

Dr. Bill Smock, Police Surgeon Louisville, KY



- “Every victim of a crime has some sort of evidence on them. That's why staff is trained to recognize and preserve the evidence.”
- "It's critical for the doctors and nurses that take care of these patients to recognize and preserve that evidence.”
 - <http://www.emsworld.com/news/10339226/new-hospital-protocol-helps-protect-evidence>

Identifying the Signs and Symptoms of Strangulation Assaults

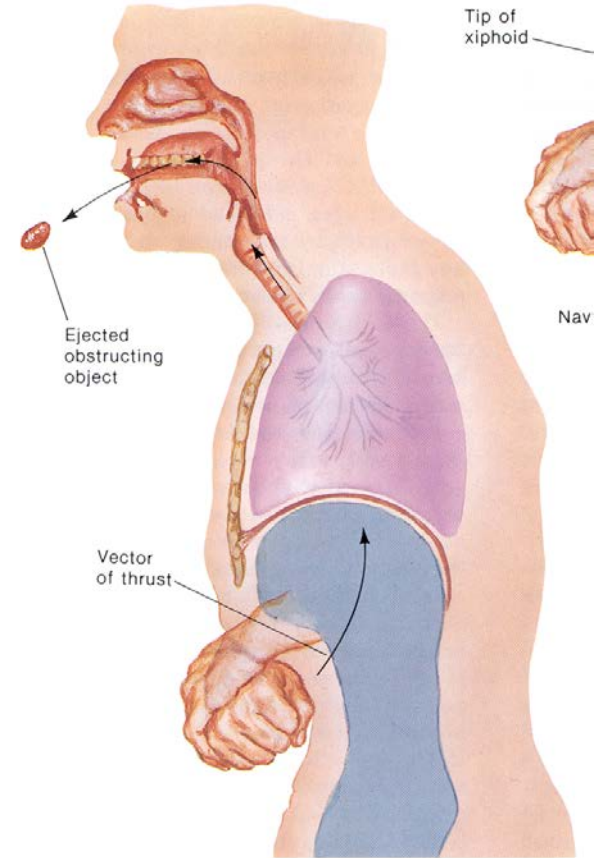
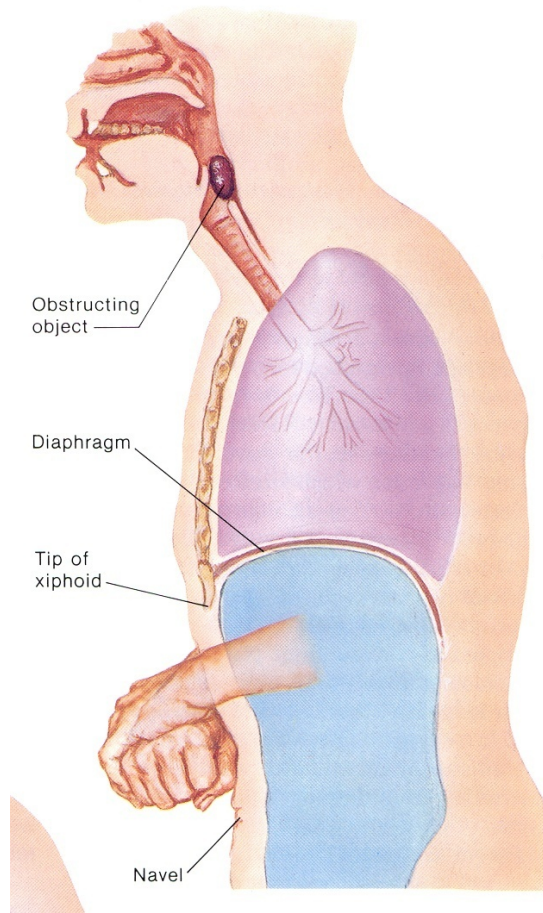
Louisville Team



Definition

- Strangulation is a form of asphyxia characterized by closure of the blood vessels and/or air passages of the neck as a result of external pressure on the neck

Strangulation is not “choking”



