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**STRANGULATION ASSESSMENT**

**OBJECTIVES**
*After Reviewing the figures presented in this section, the student will be able to:*

1. Identify anatomy of the neck.
2. Define strangulation.
3. Identify signs and symptoms of strangulation.
4. Identify potential complications from strangulation.
5. Define recommended courses of treatment and care for patients with a history of strangulation.

**INSTRUCTIONS**
An anatomical diagram of the neck has been provided to help the participant correctly identify anatomical landmarks. Participants should refer to this diagram, in conjunction with the definitions that follow, when documenting normal anatomy, injuries, and other variant conditions or findings throughout *Strangulation Assessment for Health Care Providers and First Responders*.

Additionally, participants are encouraged to review the sections on symptoms, lethality, and treatment as a supplement to the exercises in *Strangulation Assessment for Health Care Providers and First Responders*. By familiarizing themselves with signs and symptoms of strangulation and treatments available to patients, participants will be better prepared to identify and respond to cases of strangulation, in addition to documenting visible physical injuries.

**DEFINITIONS OF STRANGULATION**
— *Strangulation* is a form of asphyxiation (ie, oxygen deprivation) characterized by closure of the air passage or vessels of the neck, resulting from external pressure applied to the neck. As opposed to:

— *Choking*: Blocking of a respiratory passage by constriction of the neck, obstruction of the trachea, or swelling of the larynx. May result from materials, such as food, blocking the deeper respiratory tract, thereby preventing oxygen from entering the alveoli.

— *Positional asphyxia*: Potentially lethal obstruction of breathing due to physical position.

— *Suffocation*: External prevention of respiration via occlusion of the nose and mouth with an object (eg, hand, pillow, plastic bag).

— *Abrasions*: Superficial injuries to the skin that are limited to the epidermis and superficial dermis. Abrasions are normally caused by rubbing, sliding, or compressive forces against the skin in a parallel manner rather than by vertical force (Faugno D, Speck PM, Spencer MJ, Giardino AP. 2016. Sexual assault quick reference (2nd ed.). St. Louis, MO: STM Learning).
— **ALS light**: A valuable tool that helps detect forensic evidence (eg, urine, sweat, semen, saliva, vaginal secretions, fibers) and other substances (eg, lotion, oils, powders) that would otherwise remain invisible to the naked eye. The area fluoresces, or glows, allowing potential evidence to be collected; however, the collector cannot confirm the origin of the substance or fiber at the time of collection (Ditton M, Gray L. 2015. The ABC’s—Anatomy, “Bunk” and the Courtroom of Sexual Assault. Ft. Wayne, IN: Socratic Parenting LLC).

— **Bruise or Contusion**: An area of hemorrhage on soft tissue caused by the rupture of blood vessels from blunt force trauma. Contusions may be present in skin and internal organs. Contusions may be patterned to reflect the configuration of the object used or correspond to the edges of the object used. Deep bruising may not be visible externally. A contusion can be presumed if the area is tender but the hemorrhage is nonvisible. Estimation of the age of contusions is imprecise and discouraged (Besant-Matthews, P. Blunt and sharp injury examination. [PDF document] Retrieved from Lecture Notes Online Website: http://www.lancasterergeneralhealth.org/LGH/ECommerceSite/media/LGH-Media-Library/Documents/LCCA/Blunt-and-Sharp-Injury-Examination.pdf).

— **Buccal swabs**: Cotton swabs used to collect cheek cells for DNA sample from the inside of the mouth (Ditton M, Gray L. 2015. The ABC’s—Anatomy, “Bunk” and the Courtroom of Sexual Assault. Ft. Wayne, IN: Socratic Parenting LLC).

— **CT**: Computed tomography (CT) is an imaging technique that has revolutionized medical imaging. It is widely available, fast, and provides a detailed view of the internal organs and structures. The two major types of CT are helical CT and conventional, axial, step-and-shoot CT. Helical CT is most prevalent, but conventional, axial, step-and-shoot CT technique is used for high-resolution scanning of the lungs, coronary artery calcium scoring, and prospective ECG-gated coronary CT angiography (Stark P. (June 2, 2015). Principles of computed tomography of the chest. Retrieved from http://www.uptodate.com/contents/principles-of-computed-tomography-of-the-chest?source=preview&search=CAT+Scan&language=en-US&anchor=H1&selectedTitle=1~150#H1).

— **DNA, RNA, and Protein**: Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) are linear, polymerized strands of linked nucleotides and considered the building blocks of life. A nucleotide is a nucleoside, or a combination of a sugar (ribose or deoxyribose) and a base, that is linked to a phosphate group. RNA differs from DNA in that the hydrogen at the 2’ position in DNA is replaced by a less stable hydroxyl group in RNA. There are four DNA bases: adenine (A), cytosine (C), guanine (G), and thymidine (T). In RNA, thymidine is replaced by uracil (U). DNA or RNA polymers are formed by the linking of the 5’ phosphate of one nucleotide to the 3’ hydroxyl group of another (Raby BA. [April 4, 2016]. DNA: Basic principles of molecular genetics. Retrieved from http://www.uptodate.com/contents/basic-principles-of-genetic-disease?source=machineLearning&search=DNA&selectedTitle=1%7E150&sectionRank=1&anchor=H5203404#H5203404).

