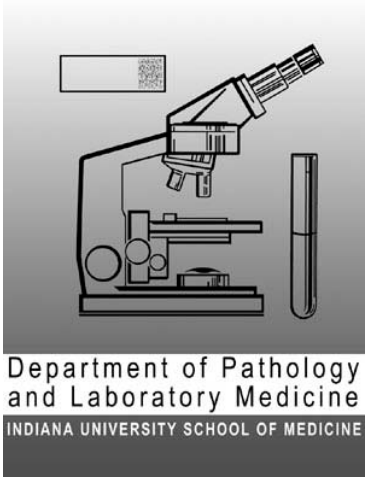
Forensic Medical Findings in Fatal and Non-fatal Intimate Partner Strangulation Assaults



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Autopsy examination in cases of fatal strangulation is a procedure that has probably not changed very much in the last few decades. In fact, perhaps the best medical scientific paper ever written about examination of strangulation victims was published by Gonzales in 1933, relying on European references from the 19th century.[1] The process of strangulation, whether by hand (manual), or by ligature, results in blunt force injury of the tissues of the neck. The pattern of these injuries allows us to recognize strangulation as a mechanism, and to distinguish strangulation from other blunt injuries including hanging, traumatic blows to the neck, and artifacts of decomposition. [2, 3, 4, 5, 6, 7, 8, 9, 10] Strangulation is not always fatal, it does produce medical signs and symptoms for survivors, and the non-fatal assaults are very typical of domestic violence.[11, 12, 13, 14]

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. At autopsy we can exam all of the tissues of the neck, superficial and deep, and track the force vector that produced the injuries. In living people, we are left with superficial examination of the skin, and two-dimensional shadows by radiography.[15, 16] Oftentimes, even in fatal cases, there is no external evidence of injury[17]. While patterned abrasions and contusions of the skin of the anterior neck are typical of strangulations cases, some cases have no externally evident injury whatsoever. The injuries that may occur include patterned contusions and abrasions caused by fingernails, finger touch pads, ligatures, or clothing. These injuries are then prone to change over time, with the healing process. Injuries not at all apparent on the day of death may actually become visible by the next day, as the skin begins to dry and become more transparent. Strangulation injury may be observed by a dentist during routine dental examination.[18

Much medical research has been published on the findings of strangulation, owing to a no-longer promoted practice by police agencies wherein “choke holds” were trained and practiced as a way for officers to subdue suspects.[19, 20, 21, 22] The summary experience with choking for control of suspects -- also called the “carotid restraint hold” ,“shime waza”, or “the sleeper hold” -- is that death can ensue without the intent of the officer, and without leaving external marks on the body. The likelihood of death during neck compression increases if there is advanced age, coronary artery disease of the heart, intoxication with stimulant drugs, or prior brain injury.[19] To quote Drs. Reay and Eisele, “Use of neck holds (by police officers) must be viewed in the same way as firearms; the potential for a fatal outcome is present each time a neck hold is applied and each time

a firearm is drawn from its holster. The neck hold differs in that its fatal consequence can be totally unpredictable."[19]

In addition to the blunt force injuries of the neck, strangulation produces evidence of regional venous obstruction in the neck, recognized as pinpoint hemorrhages (petechiae) in the skin, conjunctiva of the eyes, and deep internal organs of the head and neck, geographically located above the point of constriction in the neck.[23, 24] Ear bleeding has been reported as an infrequent finding in fatal strangulation, related to the mechanism of petechiae.[25] A localized geographic distribution of petechiae develops because the veins are obstructed at the level of the stranglehold, but the arteries are still open, allowing the distal capillaries and venules to over-fill with blood, and rupture. If a medical blood pressure cuff is placed around the left upper arm, and inflated to a pressure that is high enough to obstruct the veins, but that pressure is sustained low enough to leave the arterial flow open, then there develops a regional, geographic distribution of petechiae in the left hand, and left forearm. This happens promptly, and it will not be associated with petechiae anywhere else in the body. The petechiae are confined to the geographic distribution of blood vessels distal to the point of application of force.

