The Medical-Forensic Evaluation of Strangulation

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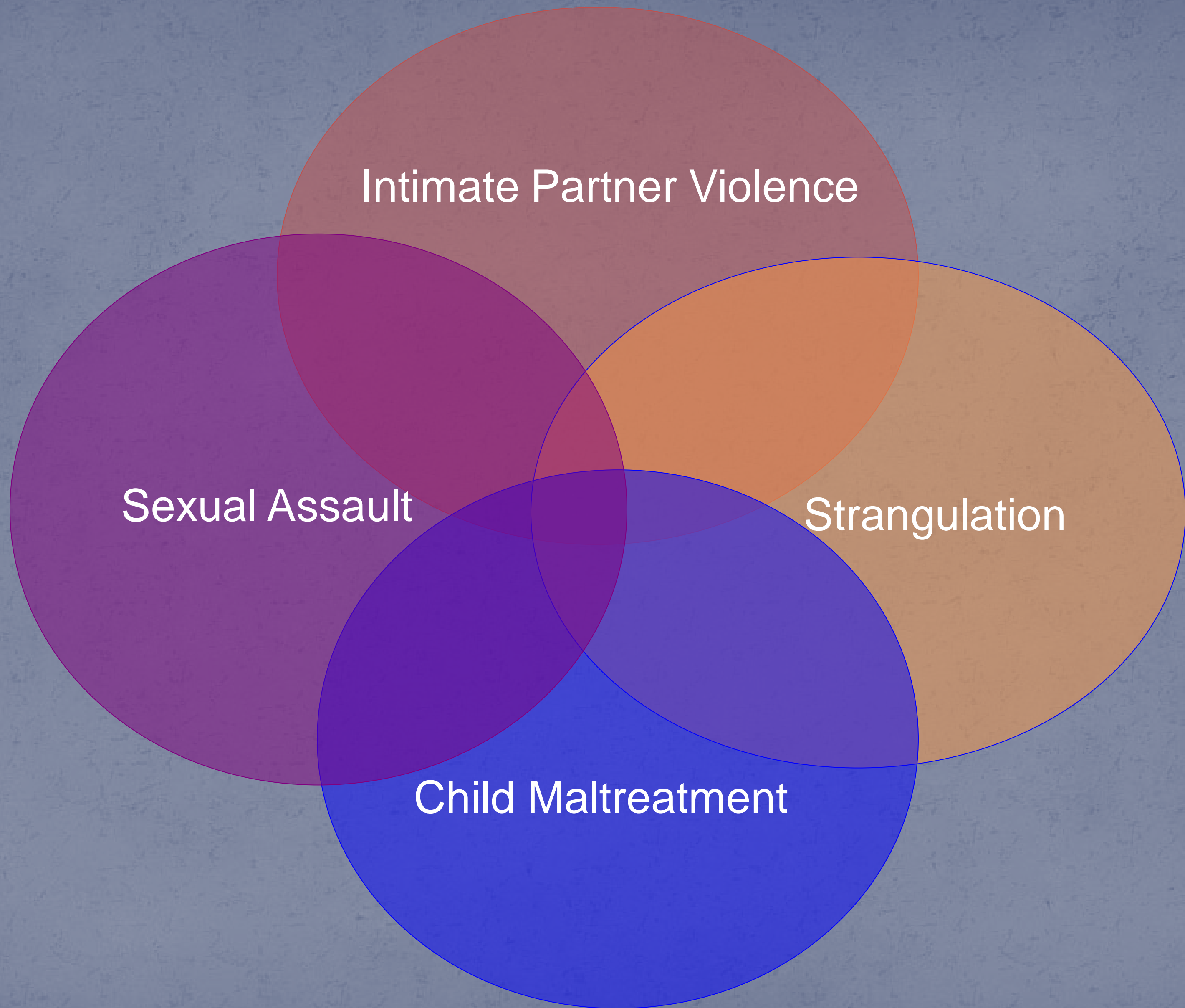