Suffocation

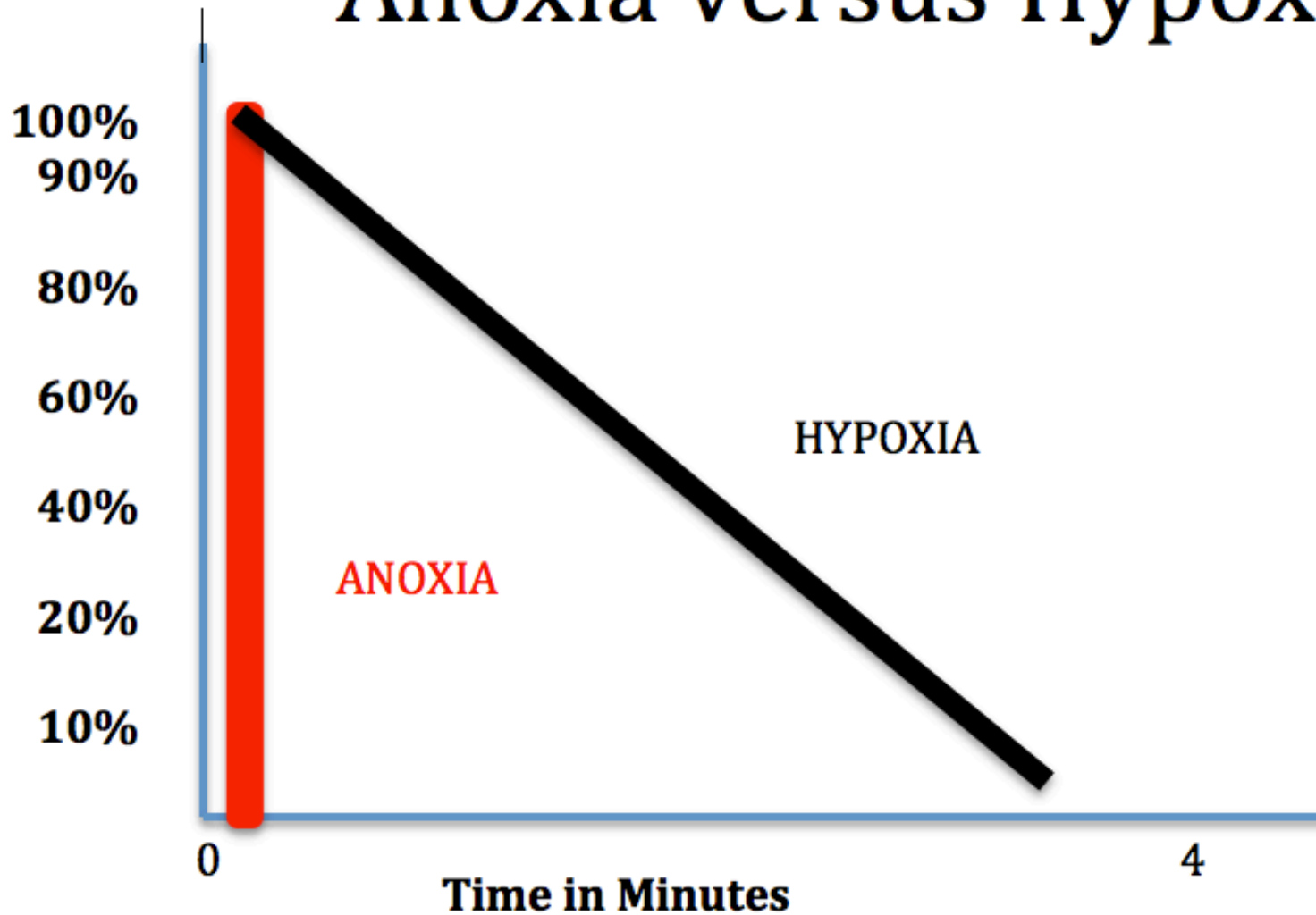
- **Obstructing oxygen from getting into the lungs**
- **Sealing off the mouth and nose by manual compression**
- **Duct tape over face**
- **Head inside plastic bag**
- **Pillow over mouth and nose**
- **Sitting on chest**