The necessary event for creating a localized geographic distribution of petechiae in the head is a pressure high enough to obstruct venous return, but low enough to allow continued arterial filling, and then sustaining that pressure long enough so that the local capillaries and venules over-fill, and rupture under arterial pressure. If the pressure is so great as to obstruct the arterial flow, then there may not be geographic petechiae, but there could still be death. If the pressure is not sustained for long enough to over-fill the blood vessels, then there may not be petechiae, but there could still be death by cardiac arrhythmia, as discussed later.

In addition to the localized, geographic distribution of petechiae sometimes observed with strangulation, one may also have generalized petechiae. Generalized petechiae are a non-specific finding, not specifically related to strangulation by sometimes found in strangulation assault as well as a myriad of other complex circumstances and illnesses. Generalized petechiae can develop from any cause of elevated central venous pressure including, but not limited to, suffocation by pressure on the chest or abdomen. Generalized petechiae in this context are the result of centrally-elevated venous pressure in the chest, rather than a focal or regional venous compression such as a strangulation or a blood pressure cuff on the arm. The causation of increased venous pressure by physical force applied to the chest and abdomen can be a deliberate inflicted injury of suffocation, such as the assailant sitting on the victim's chest or abdomen during an assault, or it can occur by accident such as entrapment beneath a motor vehicle when a mechanic is working on the

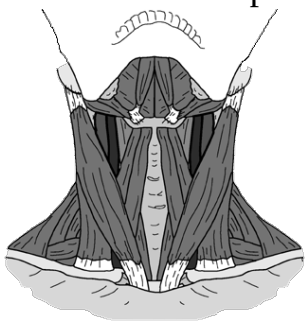
underside of the car and the jack fails. In a medical context, suffocation resulting in elevated central venous pressure and generalized petechiae can happen when medical patients attempt to climb out of hospital beds, and become entrapped in bed rails. Smothering by obstruction of the mouth and nose, (a variant of which is the "sudden infant death syndrome" by face-down sleeping posture for infants), aspiration of gastric contents, profound depressant drug intoxication, and some natural diseases with congestive heart failure can also result in generalized petechiae by increased intra-thoracic negative pressure. In these cases the petechiae do not arise as a result of the asphyxiation alone, but via the elevation in central venous pressure. Drowning and suffocation within an inflated plastic bag (oxygen-deprived atmosphere) are less likely to produce generalized petechiae because the mechanism for increased central venous pressure is absent.[26] Further, generalized petechiae can occur from disorders of blood coagulation, like leukemia, some bacterial infections, excess levels of anticoagulant medications, and other medical circumstances completely unrelated in increased central venous pressure. By these combined mechanisms, simultaneous strangulation and suffocation, when the assailant is sitting on top of the victim while strangling, can result in both geographic and the generalized petechiae. The presence of petechiae does not prove strangulation, and the absence of petechiae does not disprove strangulation.[27] In addition to petechiae, one may also (rarely) find interstitial free air in the lung or mediastinum.[28, 29]

Fingernail marks are superficially incised curvilinear abrasions, occurring singly or in sets. In rare cases, all four fingers will mark the skin in a single pattern.

Fingernail marks are rarely associated with the assailant's hands, but commonly associated with the victim's own fingers, as she struggles to pry the assailant's grasp off her neck. Finger touch pad 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. Ligature abrasions follow a predictable pattern of horizontal circumscription about the neck; distinguishable from the marks left by suicidal hanging, where a suspension point causes the ligature furrow to rise toward one ear.

A common scenario for homicidal strangulation is that the individual is found dead, often reported by the assailant, with a vague history of substance abuse or depression. There being no externally-evident injury, the body is taken for autopsy with a suspicion of drug overdose, and the injury of strangulation is not found until the neck dissection is carried out at autopsy, ordinarily at the end of the case. Therefore, photographs and trace evidence collections are not made.