— **Dysphonia**: Involves the muscles of the throat that control speech, otherwise known as spastic dysphonia. It causes strained and difficultly speaking. (California District Attorneys Association and Training Institute on Strangulation Prevention. 2013. The investigation and prosecution of strangulation cases. Grant Award Number LV12141059 from the California Emergency Management Agency [Cal EMA]. San Diego, CA: CDAA and Cal EMA printing office).

— **Dyspnea**: Shortness of breath or difficulty breathing. (California District Attorneys Association and Training Institute on Strangulation Prevention. [2013]. The investigation and prosecution of strangulation cases. Grant Award Number LV12141059 from the California Emergency Management Agency [Cal EMA]. San Diego, CA: CDAA and Cal EMA printing office).

— **MRI:** Magnetic resonance imaging (MRI) is a technique that uses a magnetic field and radio waves to create detailed images of the organs and tissues within the body. An MRI machine can also be used to produce 3-D images that can be viewed from many different angles (Tests and Procedures MRI: Definitions. (n.d.). Retrieved from http://www.mayoclinic.org/tests-procedures/mri/basics/definition/pcr-20012903).

— **Odynophagia:** Pain when swallowing (California District Attorneys Association and Training Institute on Strangulation Prevention. (2013). The investigation and prosecution of strangulation cases. (Grant Award Number LV12141059 from the California Emergency Management Agency (Cal EMA). San Diego, CA: CDAA and Cal EMA printing office).

— **Petechial hemorrhages:** Small, pinhead-sized hemorrhages caused by leaking capillaries that may be singular or multiple in appearance. Frequency of hemorrhages is caused by increased pressure within the blood vessel, as with straining during vomiting or strangulation. This may also be caused by a bleeding disorder, infection, or localized trauma (Besant-Matthews, P. Blunt and sharp injury examination. [PDF document] Retrieved from Lecture Notes Online Website: http://www.lancastergeneralhealth.org/LGH/ECCommerceSite/media/LGH-Media-Library/Documents/LCCA/Blunt-and-Sharp-Injury-Examination.pdf).

— **Positional asphyxia,** also known as postural asphyxia, is a form of asphyxia which occurs when someone’s position prevents the person from breathing adequately. (Example: Someone sitting on your chest and you cannot get breath.)

— **Pulse oximetry:** A device that measures the oxygen saturation of arterial blood in a subject. A sensor is attached typically to a finger, toe, or ear to determine the percentage of oxyhemoglobin in the blood that is pulsating through a network of capillaries (Pulse oximetry. (n.d.). Retrieved from http://www.hopkinsmedicine.org/healthlibrary/test_procedures/pulmonary/oximetry_92,p07754/).


— **SANE:** Sexual Assault Nurse Examiner. A registered nurse who has an advanced education in the forensic examination of sexual assault patients (Faugno D, Speck PM, Spencer MJ, Giardino AP. 2016. Sexual assault quick reference (2nd ed.). St. Louis, MO: STM Learning).

— **SART:** Sexual Assault Response Team. SARTs are coalitions of agencies that serve sexual assault victims. Core membership for SARTs typically includes victim advocates, law enforcement officers, forensic medical examiners, forensic scientists, and prosecutors. Multidisciplinary SARTs work together to formalize interagency guidelines that prioritize victims’ needs, hold offenders accountable, and promote public safety (National Sexual Violence Resource Center. (2011). Sexual assault response team development: A guide for victim service providers. Enola, PA: NSVRC).

— **Suffocation:** Obstruction or restriction of breathing by external mechanical forces. Suffocation does not require blunt force (California District Attorneys Association and Training Institute on Strangulation Prevention. (2013). The investigation and prosecution of strangulation cases. (Grant Award Number LV12141059 from the California Emergency Management Agency (Cal EMA). San Diego, CA: CDAA and Cal EMA printing office).
— **Victim advocate**: Someone who pleads, supports, or defends the cause for the victim (Ditton M, Gray L. 2015. The ABC’s – Anatomy, “Bunk” and the Courtroom of Sexual Assault. Ft. Wayne, IN: Socratic Parenting LLC).

**METHODS OF STRANGULATION**

— **Hanging**: Suspension from a cord or cord-like object wound around the neck.

— **Ligature strangulation**: Strangulation without suspension using some form of cord-like object.

— **Manual Strangulation**: Strangulation using the hands, fingers, or other extremities.

**MECHANISMS OF STRANGULATION**

— **Compression of the laryngopharynx, larynx, or trachea**: Inhibits inhalation and exhalation, causing asphyxia.