Intimate Partner Violence
Sexual Assault
Strangulation
Child Maltreatment

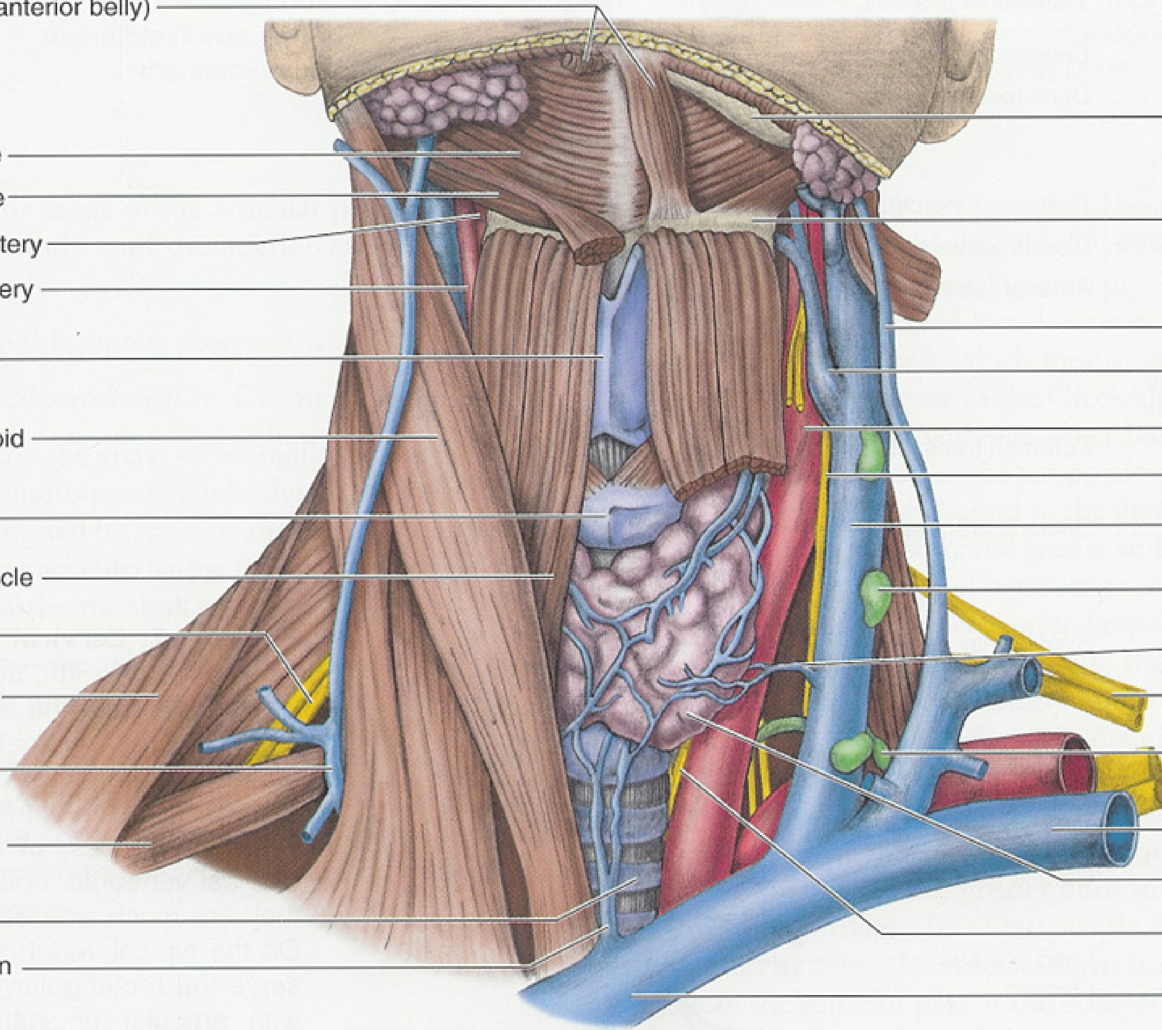
Some materials adapted from Dean Hawley, George McClane & Gael Strack series in the Journal of Emergency Medicine (2001): A Review Of 300 Attempted Strangulation Cases (I-III), and Funk and Schuppel's Strangulation Injuries (Wisconsin Medical Journal, 2003).