The scene investigation may be useful in identifying strangulation assaults, based on blood spatter and ligatures.[30] Rarely, the latent fingerprints of the assailant may be recovered from the skin of the victim's neck.[31, 32, 33] Of research interest, it may be possible to actually recover the assailant's skin cells from the victim's injured neck, and DNA-type the recovered cells to the suspect.[34, 35]



Ultimately, a medical opinion of strangulation as the mechanism of neck injury will be based on a complete examination of the patient's neck, either at autopsy or by radiography, to detect superficial and deep injuries fitting a pattern that supports the diagnosis. A common cited injury is fracture of the hyoid bone, actually only found in a minority (no more than one third) of all fatal strangulations.[36, 37, 38, 39, 40, 41, 42] One must keep in mind that the seriousness of the internal injury may take a few hours to be appreciated, and delayed death has been reported.[43, 44]

Autopsy examination of the neck includes complete dissection with removal of the larynx including the hyoid bone, and preferably with the tongue attached. The superficial and deep musculature must be individually examined for contusion hemorrhage. The laryngeal skeleton is then exposed to examine for cartilage fracture. Finally, the cervical spine may be opened and examined for injury.

There is considerable folklore about the neck injury in judicial hanging, including the notion that radical displaced fractures occur. So, common misconception allows that there will be fractures or some sort of internal neck injury in people who hang themselves. In fact, in suicidal hanging there is rarely any internal evidence of neck injury at all. Suicidal hanging is usually affected with very little force. Although there is evidence in the medical literature that neck injury occurs during alleged suicide hangings in Serbia, such injuries are rarely encountered in cases in North America.[45, 46] There are different physiologic mechanisms involved in suicidal hanging, depending on the forces provided by the mechanism as constructed by the decedent.[47] Suicidal hanging is usually painless, and can be accomplished even when lying down in bed. External injury including the dramatic "rope burns" or ligature abrasion only occurs after the body has been suspended for several hours after death.[48] If the ligature is released at the moment of death, there will be no mark in the skin. Leave the body hang suspended by the ligature for a few hours, and a very dramatic furrow and ligature abrasion will develop post-mortem.

Immediate death from hanging or strangulation can progress from one of four mechanisms:

1. **cardiac arrhythmia may be provoked by pressure on the carotid artery nerve ganglion (carotid body reflex) causing cardiac arrest**

2. **pressure obstruction of the carotid arteries prevents blood flow to the brain**
3. **pressure on the jugular veins prevents venous blood return from the brain, gradually backing up blood in the brain resulting in unconsciousness, depressed respiration, and asphyxia**
4. **pressure obstruction of the larynx cuts off air flow to the lungs, producing asphyxia**

Item number 1(carotid body reflex arrhythmia) must be very uncommon. The reflex cardiac arrhythmia can be reproducibly demonstrated in humans, but force must be applied over a very localized and specific anatomic area.[19, 20, 21] Item number 2 (carotid artery occlusion) must also be very uncommon in suicidal hangings, but may be more frequent in homicidal strangulations. Quite a bit of pressure is required to obstruct arterial flow in the carotids, and that amount of force would typically be associated with obvious soft tissue injury locally within the neck muscles or soft tissue planes. Physiologic study has disclosed the forces, location and timing for development of cerebral hypoxia and loss of consciousness with carotid compression by strangulation.[49] When the force is promptly sufficient to obstruct carotid arterial flow, petechiae will not develop.[24] Blunt force injury of the carotid arteries is oftentimes fatal due to arterial thrombosis, stroke, or dissection of the arteries.[50, 51, 52] Carotid artery injury by non-fatal strangulation may also result in delayed stroke with visual defect.[53] Item number 3 is probably the usual route for death by suicidal hanging.[5, 6, 7] Suicidal hanging is often accomplished by standing, sitting or lying with the neck supported by a suspended ligature, so that escape is possible by just standing up or sitting upright. Jumping into the ligature, from a ladder or tree limb is less common. Testing of the ligature, experimenting with the apparatus or checking out the pain threshold is accomplished with slight and completely voluntary pressure applied against the ligature. This pressure fully or at least partially obstructs venous return in the jugular veins, gradually causing passive congestion of blood in the vessels within the brain. This diminishes oxygen delivery to the brain, eventually resulting in loss of consciousness. The type of pressure required is slight, but prolonged. Unconsciousness probably doesn't occur for several minutes, but the overall process is completely painless. Once unconscious, the full weight of the suspended part of the body becomes supported by the ligature, and death ensues. In the practice of autoerotic sexual asphyxia – a behavior of intentional ligature hanging – the asphyxia is alleged to be associated with sexual arousal.[54] Autoerotic asphyxia (discussed in more detail below) is occasionally seen resulting in accidental death in males. But to quote Byard, "autoerotic asphyxial activity by women is a rarely described phenomenon."[55] In cases of suicidal hanging, eventually the individual becomes unconscious, then Item 4 takes over. With the person unconscious, the full weight of the suspended part of the body falls against the ligature, creating enough pressure to restrict air flow through the trachea. Then, irreversible asphyxiation follows in just a few minutes. In a review article posted on