— **Compression over the carotid artery ganglion**: Stimulates the carotid sinus reflex; produces bradycardia, hypotension, and cardiac arrest.

— **Sustained compression of the carotid arteries**: Prevents oxygenated, nutrient-rich blood flow to the brain. Leads to cerebral hypoxia within seconds.

— **Sustained compression of the jugular veins**: Prevents outflow of venous blood from the brain. Leads to a gradual backup of blood into the brain, leading to stagnant hypoxia, unconsciousness, decreased respirations, and ultimately, asphyxia.

**ANATOMY OF THE NECK**

To best understand the clinical features associated with strangulation, one must understand the basic anatomy and functions of the neck. The neck is comprised of subcutaneous fat, muscle, cartilage, bone, vessels, nerves, lymph nodes, and salivary glands. The underlying neck structures that are especially vulnerable to the intentional external pressure of strangulation are located in the anterior and anterolateral neck. These structures include the hyoid bone, larynx, trachea, jugular veins, carotid arteries, and carotid artery nerve ganglion. To grasp the importance of these structures, one must understand their role in the cardiovascular and respiratory system.

Life-sustaining oxygenation depends on the combination of air and blood flow. Respiration is the free movement of oxygenated air through the upper air passages (ie, the nose and mouth). Then, the air must flow freely through the larynx, to the trachea, and finally, to the lungs. Oxygenation occurs when the lungs shift oxygen from inhaled air into the blood. Following that, the cardiovascular system pumps oxygenated blood through the heart and up into the carotid arteries of the neck for oxygenation of the brain. At the brain’s cellular level, blood exchanges oxygen for waste products, which are then transported down the neck’s jugular veins to the lungs for exhalation.

Cessation of oxygenated blood flow to the brain cells leads to asphyxia. Asphyxia may result from strangulation when intentional pressure to the neck compromises air flow, blood flow, or both. Asphyxia, resulting from compressive force on the vessels and air passages of the neck, is the most common cause of lethality in strangulation. Injuries to neck structures may also lead to compromised air and blood flow. Anterior neck structure fractures, tears to neck vessels, intrinsic neck muscle bleeding, supporting ligament tears, nerve injury, and cervical spine fractures or lacerations may also occur as a result of the locational force applied during strangulation. Injury-associated bleeding, swelling, and/or functional disability in maintaining a patent airway interferes with oxygenation leading to asphyxia.

The following is a more detailed explanation of underlying neck structures, including their location, function, and susceptibility to compressive forces of strangulation.
Section I: Strangulation Assessment

CAROTID ARTERIES
The carotid arteries originate from the aortic arch at the top of the heart and are located on the left and right side of the neck. Protected by neck muscles, the carotid arteries lie deeper than the jugular veins and more proximal to the midline structures of the neck. The carotid arteries carry oxygenated, nutrient-rich blood from the heart to the head and brain. Pressure inside the carotid arteries exerts the force required not only to deliver oxygenated blood but to diffuse oxygen throughout the brain tissues.

It takes approximately 11 pounds of pressure to occlude the carotid arteries and compromise oxygenated blood flow to the brain. Sustained pressure causes unconsciousness within 10 seconds, due to immediate cessation of oxygenated blood flow. Immediate relief of pressure allows consciousness to return in approximately 10 seconds. Permanent brain damage can occur within 2 minutes. Carotid artery occlusion has caused death in as little as 15 to 20 seconds, usually resulting from force sufficient to crush or tear the arteries as they are compressed against underlying neck structures. Tears can also occur to the internal lining of the carotid arteries. As the arteries heal, small blood clots can form at the site of injury. These blood clots can break off, travel to the brain, and compromise blood flow. As a result, neurologic compromise often presents with clinical symptomology of a stroke. These findings are often delayed and may not present until weeks after strangulation occurs.

CAROTID ARTERY GANGLION
The carotid artery ganglion, also called the carotid body, is a cluster of cells located at the bifurcation of the carotid artery. The carotid body is an important neurological sensor—primarily stimulated by oxygen and highly sensitive to carbon dioxide. Its main function is to trigger nerve impulses for relay of important information to the central nervous system. Although it requires a specific area of compression with strangulation, sustained compression for 3 to 4 minutes activates the carotid sinus reflex, resulting in bradycardia, which often leads to unconsciousness. If compression continues, cardiac arrest may occur.
HYOID BONE
The hyoid bone is a horseshoe-shaped bone located at the base of the mandible and above the larynx. It is not connected to any other bone in the body. The hyoid bone’s main function is to support the tongue in movement and swallowing. A fracture of the hyoid bone may lead to difficulty swallowing (ie, dysphagia), painful swallowing (ie, odynophagia), and pain upon neck rotation. Effective swallowing is important to maintaining uncompromised air flow in respiration. Therefore, a hyoid bone fracture’s impact on swallowing, as well as the potential for associated bleeding and/or swelling, may compromise airway patency. Hyoid bone fracture is more common in manual strangulation and requires approximately 35 to 46 pounds of pressure.