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)

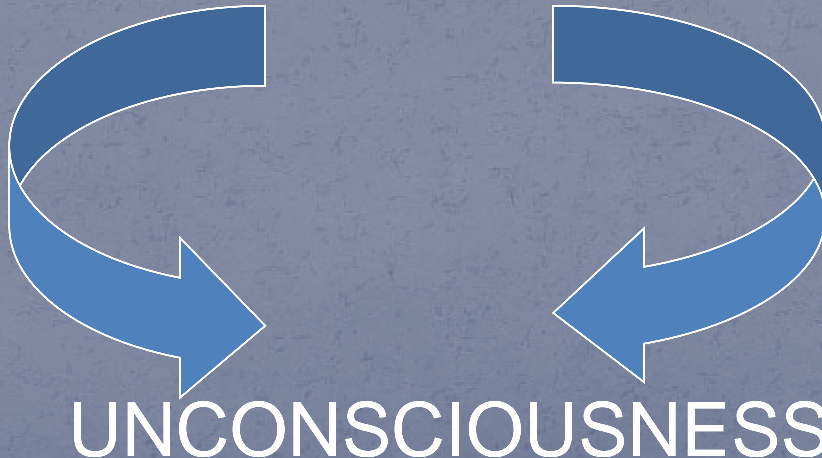
Types of Strangulation

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


Digastric muscle (anterior belly)
Mylohyoid muscle
Stylohyoid muscle
External carotid artery
Internal carotid artery
Thyroid cartilage
Sternocleidomastoid
Cricoid cartilage
Sternothyroid muscle
Brachial plexus
Trapezius muscle
External jugular vein
Omohyoid muscle (inferior belly)
Trachea
Inferior thyroid vein
Anterior view
Mandible
Hyoid bone
External jugular vein
Superior thyroid vein
Common carotid
Left vagus nerve
Internal jugular vein
Deep cervical lymph node
Middle thyroid vein
Brachial plexus
Thoracic duct
Subclavian vein
Thyroid gland
Recurrent laryngeal nerve
L. brachiocephalic vein

Vessel Occlusion

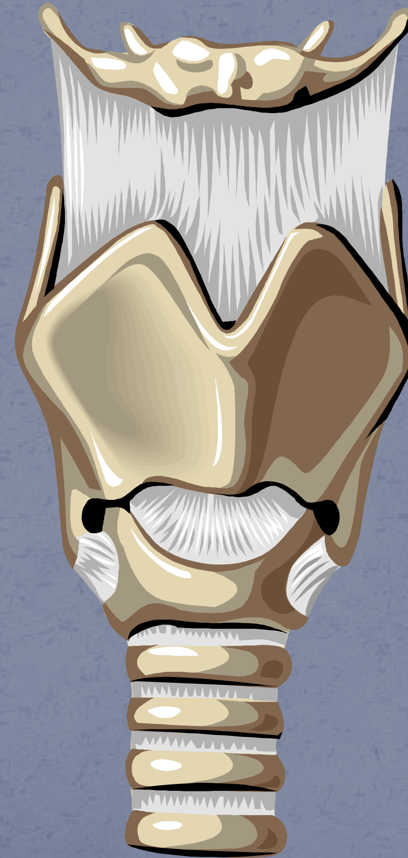
- Carotid artery occlusion
  - Anterior neck
  - 11lbs of pressure for 10 seconds
- Jugular vein occlusion
  - Lateral neck
  - 4.4 lbs of pressure for 10 seconds