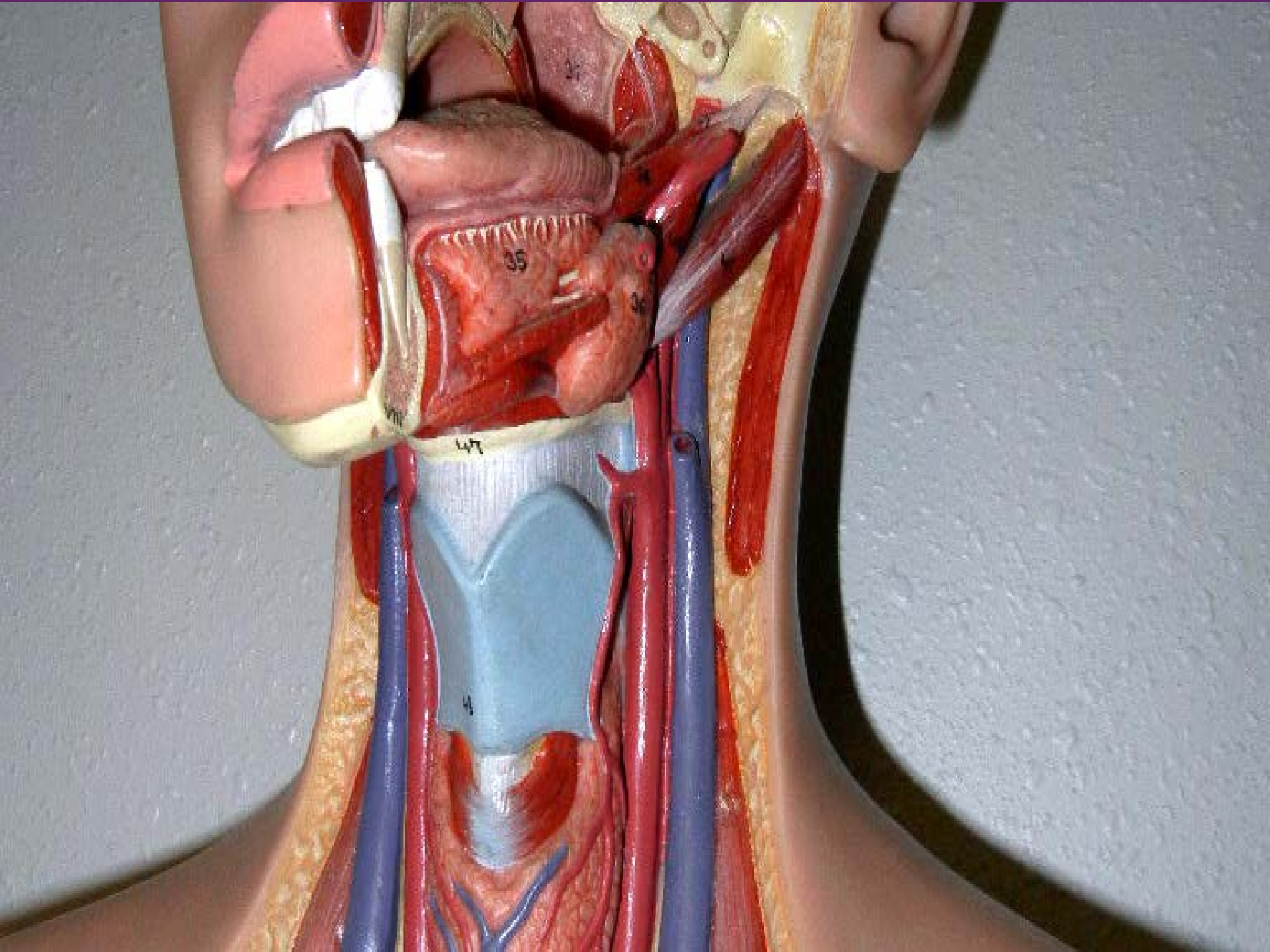
Key Terms

- Asphyxia (as-phyx-i-a):
 - A condition arising when the body is deprived of oxygen causing unconsciousness or death; suffocation.
- Anoxia (a-nak-se-a):
 - Absence of oxygen supply to tissue (carotid compression in strangulation-no blood flow)
- Hypoxia (hy-pox-i-a):
 - Deficiency in the amount of oxygen reaching the tissue (drowning-blood flow with decreasing oxygen levels)