JUGULAR VEINS
The jugular veins are vessels located on the left and right side of the anterior neck and are more external and lateral to the carotid arteries. The jugular veins return the bulk of deoxygenated blood from the brain and head back to the heart.

It takes approximately 4.4 pounds of pressure to occlude the jugular veins. This occlusion causes venous outflow obstruction, resulting in deoxygenated blood backing up into vessels of the head and brain. This build-up of deoxygenated blood is known as stagnant hypoxia. If venous outflow is obstructed without carotid artery occlusion, the veins above the level of constriction will begin to dilate in order to accommodate the incoming blood that cannot exit the neck. This process causes the veins to engorge, resulting in increased internal venous pressure. When pressure is sustained for approximately 20 to 30 seconds without carotid occlusion, the dilated vessels will rupture, causing pinpoint hemorrhages known as petechiae. Petechiae may occur anywhere above the level of constriction, including the brain, scalp, skin, conjunctiva of the eyes, soft palate of the mouth, and the external ear canal. Brain asphyxia eventually develops as venous filling restricts incoming arterial blood, ultimately compromising oxygen delivery to the brain. Unconsciousness may occur in as little as 15 to 30 seconds. Permanent brain damage may occur in 2 minutes. Death usually occurs around 4 minutes.

LARYNX
The larynx (ie, voice box) is a tubular framework of cartilage connected superiorly to the hyoid bone and inferiorly to the trachea. The larynx serves two important functions: First, as a part of the respiratory tract, the larynx allows inhaled air to pass while simultaneously keeping food and liquid from obstructing the airway. Second, the larynx houses the vocal cords and so functions to produce sound and vocalization. The larynx contains the following structures, which are important to swallowing and vocalization: cricoid cartilage, epiglottis, thyrohyoid membrane, thyroid cartilage, and vocal cords.

— Cricoid cartilage. A ring-shaped structure providing the transition from larynx to trachea. Provides an attachment point for the cartilage, ligaments, and muscles involved in sound production and the opening and shutting of the airway.

— Epiglottis. An elastic, spoon-shaped flap extending from the posterior tongue to the anterior border of the thyroid cartilage. During swallowing, the epiglottis folds over to cover the opening of the larynx (ie, glottis) to block any food or fluid from entering the airway.

— Thyrohyoid membrane. A fibrous, elastic membrane connecting thyroid cartilage to the hyoid bone by a mucosa bursa that aids the upward movement of the larynx in swallowing.

— Thyroid cartilage. A semicircular structure positioned on the anterior larynx. Consists of a fusion of 2 cartilage plates. The external point of fusion is the laryngeal prominence (ie, Adam’s apple) and is more visible through the skin in males. The thyroid cartilage supports and protects the upper larynx and anchors the anterior portion of the vocal cords.
— **Vocal cords**: Situated in the mucous membrane on each side of the larynx opening. As exhaled air moves through the larynx, the vocal cords vibrate and produce sound.

The compressive forces of strangulation may lead to occlusion, fractures, and hemorrhages of the larynx’s cartilaginous framework. It takes approximately 22 pounds of force for airway occlusion at the level of the thyrohyoid membrane, 31.5 pounds of force to fracture the thyroid cartilage, and 41 pounds of force to fracture the cricoid cartilage. Laryngeal fractures may allow air to escape into the soft tissues of the neck (ie, subcutaneous emphysema), resulting in potential airway compromise, acute asphyxia, and death. Subsequent hemorrhages and swelling may also play a role in airway compromise as a result of these fractures. If these fractures go untreated or unrecognized, the victim may survive initially, but over hours or even days, the victim may develop life-threatening airway complications, leading to a delayed death. Vocal cord swelling and/or hematoma formation may lead to temporary or long-term vocal dysfunction that includes a hoarse voice (ie, dysphonia) or the inability to produce a voice (ie, aphonia).

**Trachea**

The trachea is a hollow tube located along the body’s midline that connects the larynx to the 2 main bronchi of the lungs. Incomplete, highly elastic, C-shaped cartilage rings are located anteriorly along the tracheal wall. The trachea’s primary function is to allow air flow to and from the lungs. It takes approximately 33 pounds of pressure during strangulation to completely occlude the trachea. Tracheal occlusion inhibits the inhalation of oxygen and the exhalation of carbon dioxide, resulting in multisystem hypoxia and acidosis. Force of strangulation may also fracture the trachea, causing subcutaneous emphysema and subsequent airway compromise.

**Strangulation-Related Injuries and Conditions**

The participant may find reviewing the following definitions useful in completing the activities within this book. Terminology for indicators of direction when documenting findings in a medical forensic examination include **anterior** (nearer the front), **posterior** (nearer the back), **inferior** (nearer the bottom), **superior** (nearer the top), **medial** (at the middle), **lateral** (to the side), **proximal** (nearer the center of the body), and **distal** (away from the center of the body).