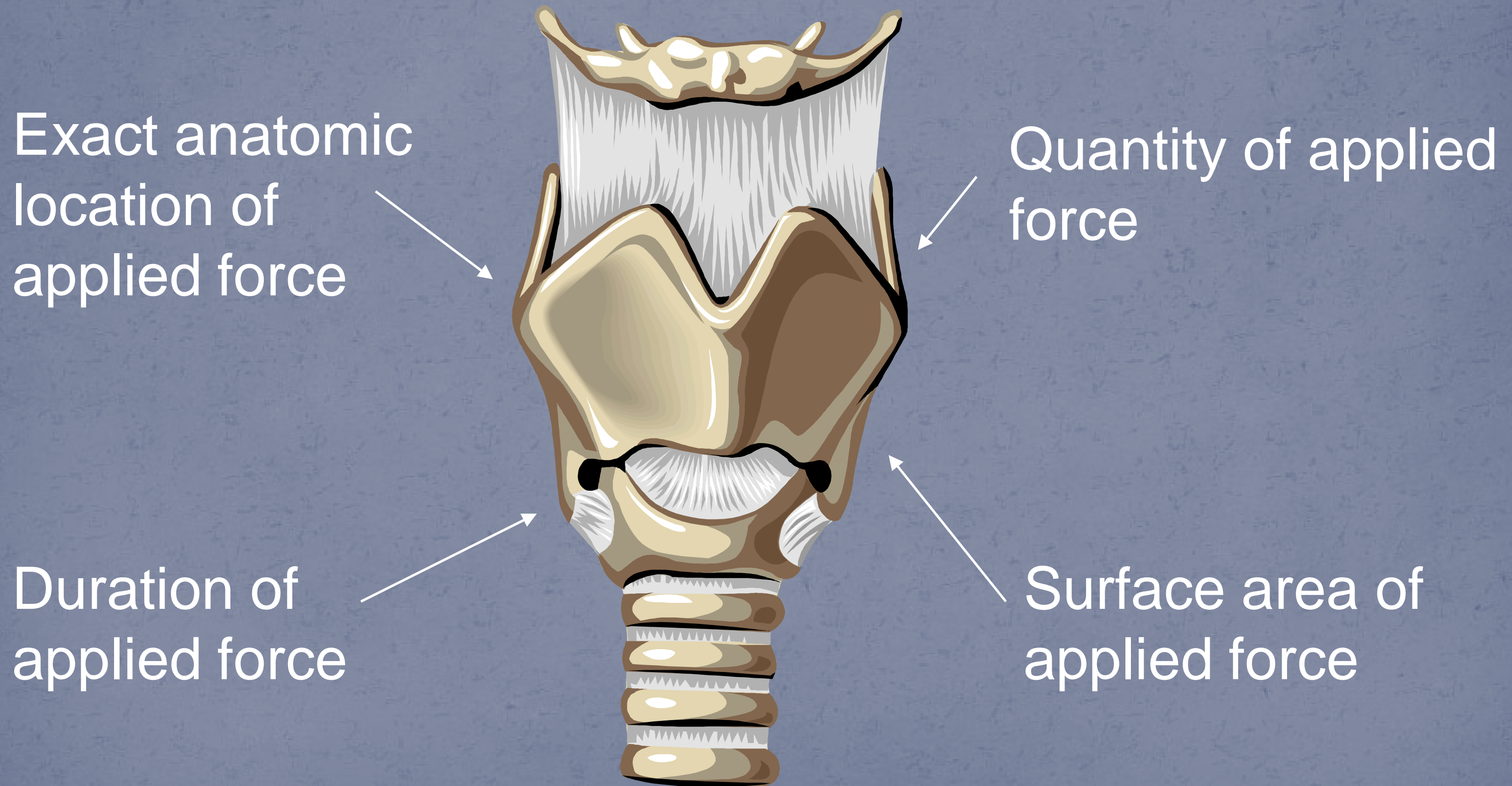
UNCONSCIOUSNESS

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



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

Fatality

- 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

Duration of Abuse

- 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

Miscarriage

- 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 cephelad 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 asphyxia 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

Evaluation

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)
- Laryngobronchoscopy (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

Advocacy

- 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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