02 SAT

Anoxia versus Hypoxia





Vessel Occlusion

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





The Choking Game

Since January 2006, when this woman's son (Alex age 13) died, the strand of beads has grown to 645 beads, more than 23 feet in length. She doesn't need to add any more.

www.salon.com

Neurologic Insult to Brain

ACUTE ARREST OF CEREBRAL CIRCULATION
IN MAN

LIEUTENANT RALPH ROSSEN (MC), U.S.N.R.*

HERMAN KABAT, M.D., PH.D.

BETHESDA, MD.

AND

JOHN P. ANDERSON

RED WING, MINN.

Archives of Neurology and Psychiatry, 1944 Vol. 50, 5



Anoxic Progression

- 6.8 seconds – unconscious (brain cells begin to die)
- Anoxic seizure (lasts 2-8 seconds)
- 15+ seconds – loss of bladder control
- 30+ seconds – loss of bowel control
- ?? seconds – point of no return: “brain dead”/coma
- Amount of brain cell death will depend on the location of oxygen deprivation in the brain, length of unconsciousness, age, prior anoxic episodes.
- 1 - 2.5 Minutes – death (no controlled human studies but videos of deaths))

Anoxic (lack of oxygen) Injury

- “Anoxic Convulsions: These seizures were of a generalized tonic and clonic type; they were usually relatively mild and rarely continued more than six to eight seconds.”
- “The convulsion was preceded by loss of consciousness”
- “had no memory of it (seizure)”

Internal/External Signs

- Involuntary urination or defecation (sphincter incontinence)

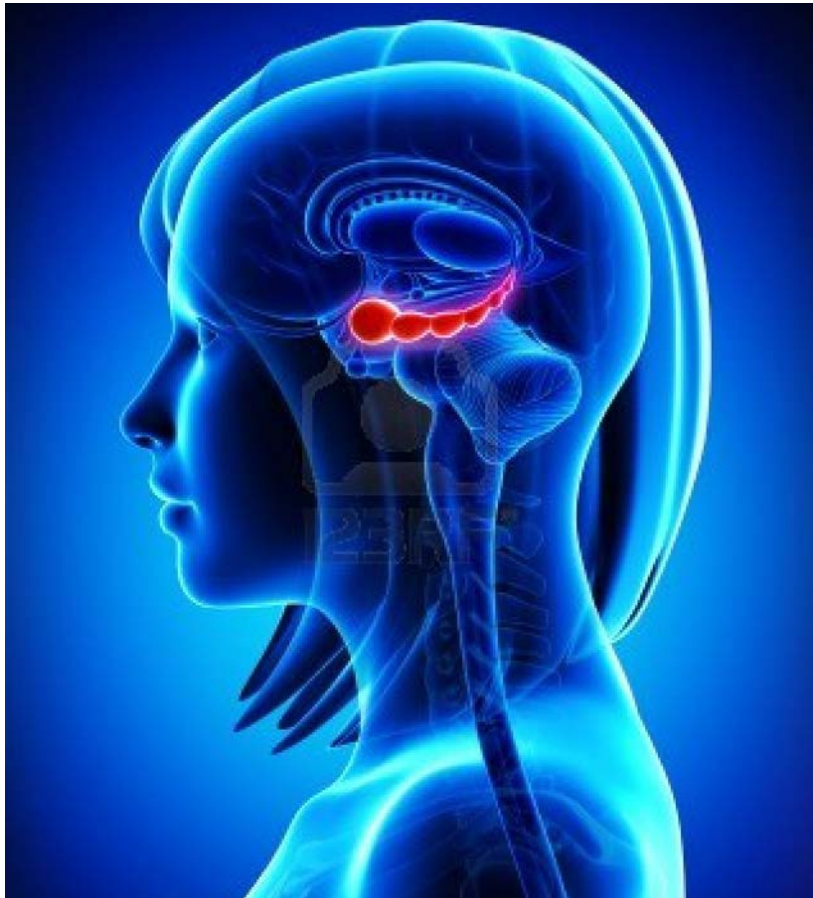


Evidence of Alterations of Consciousness = Anoxic Injury

Brain Injury in Battered Women, Journal of Consulting and Clinical Psychology, 2003, Vol. 71, No. 4, 797-804