**Visible Injuries to the Neck**

— **Abrasion** *(scratches and scapes)*: The scraping or wearing away of a surface, such as skin. A variety of traumatic abrasions may result from strangulation:
  
  — **Chin abrasion**: Incurred when, in an effort to protect the neck, the victim instinctively lowers and scrapes the chin against whatever is applying external pressure to the neck.
  
  — **Claw mark abrasion**: Abrasions left by fingernails that may present as grouped, parallel markings running vertically down the front of the neck, though they are often scattered in a random fashion. Tend to be more “vicious” and “dramatic” in appearance.
  
  — **Impression mark abrasion**: Occurs when fingernails cut into the skin, leaving a curvilinear (ie, semicircular) mark.
  
  — **Ligature mark abrasions**: Horizontal, circumferential abrasions left on the neck that follow a predictable pattern. Distinguishable from suicidal hanging marks by the suicidal suspension ligature mark rising toward one ear.
  
  — **Scratch mark abrasion**: Long, superficial abrasions that may be as wide or narrow as the fingernail itself. Because strangulation victims are usually female, the scratch marks caused by their longer nails are more severe than the scratch marks caused by the assailant.
— **Bruise (contusion):** Injuries occurring below the intact epidermis, resulting from extravascular collection of blood leaked from ruptured capillaries or blood vessels after sufficient force has been applied to distort soft tissues and tear one or more vessels. Results in discoloration of the skin or other organs.

— **Clustering bruises:** Usually located on the sides of the neck and on the jawlines. May extend onto the chin and collar bones. Consistent with fingers in a hand grasp strangulation.

— **Fingertip bruises:** Circular, oval-shaped, often faint bruises consistent with the assailant’s grasp.

— **Single bruise on neck:** Most frequently caused by the assailant’s thumb. Because the thumb generates more pressure than any other finger, this bruise is found more often than fingertip bruises in a hand grasp strangulation.

— **Petechiae (tiny red spots):** Occur in cases of strangulation involving sustained pressure to the jugular veins without carotid obstruction, causing venous engorgement and subsequently ruptured capillaries. May be found only under the eyelids (conjunctivae), around the eyes, scalp, or anywhere on the face and neck in and above the area of constriction.

— **Subconjunctival hemorrhage:** Capillary rupture and bleeding into the white portion of the eye (ie, sclera). Suggests a particularly vicious struggle between the patient and assailant.

— **Swelling (edema) of the neck:** Notable puffiness and/or tight appearance of the neck caused by tissue trauma, bleeding, or subcutaneous emphysema. Victim may complain of feeling tightness or fullness in the neck. Examiner may see jewelry impressions on the neck.

### Signs and Symptoms of Strangulation

— **Breathing changes:** Difficulty breathing (dyspnea), hyperventilation, inability to breathe (apnea).

— **Evidence of hypoxia and near-unconsciousness:** Changes in vision (tunnel vision, blurred), changes in hearing (hearing loss, ringing), loss of control over body (weakness/limpness).

— **Evidence of hypoxia and unconsciousness:** Loss of memory, unexplained injuries, involuntary urination and defecation.

— **Mental status changes:** Restlessness/combativeness, seizure activity, frank psychosis/amnesia.

— **Swallowing changes (larynx/hyoid bone injury):** Difficult, but not painful, swallowing (dysphagia); painful swallowing (odynophagia).

— **Symptomatic voice changes:** Hoarse or raspy voice (dysphonia), complete loss of voice (aphonia).

### Lethality of Strangulation

Lethality refers to capacity to cause death. Therefore, lethality of strangulation refers to one’s chances of dying as a result of strangulation.

### Lethality as a Result of External Pressure

— **Hypoxia:** In cases of strangulation, an oxygen deficiency depriving the brain of oxygenated blood. Characterized by tachycardia, hypertension, dizziness, mental confusion.

— **Neck swelling:** May present as tissue trauma/inflammation, internal bleeding (carotid dissection), laryngeal injury (subcutaneous emphysema). May progress slowly.

— **Pneumonitis:** Inflammation of the lung, resulting from inhaled emesis where the gastric juices begin to digest lung tissue.
— Postanoxic encephalopathy: Decrease in blood flow to the brain by which some brain cells die immediately while others survive for days. Surviving brain cells eventually succumb to the cerebral hypoxia. Surviving patients may incur lifelong brain damage and neurologic deficits. May be fatal: “brain death,” persistent vegetative coma, cerebral edema (ie, brain swelling), and herniation of the brain.

— Pulmonary edema: Accumulation of extravascular fluid in lung tissues and alveoli. Caused by excessive negative inspiratory pressures resulting from victim’s attempts to breathe while external neck pressure impedes the airway.

