilbur, et al. (2001) in a study of 62 women in LA and Dallas found that almost 70% had been strangled. 
- Average duration of the relationship prior to initial strangulation event was 5.2 years.
- Average length of abuse prior to initial strangulation event was 3.1 years.
- 87% had been threatened with death while being strangled and 70% believed they were going to die during strangulation event.
Victim Experience

- McClane et al. describe 4 stages patients describe during the strangulation event prior to LOC:
  - Denial: “I couldn’t believe this was happening to me”
  - Realization: “this really is happening to me”
  - Primal: struggle to preserve life
  - Resignation: “He’s going to kill me; I hope my kids will be okay”
Clinical Presentation
Signs and Symptoms

- Dependent upon the method used, the force used and the duration of the strangulation
Voice Changes

- May occur in up to 50% of patients
- Ranging from dysphonia to complete aphonia
Swallowing Changes

- Primarily from injury to the larynx and/or hyoid bone
- May be difficult, but not painful (dysphagia), or painful (odynophagia)
Breathing Changes

- From hyperventilation or secondary to underlying neck and airway injury
- Dyspnea
- Orthopnea
- Although changes may appear mild, they can become fatal within 36 hours
Mental Status Changes

- Restlessness and combativeness secondary to hypoxia and severe stress reaction
- Changes can also be long-term, resulting in amnesia and psychosis
Bladder & Bowel Incontinence

- May be a good indicator that LOC has occurred
Wilbur et al in their study reported that 4 of 42 women who had been strangled experienced miscarriage within 2 weeks of the event.

Little info in the literature related to miscarriage and fetal demise in surviving strangulation victims.
Neck Swelling

- Edema from:
  - Internal hemorrhage
  - Injury of underlying neck structures
  - Fracture of the larynx causing subcutaneous emphysema
Lung Injury

- Aspiration pneumonitis from vomiting
- Pneumonia, hours to days later
- Pulmonary edema possible
Visible Injury

It is no coincidence that the best medical evidence of strangulation is derived from post mortem examination (autopsy) of the body, but even in living survivors of strangulation assaults it may be possible to recognize a pattern of injury distinctive for strangulation.

-Dean Hawley, MD
Visible Injuries to Neck

- Scratches (nail marks rarely from assailant)
- Abrasions
- Claw marks (self-inflicted)
- Pressure erythema
- Contusions
- Only about half of strangulation victims have visible injury
Finger contusions are caused by the assailant’s grasp. The thumb generates more pressure than the other fingers, so singular thumb impression contusions are found more often than contusions showing the complete hand grasp.
Visible Injuries to Other Areas

- Contusions behind ears, jaw line, submandibular area
- Tongue injury, including edema and bite wounds (from victim)
- Chin abrasions: protective mechanism causes injury as victim tries to protect neck by bringing chin to chest
- Defense wounds
Ligature Marks

- Presence should increase suspicion of hyoid bone fracture
- May resemble natural folds of neck
- Presence of jewelry can cause ligature-type marks, even when manual strangulation was sole mechanism of injury
Petechiae

- Burst capillaries occurring cephalad to the point of pressure
- May be found under and on eyelids, periorbital areas, face, scalp, and neck; also look at lower lip and hairline
  - Petechiae is a hallmark of jugular vein occlusion--why?
  - How can we differentiate strangulation-related petechiae from other causation?
Petechiae

- HOWEVER, it’s a non-specific finding which can be caused from asphyxiation of any type:
  - Hanging
  - Drowning
  - SIDS
  - Aspiration of gastric contents
  - Profound depressant drug intoxication
    - Lack of petechiae does not disprove strangulation
Subconjunctival Hemorrhage

- May be to entirety of conjunctiva, or isolated spot
- Particularly common with repeated pattern of pressure and release
Neurological Findings

- Ptosis
- Facial droop
- Unilateral weakness
- Paralysis
- Loss of sensation
Neurological Findings

- Studies indicate that victims of repeated strangulation have a significant increase in these symptoms (Smith, et al. 2001)
Psychiatric Symptoms

- Memory loss
- Depression
- Anxiety
- Suicidal ideation
- PTSD symptoms
- Nightmares (significant increase in patients who have experienced multiple strangulations)
Miscellaneous Symptoms

- Dizziness
- Tinnitus
- Acid reflux
Medical Evaluation & Documentation
Evaluation

- Strangulation victims consistently under-evaluated in EDs
- Lack of visible injury often correlates with lack of thorough eval
- Patients may frequently be dismissed as hysterical, emotionally labile, intoxicated, exaggerating assault details
Evaluation

- Existing symptoms, such as hyperventilation and agitation easily written off as patient drama rather than seen as a logical response to a terrifying and hypoxic event
Evaluation

- Should be dependent upon signs and symptoms displayed
- Patients with more significant findings, such as dyspnea, visible neck lesions, behavioral or neurologic changes should have more in-depth studies
Recommended options by McClane et al. (2001):

- Pulse Oximetry
- Chest X-ray (identify pulmonary edema, pneumonia or aspiration)
- Nasal X-ray (for patient presenting w/hemoptysis, r/o nasal fx)
- Soft tissue Neck X-ray (subcutaneous emphysema secondary to fractured larynx; identify tracheal deviation because of edema or hematoma)
- Cervical spine X-ray (lateral view may reveal fractured hyoid bone)
Evaluation

- CT scan/MRI of neck structures
- Carotid doppler ultrasound (for patients with neurological lateralizing signs)
- Pharyngoscopy (may reveal pharyngeal petechiae, edema or other related-findings)
- Laryngobronchoscopic (evaluation of vocal cords & trachea for patients with hoarseness, dyspnea & odynophagia)
Evaluation

- Consider admission for continuous monitoring of airway, etc.
- Progressively worsening symptoms should merit consults with specialty services such as Neurology, Pulmonology and Otolaryngology
- Special care and an aggressive search for occult injury should be employed in intoxicated victims with strangulation history
Always assess IPV victims for strangulation
Promote the medical/forensic exam if the victim has experienced strangulation within 72 hours, longer if pregnant
Law Enforcement

- Assess for strangulation using, if possible a standardized strangulation assessment tool
- Promote a medical/forensic evaluation if within 72 hours of a strangulation event, longer if pregnant
Prosecution

- Utilize medical experts to explain the lethality associated with strangulation
- Both immediate and delayed
- Medical examiner’s office
- Trained forensic nurses
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