- A period of dizziness
- Stunned or disoriented
- Saw stars or spots (visual impairment)
- Loss of consciousness or blacked out
- Loss of memory
- Gaps of time or location
- Standing up one minute then waking up on the floor
- Bowel or bladder incontinence
- Unexplained bump on head

Hippocampus



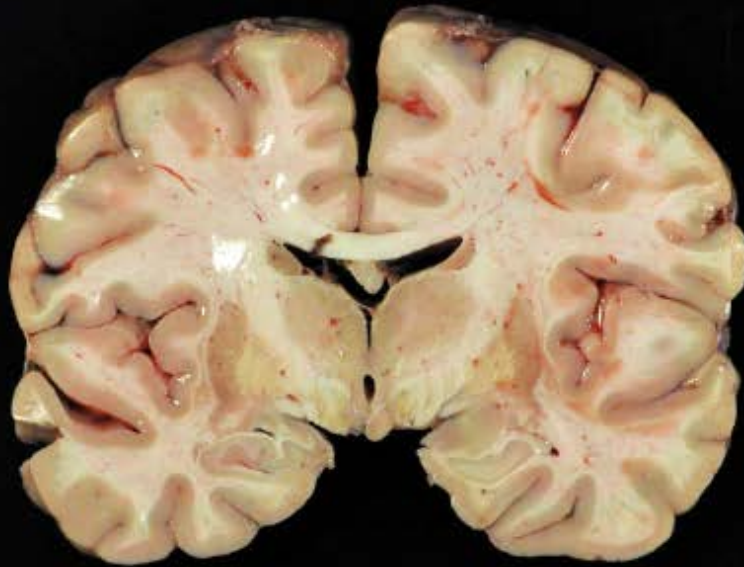
- The hippocampus is critical for forming memory, organizing and storing.
- Hippocampus is very sensitive to lack of oxygen.
- If no blood flow, the brain is NOT working.
- No blood flow. No memory.
- No memory means damage to hippocampus.

SIE: Strangulation Induced Encephalopathy

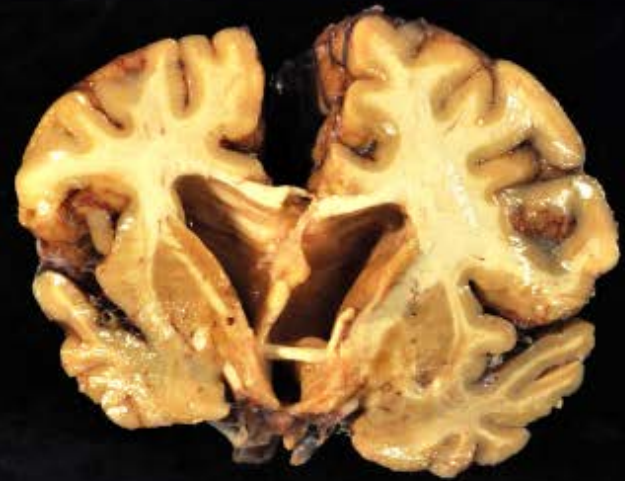
(Symptoms similar to CTE)

- Behavioral Changes
 - Early: Restlessness and violence
 - No memory or unable to remember is she lost consciousness
 - Long term:
 - Psychosis
 - Amnesia
 - Changes in personality
 - Progressive dementia
 - Cryptogenic strokes





Normal Brain



Advanced CTE

Source: Boston University Center for the Study of Traumatic Encephalopathy

SIGNS (Objective)

SIGNS (WHAT YOU MAY SEE OR HEAR):