**Lethality of Interpersonal Violence (IPV) With Nonfatal Strangulation: Risk for Homicide**

— Nonfatal strangulation has been reported in 45% of attempted homicides.

— Nonfatal strangulation has been reported in 43% of completed homicides.

— With nonfatal strangulation, odds of attempted homicide increase sixfold.

— With nonfatal strangulation, odds of completed homicide increase sevenfold.

**Tests and Treatment**

— CT angiography: Considered the gold standard for strangulation because it is sensitive for bony, cartilaginous, and soft tissue injuries as well as for blunt vascular injury. This technique visualizes arterial and venous vessels and is highly sensitive for clinically significant injuries.

— CT of the neck: Sensitive for bony, cartilaginous, and soft tissue injuries. Also identifies edema, hemorrhage, and subcutaneous emphysema.

— Discharge: Considered safe if patient experienced no loss of consciousness, presents with no injury/minimal soft tissue neck injury and no objective/subjective neurological findings, and if patient has access to reliable home monitoring.

— Fiber optic laryngoscopy: Evaluates the soft tissues of the oropharynx; however, this approach does not offer information on deep soft tissue injuries.

— Forensic nurse consultant: Treat assault victims, investigate crime scenes, and/or provide health care in correctional settings.


— Plain radiographs: May identify bone and laryngotracheal injuries (eg, hyoid bone fracture, subcutaneous emphysema, edema, hemorrhage, tracheal deviation).

**Mannequin Demonstration**

Use of a mannequin can be very powerful in helping to understand the dynamics of an assault with strangulation and how the victim and perpetrator were physically placed in relation to the event (**Figures 1 through 3**). Strangulation is a dynamic event, often involving a struggle, that may result in different injuries in multiple locations (eg, arms, chest, neck, head, face) of both victim and perpetrator. A simple Styrofoam head can be used for demonstration, such as those used in beauty schools (pictured). Do not use a toy or stuffed animal, as this is a recreation of a traumatic event and should be treated seriously. The victim should have no pressure applied to her neck, as this may cause additional trauma or retraumatize her/him. Prior to bringing the mannequin head out for the victim, be sure to tell her that you are going to ask her to demonstrate what happened during the assault. Be prepared for a wide range of reactions, from disbelief to violence, as victims may react very strongly.

**APPENDIX 1-1**

**RECOMMENDATIONS for the MEDICAL/RADIOGRAPHIC EVALUATION of ACUTE, NON-FATAL STRANGULATION**

Strangulation patient presents to the Emergency Department

**GOALS:**
- Evaluate carotid and vertebral arteries for injuries
- Evaluate bony/cartilaginous and soft tissue neck structures
- Evaluate brain for anoxic injury

**Recommended Radiographic Studies to Rule Out Life-Threatening Injuries**

- CT Angio of carotid/vertebral arteries (most sensitive for vessels, good for bony/cartilaginous structures)
- CT neck with contrast (less sensitive than CT Angio for vessels, less sensitive than MR/CT for soft tissue)
- MRA of neck (most sensitive for vessels, good for bony/cartilaginous structures)
- MR/CT of brain (most sensitive for anoxic brain injury, stroke symptoms)

**Continued ED/Hospital Observation**

- Consult Neurology/Neurosurgery/Trauma Surgery for admission
- Consider ENT consult for laryngeal trauma with dysphonia

**REFERENCES**

1. Sethi PK, Sethi NK, Torgovnick J, Arsura E, Delayed Left Anterior and Middle Cerebral Artery Hemorrhagic Infarctions After Attempted Strangulation, Am J Forensic Med Pathol 2012;33:105-106

**Figure 1.** C-clamp hold.
**Figure 2.** Two-handed hold.
**Figure 3.** Ceratoid hold.
APPENDIX 1-2

Appendix 1-2. Domestic Violence Aftercare Instructions

Forensic Nurse Examiner:______________________________________
Diagnosis: _________________________________________________
(Domestic Violence, Physical Assault, Intimate Partner Violence, Other)

TODAY’S EXAMINATION:

Examination: A Medical-Forensic Examination was completed to identify and document areas of possible injury, provide care, and collect samples and clothing that may be examined as part of the investigation of your assault. Some of the care provided may include basic wound care, recommendation for further evaluation and follow-up care, and follow-up photographs outlined below.

Evidence Collection: Samples and clothing may be examined for evidence. The detective assigned to your case will determine what testing may be required by the crime laboratory on the samples and clothing collected today. Any results of this testing will go directly to the detective assigned to your case and will become part of the legal record of this assault. Please contact the detective with any questions regarding this part of the process.

Photographs: Photographs have been taken that show the visible injures to your body. Repeat photographs may be beneficial to show a progression of injury. Some injuries become more visible in the next few days, the recommendation of follow-up photographs as outlined below. Please notify our office at 480-312-6340 and the police department or your case detective to see if additional photographs taken are needed.

Tetanus Vaccine: You did not receive a tetanus vaccine.