the medical internet service “UpToDate” accessed in November 2012, Ulrich and Goodkin wrote a dissertation titled, “The Choking Game and Other Strangulation Activities in Children and Adults,” wherein they reviewed prior scientific measurements of the timing for loss of consciousness, permanent brain damage, and death during strangulation and suffocation:

> **Cerebral hypoxia and hypoperfusion** — Several elements of strangulation activity may result in cerebral hypoxia. These include breath holding, external limitation of chest wall expansion, and compression of the carotid arteries.* Compression of the carotid sinuses further reduces cerebral oxygenation through reflex bradycardia and vasodilation.*
>
> Acute severe hypoxia can cause loss of consciousness in 10 to 20 seconds, permanent brain damage in three minutes, and death in four to five minutes.** Hypoxia that is less severe can cause impaired judgment, drowsiness, dulled pain sensation, excitement, disorientation, and headache.** Other symptoms and signs of hypoxia include anorexia, nausea, vomiting, tachycardia, and tachypnea; hypertension occurs when hypoxia is severe.
>
> The effects of arrest of cerebral circulation were evaluated in a study that was performed before the Belmont Report (which outlines ethical principles and guidelines for the protection of human subjects).*** Complete arrest of cerebral circulation for 5 to 10 seconds resulted in a rapidly reversible loss of consciousness and convulsive syncope that was preceded by an aura of visual blurring and constriction.
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> *Ullrich NJ, Bergin AM, Goodkin HP. "The choking game": self-induced hypoxia presenting as recurrent seizurelike events. Epilepsy Behav 2008; 12:486.
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> **McPhee SJ, Ganong WF. Respiratory adjustments in health and disease. In: Pathophysiology of Disease: An Introduction to Clinical Medicine, 5th ed, McGraw-Hill, New York 2005
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> ***Rossen R, Kabat H, Anderson JP. Acute arrest of cerebral circulation in man. Arch Neurol Psychiatry 1943; 50:510.

A determination of whether a neck assault has caused “serious bodily injury,” or whether that assault resulted in “a significant risk of serious bodily injury,” is a dilemma for medical experts. Such an opinion could easily “invade the province of the jury,” in a criminal matter, and may actually be a burden of proof or element in a criminal case, rather than language that should be used by a medical expert in offering an opinion about injury risk. A study by Plattner, et al attempted to define this risk, based on the temporal relationship of skin injury, deep muscle injury, petechiae, and loss of consciousness; though the authors admitted that 29% of their population of fair-complexioned Swiss women failed to follow this progression. Plattner, et al did provide a scheme of “light, moderate, or severe life-threatening” strangulation assaults, but were only able to fit 71% of their cases into this scheme.[56] A subjective division of “life-threatening,” and “non-life threatening” for internal MRI