BLOOD RED EYES

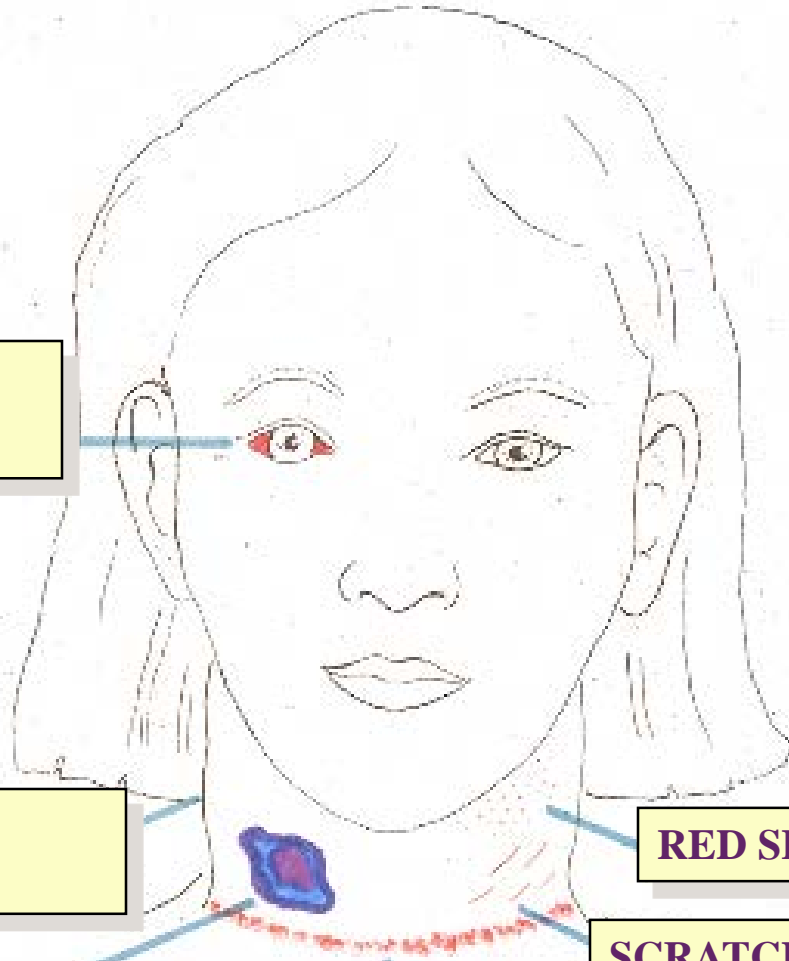
NECK SWELLING

BRUISING

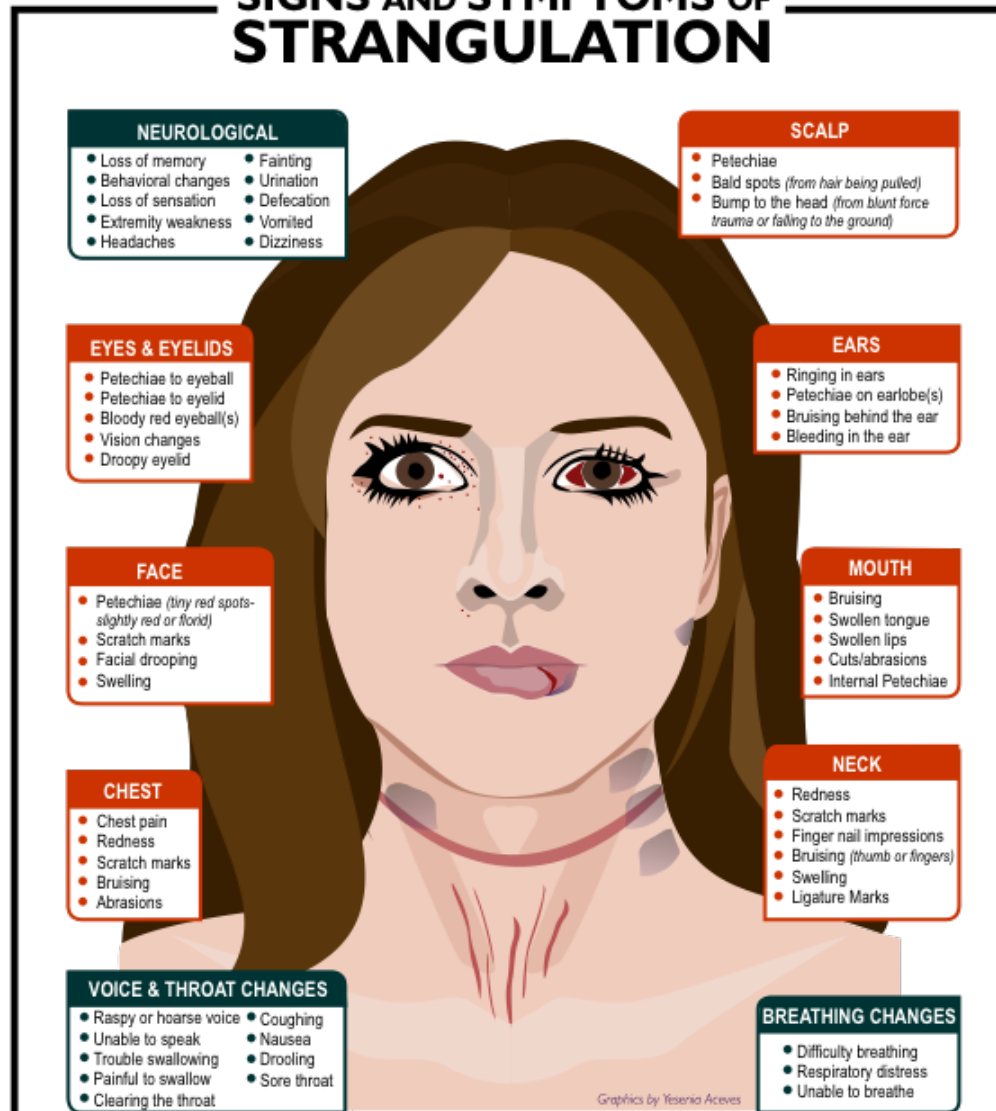
RED SPOTS

SCRATCHES

ROPE BURNS



SIGNS AND SYMPTOMS OF STRANGULATION



Source: Strangulation in Intimate Partner Violence, Chapter 16, Intimate Partner Violence, Oxford University Press, Inc. 2009.

Why no bruising or lots of bruising?

- Use of a broad soft ligature or forearm when the force is applied over a wide area
- Multiple variables: health conditions, medications
- When rapid death due to reflex cardiac arrest occurs, bruising will not have time to develop



Petechiae



**Petechiae are
smooth and flat.**

**Acne is usually
raised or bumpy.**

Note the distinction.

Petechial Hemorrhage: Rupture of vessels from increased venous pressure (blockage of jugular vein)