Your examination and treatment today was provided on an emergency basis only. This is not a substitute for, or an effort to provide complete medical care. You must let your health care provider check you again. Tell your health care provider about any new or lasting problems. It is impossible to recognize all injuries or illnesses that may result from a physical assault in a single examination. It is possible that no injuries are found. Medical Direction: Dr. ___________________

If you have questions regarding your examination, please call ______________________.

FOLLOW-UP CARE RECOMMENDATIONS:

Counseling: Early counseling is recommended to help prevent lasting complications associated with this type of assault. Your discharge packet contains a list of counseling options for your consideration.

Safety Plan: A personalized safety plan consists of established steps or a plan for preparing yourself for the possibility of further violence. Although you do not have control over the violent acts of others, you do have a choice about how to respond to him or her and how to best get you and your loved ones to safety: Your discharge packet contains a Personalized Safety Plan that should be completed by you to ensure your safety.

Medical Follow-up: Follow-up examination is recommended As recommended for strangulation below. You should be re-evaluated for: complications secondary to strangulation

Repeat Photographs: A progression of injury may occur in the next few days. It may be recommended for you to return for repeat photographs to capture the progression and changes that will occur during the healing process of the injuries from the assault. Please call for follow-up photographs by appointment only.

ADDITIONAL INSTRUCTIONS:

Strangulation: Is the disruption of a person’s normal air and blood passage in the neck by hands or an object, such as a rope. Although there may be no visible signs of strangulation, there may be numerous effects from it. Strangulation may cause a sore throat, difficulty swallowing or breathing, dry cough, a raspy or hoarse voice, ringing of the ears, small broken blood vessels on the neck, face and scalp, reddened eyes, heartburn and feelings of “head rush.” If pregnant, a miscarriage may occur. Memory problems, anxiety, insomnia, nightmares, and depression may also occur.

Name:
Date:
MR#:
DR#:

(continued)
Call your doctor as needed with any concerns. Symptoms of strangulation are very serious and may present, persist or even progress over the next several days.

Because you have reported being “choked” or strangled, we are providing you with the following instructions. Please report to the nearest ER or call 911 immediately if you notice:

- Difficulty breathing or shortness of breath
- Loss of consciousness or “passing out”
- Changes in your voice or difficulty speaking
- Difficulty swallowing, lump in throat, or muscle spasms in throat or neck
- Tongue swelling
- Swelling to throat or neck
- Prolonged nose bleed (greater than ten minutes)
- Persistent cough or coughing up blood
- Persistent vomiting or vomiting up blood
- If pregnant, vaginal bleeding greater than 1 pad an hour
- Left or right-sided weakness, numbness, or tingling
- Headache not relieved by pain medication (Tylenol or Motrin as directed on bottle)
- Seizures
- Behavioral changes or memory loss
- Thoughts of harming self or others

**It is important that the above symptoms be evaluated by a physician.**

After evaluation, keep a log of any changes in symptoms for your physician and law enforcement. If symptoms worsen, report to your physician or nearest ER. You should follow-up with law enforcement regarding documentation of symptoms changes. It is important that you have a follow-up medical screening in two weeks at the clinic or physician of your choice. Make sure to bring your discharge instructions with you.

**Lacerations, Cuts, Abrasions:**

- A **laceration** is an open skin wound that results from overstretching the skin or blunt force trauma (injury). There is no skin missing but it is separated and may be jagged or irregular. It will usually bleed.

- A **cut** is also a separation in the skin or tissue caused by a sharp object, such as a knife, piece of glass or razor blade. This type of injury will also bleed.

- An **abrasion or scrape** occurs when the top few layers of skin are scraped off.

Care of lacerations, cuts, and abrasions:

- Wash hands before and after touching the area.
- Keep the wound clean by gently washing with mild soap and water 2 to 3 times each day to decrease chances of infection.
- If the area has a dressing or band-aid on it, keep it dressed or covered with a band-aid for at least the first two days. Change the dressing if it becomes wet or soiled.
## Appendix 1-2. Domestic Violence Aftercare Instructions (continued)

- Elevate the affected area if possible to increase healing.
- If bleeding starts again, apply pressure directly over the wound with a clean cloth or gauze.
- You may also use a thin layer of antibiotic ointment, such as Bacitracin ointment, on the wound.
- If your wound was closed using steri-strips, leave these in place for at least 5 to 7 days.

*Call your doctor if you have: increased redness or swelling, red streaks coming from the wound, drainage that is not clear coming from the wound (yellow, white, or green), developed a fever or any new or severe symptoms.*

### Contusions

**Contusions (Bruises):** An injury caused by a blunt object or force. The force of the injury causes blood vessels under the skin to break, which may result in swelling or discoloration of the skin and pain. As it heals, the swelling will decrease and the color may change. Discoloration may not appear until a few days after the injury occurred.