image determination of strangulation injuries was offered by Christe, et al, followed by a discussion of the usefulness of MRI for survivors in determining "danger to life."[57, 58] One shortcoming of the data from Switzerland using MRI to detect internal injuries that are not externally evident is that these studies do not account for causations of injury other than the strangulation event. There is no mention in these papers of blunt force injuries, or injuries that could have been produced by co-occurring suffocation or positional asphyxia such as sitting on the chest or abdomen during the assault, so it is possible that the data reflect a composite of other modalities of injury during an assault. Notwithstanding the drawbacks, data coming out of Europe on intimate partner strangulation suggests a compelling argument in favor of a broad utilization of patient history, symptoms, clinical signs, and radiologic tests as a means of determining that an assault posed a significant risk of death for the victim. These studies also validate the earlier works suggesting hoarseness of voice, pain on swallowing, and breathing difficulty as cardinal clinical signs of strangulation, while also proving that loss of consciousness, urinary or fecal incontinence, and petechiae are strong indicators of a near-lethal experience for the patient. Non-fatal strangulation is a recognized risk factor for subsequent intimate partner homicide, whether by a repeat strangulation assault, or by some other violent act such as stabbing or gunshot.[59, 60]

Suffocation, by obstruction of breathing, can occur as a component of homicidal assault, and can also occur by accident. Covering the mouth and nose by hand, or using a pillow, plastic bag or other object, may result in death by anoxic encephalopathy. Homicidal suffocation is particularly implicated in cases where the victim is especially vulnerable, such as babies, the diseased elderly, or adults significantly impaired by intoxication with alcohol or drugs.[61, 62, 63. 64, 65, 66, 67,68]

In strangulation and suffocation cases, and some suicidal hangings where the individual is "saved" before death, there may be a prolonged period of survival with obvious brain damage, followed by death. This delay is the effect of loss of blood flow to the brain, with partial asphyxiation of the brain. The presence of asphyxial brain damage does not imply a specific mechanism, and there are many ways for asphyxiation to occur involving natural diseases, accidents, suicidal injury, and assaults. A study of the human gene regulatory response to strangulation, suffocation, and natural disease showed prompt and reaction for RNA transcription up-regulation in individuals who were killed by suffocation.[69] The vocabulary for the mechanisms of various asphyxia events is not consistently used in the medical literature; so it is even possible to find medical articles where "strangulation" is used to describe a suicidal hanging death. There has been a proposal for a unified classification scheme for the medical use of the vocabulary of asphyxial trauma; but there are authors and research investigators who have also pointed out definite

shortcomings to the dogmatic use of certain terms, like “traumatic asphyxia,” and “compressional asphyxia.”[70, 71]

A decrease in blood flow to the brain will produce a pathologic change called *anoxic encephalopathy*. Brain cells are not all equally sensitive to loss of blood flow. Some cells die soon, while others survive for days and eventually succumb to the delayed effect of oxygen deprivation. Nerve cell death may be patchy in the brain.[72] Certain localized parts of the brain are more susceptible to anoxia, and other areas are more resistant to anoxia. Fatal anoxic encephalopathy results in clinical “brain death” where the functions of the heart and internal organs can be maintained by medical life support, but all hope of meaningful recovery is lost. Complications may include persistent vegetative coma, cerebral edema (brain swelling), and herniation of the brain. For patients who do recover consciousness, lifelong brain damage may be observed. The damaged nerve cells have been shown to express a gene product, c-fos, which may be found within anoxically-damaged nerve cells.[73]

Quantitation of the actual forces applied to the neck is not a meaningful argument. The amount of force required to compress the jugular vein is less than the force to compress the carotid, and that in turn is less than the force required to constrict the airway. However, absolute values -- measured as foot-pounds of force -- must vary tremendously from one person to the next depending on development of neck musculature, and the surface area for the application of force. If the force were applied over a very narrow surface area -- a clothesline ligature as opposed to a broad belt for example -- then much less force would be necessary. Four variables are working simultaneously:

1. The quantity of applied force or pressure
2. The duration of time that the force is applied
3. The surface area over which the force is distributed
4. The exact specific anatomic location of the applied force

For the same amount of pressure, if you decrease the surface area, or increase the duration of the force, you increase the likelihood that the force will be fatal. Further, if even a small force is applied in just the right anatomic area, the force may obviate the normal anatomic protections of the neck musculature and skeleton. A small woman can easily strangle a large man. The U.S. Army trains “close-range combatives” to use strangulation as a mechanism of lethal force.[74]

Medical resuscitation, and organ procurement procedures, work against the pathologist’s ability to detect fatal homicidal neck injury.[23] An oxygen mask can leave abrasions on the mouth and nasal bridge. During resuscitation, an airway tube is placed into the mouth or nose, and inserted into the esophagus or trachea, to establish a path through which air can be forced under pressure to the lungs. The usual airway

device is an oral endotracheal tube, but many varieties of hardware exist. The skill of the rescue staff, and the size and rigidity of the victim, dictate how much injury occurs during this intubation procedure. Traumatic intubations result in internal injuries of the deep musculature of the larynx, often completely mimicking the injuries of strangulation.[75] Ulceration of the larynx may develop from pressure produced by the inflatable cuff on the tube. The mechanical ventilation can produce barotrauma in the lungs, with air dissecting up to the skin of the neck. In cases where the rescue staff is unable to intubate the patient, they might attempt a surgical cricothyroidotomy or tracheostomy procedure to establish an airway. This would completely obliterate all signs of manual strangulation. Further, intravenous needles are sometimes placed into the jugular veins, leaving tracks of hemorrhage that can obscure physical injuries. If resuscitation is successful, the patient may linger on mechanical ventilation for hours or days, resulting in healing of soft tissue injuries in the neck that would have been recognizable if examined earlier. Toxicology is meaningless in patients who survive a few days in the hospital, so disproving a defense theory that the asphyxial death was caused by overdose of prescribed or abused drugs becomes impossible.

Postmortem changes in the body, during the fixation of livor mortis and beginning putrefactive changes, can produce alterations in the tissues of the neck and skin of the body that resemble strangulation injuries. Prinsloo and Gordon described hemorrhages in the neck due to decomposition.[9] Bockholdt, Maxeiner and Hegenbarth described “postmortem hypostatic hemorrhages,” resembling petechiae, that develop during the late postmortem interval, sometimes even in the conjunctivae of the eyes, and are associated with a face-down postmortem position of the body and morbid obesity.[76] Pollanen, et al devised an actual cadaver model for the production of postmortem hypostatic hemorrhages into the neck muscles, even finding a false appearance of inflammation in the hemorrhages, but the “rig” used to suspend the decomposing bodies required a radical inclination from toe-to-head, and even then they failed to produce postmortem hemorrhages in about half the tested cadavers.[77] Putrefaction in the neck muscles may also resemble contusions of strangulation assault. In some cases, it may not be possible to discern the presence of strangulation in decomposing bodies. Drowning has also been claimed as a mechanism for hemorrhage in the connective tissue fascia between neck muscles, as opposed to crush injury within the muscle fibers.[78] The dilemma for the medical examiner is much worse if there is a history of domestic violence, and also a history of drug or alcohol abuse or withdrawal; additional reasons to be found dead, decomposing, with potentially-factitious hemorrhages in the neck, an otherwise negative autopsy, and sub-lethal toxicology.

In some communities, organ procurement procedures are routinely performed, regardless of the circumstances of death. A dissection for heart donation can totally obliterate all evidence of injury by manual strangulation. Donation of corneas will

obscure observation of petechiae in the eyes. The prosecutor is then dependent on the organ procurement team to recognize subtle injuries before they are obscured by the procedure. Few organ procurement technicians or physicians will have any experience whatsoever testifying in murder trials. In the autopsy investigation of strangulation in domestic assault cases, every injury on the body becomes significant. Contusions of the chest wall, abdomen, and extremities become valuable evidence to establish a pattern of abuse. Like child abuse cases, the autopsy strives to illuminate a big picture, not just focus singularly on the neck examination. Each and every bruise and scrape is important. These peripheral injuries can be jeopardized by organ and tissue donation procedures.[79]