**Care of contusions:**
- Apply ice packs for twenty minutes, four times per day for the first two-three days after the injury occurred. Cover the ice pack with a thin cloth to protect skin from cold and further injury.
- If possible, elevate the area where the contusion is above heart level to decrease swelling.

*Call your doctor if you have: severe pain, excessive swelling, numbness or tingling below the injury, inability to move the injured part or new symptoms.*

### Head Injury

**Head Injury (Concussion):** An injury to the brain from a blow to the head or by a fall. It may result in headaches, dizziness, ringing in the ears, double vision, memory changes, personality changes, difficulty concentrating or fatigue. Symptoms may last from days to years.

**Care following a head injury:**
- A friend or family member should wake you up every two hours during the first night after the head injury occurred. If they cannot awaken you, they should call your doctor.
- Rest for the first few days after the injury. Resume regular activities when you feel able.
- Apply ice packs to the sores area for twenty minutes, four times per day for the first 2 days for comfort. Cover the ice pack with a thin cloth to protect skin from cold and further injury.
- Eat foods such as toast, rice, yogurt and tea if you have an upset stomach.
- Use Tylenol for headache (NOT aspirin)

*Call your doctor if you have: difficulty hearing, changes in your vision, a severe headache unrelieved by pain relievers, extreme drowsiness, lose memory of the event (amnesia), vomiting, confusion, trouble with your balance, or problems talking.*

I understand the instructions written above and discussed by the Sexual Assault Nurse Examiner. I have received all of my personal belongings, except those taken as evidence.

______________________________
Patient or Authorized Representative Signature

______________________________
Sexual Assault Nurse Examiner Signature

*Adapted from Domestic Violence/Intimate Partner Violence Aftercare Instructions Scottsdale Family Advocacy Center, 10225 E Via Linda, Scottsdale AZ, Phone: 480-312-6340. 12/2001.*
26-YEAR-OLD FEMALE PATIENT ASSAULTED BY EX-PARTNER

CASE HISTORY
Maria is a 26-year-old who cleans rooms at a resort hotel. She was in the shower getting ready for work when her ex-partner, Tom, entered the home through the kitchen window to find her in the shower. Tom grabbed her by the neck and pulled her out of the shower. At first, she was unaware of who was hurting her. Once she realized it was her ex-partner and her son’s father, she protested loudly, “you should not do this!” He then squeezed down harder on her neck. Maria said she surrendered to his directions to have sex with him. The son, who was sleeping upstairs, awoke and came downstairs. Tom released her neck when he realized their child was watching. Under Tom’s supervision, Maria ran to the bathroom to finish dressing and continued to plea for him to leave. After threatening her life if she told anyone, Tom left the home. Maria proceeded to drive her son to Tom’s mother’s house for her to watch the child while Maria is at work. After she dropped off her son, Maria left without disclosing the crime to Tom’s mother. Instead of reporting for work, she called the police who brought her to the hospital where she is met by a SANE nurse for a medical forensic examination. During the medical forensic history, Maria disclosed the strangulation.

During your examination the Maria states, “His hands are large and he only needs to put one hand on my neck. He has done this many times before. I know it will only get worse if I do not do what he wants. I usually tell the people I work with that they are suck marks. I do not discuss what happens to me when I am with him. I need to work.” Maria’s demeanor is flat. During the examination, she is playing games on her phone. Maria is not interested in anything and keeps asking to leave to go to work.
ANATOMICAL SKILLS 1-1
Refer to Figure 1-1. Using the numbers that point/correspond to the structure in the photograph, label the anatomical location.

Arrow A: __________________________________________________________

Arrow B: __________________________________________________________

Arrow C: __________________________________________________________

Arrow D: __________________________________________________________
ACTIVITIES

ACTIVITY 1-1. INJURY IDENTIFICATION

Refer to Figure 1-2. Identify any injuries in respect to their anatomical location. Give objective descriptions when documenting findings.

Arrow E: __________________________

Arrow F: __________________________

Arrow G: __________________________

Arrow H: __________________________
ACTIVITY 1-2. ASSESSMENT
List 3 to 6 additional questions the sexual assault nurse examiner or health care provider should ask regarding the physical findings.

ACTIVITY 1-3. PHYSICAL ASSESSMENT
Remember that due to the potential for diminished function, assessment is continuous in all patients and when recognized, requires immediate referral (ie, to an MD, PA, ARNP). List 3 to 6 additional physical assessment activities you should consider.

ACTIVITY 1-4. EVIDENCE COLLECTION
Using the patient’s history, what evidence will you collect?

ACTIVITY 1-5. TREATMENT AND CARE
Based on the history and your findings, what treatment would you offer this patient? Would you report this case to the police or CPS?

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________
ADDITIONAL PHOTOS

Figure 1-3. View of the patient’s neck with bruising.

Figures 1-4 and 1-5. Multiple fingertip bruises down the right side of the neck. The negative filter highlights the area so findings can be easier seen. The negative filter picture must be shown with the original picture.
NOTES