Asphyxiation in the pursuit of sexual arousal has been cited as a cause of "accidental" death in strangulation cases. A point well-taken is that sexual behavior is a common component of homicidal asphyxial deaths -- Di Maio determined rape in 66% of women strangled by ligature, and 52% of women manually strangled.[62] Autoerotic sexual asphyxia occurs in men (these combined studies include 241 men, no women) who were alone (not with someone else), engaged in a paraphilia with sexual arousal, and who died accidentally.[80,81, 82,83,84] Asphyxial death during paraphilia has been reported in eight women, but four of those eight cases had circumstances described by the authors as "equivocal" or "atypical" or "none," and the authors summarized their findings as "rarely reported in women".[55] Shields, et al reported one female in a series of eleven "atypical autoerotic deaths," and then further characterized that case as actually being a homicide perpetrated by an intimate partner, completely defying the definition of "autoerotic".[85] Gosink cites a male:female ratio of "greater than 50:1" for autoerotic asphyxiation.[86] The medical literature therefore indicates that the combined findings of strangulation and sexual assault in a woman means that homicidal behavior is likely, and accidental paraphilic behavior is extremely unlikely. In an article based only upon a review of the published litererature, Sauvageau, et al reported a 21:7 male:female ratio, but this review includes the cases previously reported by Byard [55] where those cases were described in the original work as "atypical" and "equivocal."[87] Byard subsequently (2012) published a 7-year retrospective review of cases in Australia and Sweden citing a total of 53 cases, with two of those occurring in women; which would be a ratio of men:women as 27:1. [88]

Suicide by self-strangulation has been reported as a very rare event.[89, 90] Circumstances of death would need to be very carefully examined to come to the unlikely conclusion that a strangulation death was self-inflicted. Much more common than this issue of "self-strangulation is the alleged defense of suicidal hanging in the context of suspected strangulation homicide. There are usually multiple pathologic findings that allow determination of ligature strangulation (pressure applied to the neck), where these findings also help exclude hanging (ligature suspension of the head

and neck). As already discussed, the determination of direction of applied force from the ligature mark, where gravity causes a downward force, is the most helpful. Additional support for a theory of strangulation may be found if other injuries elsewhere on the body suggest defensive injuries; whereas support for a theory of suicidal hanging may include contusions of the extremities due to body contact from dropping, swinging, or thrashing during hanging.[91]

Asphyxiation or "asphyxial game play" behavior reported in the media as "the choking game" has been reported among children.[92, 93, 94] Published tables of undocumented cases suggests that there are occasionally female child participants in this behavior.[95] A study from India where strangulation is more frequently a mechanism of homicide, reports an increasing frequency of strangulation homicide deaths of male and female children under the age of 12 years.[96]

Intimate partner strangulation homicide can be complicated by the post-mortem finding of blood levels of drugs or intoxicants that might appear to offer an elegant defense theory, that the death occurred by deliberate suicidal intoxication or overdose after the strangulation injury, so that the assailant "merely" committed a physical assault, or even a consensual "asphyxophilic sexual injury" and then the victim later committed suicide. Just such a circumstance was reported by Dettling, et al.[97] This paper addresses the technical toxicology interpretation issues for post-mortem redistribution of an anti-depressant drug, but it does not offer a conclusion or adjudication of the case, which is an alleged intimate partner strangulation homicide.

A training videotape has been produced by the office of the San Diego City Attorney, for teaching information about strangulation in domestic violence assault. This video would be useful to domestic violence instructors involved in training law enforcement first responders, domestic violence detectives, dispatch operators, prosecutors, judges, advocates, and medical and nursing specialists. The video is available as:

"*Strangulation: Never Let a Victim Die in Vain*." A video production of IMO Productions, Inez Odom, Producer. 2 hrs, VHS, with companion workbook and resource materials. An educational documentary film in"Violence Against Women, The Series," IMO Productions, 5276 Caminito Cachorro, San Diego, CA 92105. See at http://www.imoproductions.com. November, 2001

Criminal Statutes Specific for Strangulation Assault

Many states have statutes that specifically address criminal behavior of strangulation and/or suffocation in domestic violence (intimate partner violence) assaults. There have been limited studies of the effectiveness of domestic violence

felony strangulation laws, in promoting victim safety, and improving offender accountability.[98, 99, 100,101]

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