Courtesy of Dr. Smock

Medical Examination





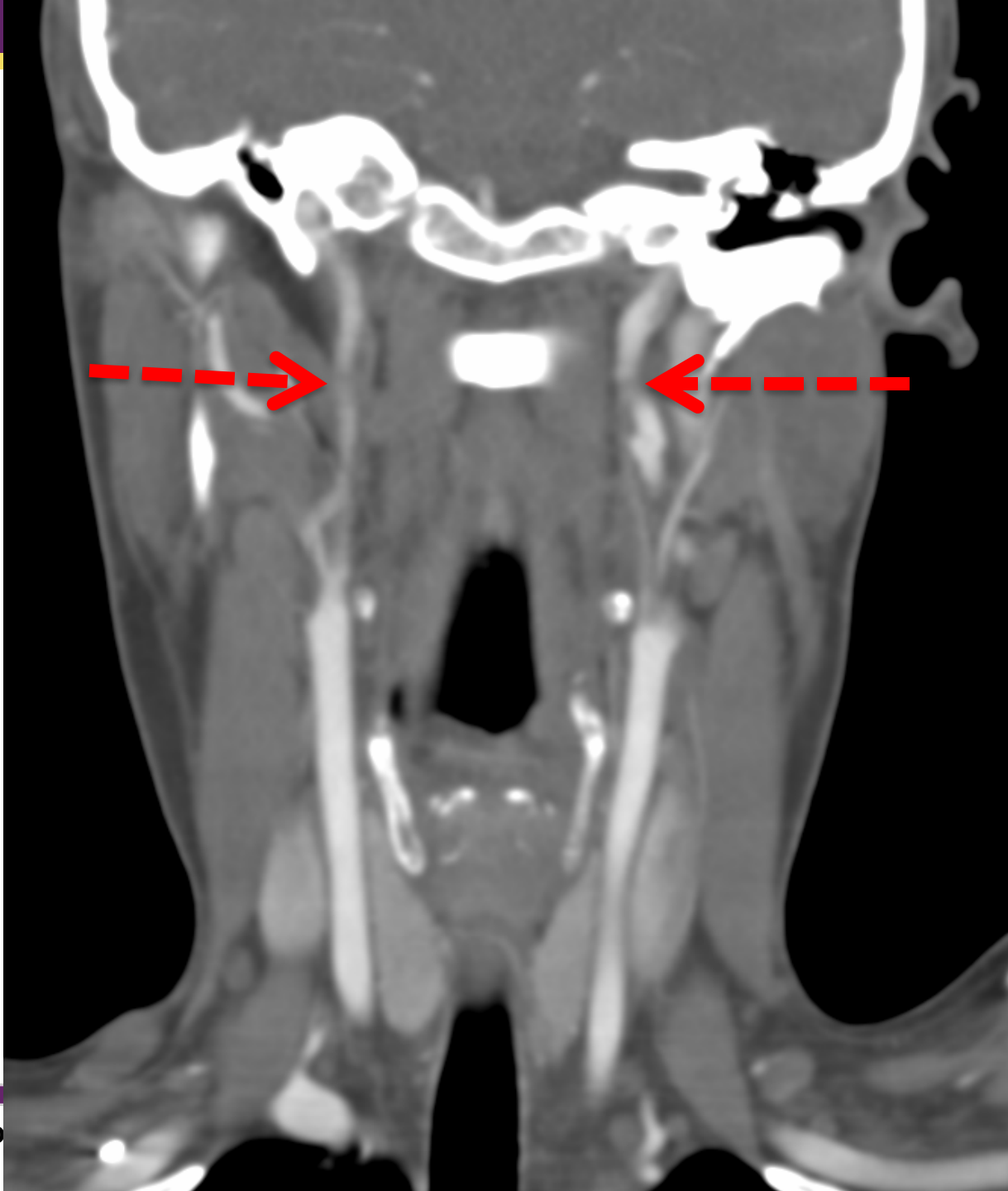


1. Contusion.
2. Status post strangulation.

DISPOSITION:
Discharge to home.

CONDITION ON DISCHARGE:
Stabilized.

DISCHARGE INSTRUCTIONS:
Follow up with Dr. Kureshi as an outpatient. Return precautions were given. Return for new or worsening symptoms or any other concerns.





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



Prepared by Bill Smock, MD and Sally Sturgeon, DNP, SANE-A
Office of the Police Surgeon, Louisville Metro Police Department
Endorsed by the National Medical Advisory Committee: Bill Smock, MD, Chair; Cathy Baldwin, MD; William Green, MD; Dean Hawley, MD; Ralph Rivello, MD; Heather Rozzi, MD; Steve Slapczynski, MD; Elen Taliaferro, MD; Michael Weaver, MD

GOALS:

1. Evaluate carotid and vertebral arteries for injuries
2. Evaluate bony/cartilaginous and soft tissue neck structures
3. Evaluate brain for anoxic injury

Strangulation patient presents to the Emergency Department

History of and/or physical exam with ANY of the following:

- Loss of Consciousness (anoxic brain injury)
- Visual changes: "spots", "flashing light", "tunnel vision"
- Facial, intraoral or conjunctival petechial hemorrhage
- Ligature mark or neck contusions
- Soft tissue neck injury/swelling of the neck/cartoid tenderness
- Incontinence (bladder and/or bowel from anoxic injury)
- Neurological signs or symptoms (LOC, seizures, mental status changes, amnesia, visual changes, cortical blindness, movement disorders, stroke-like symptoms.)
- Dysphonia/Aphonia (hematoma, laryngeal fracture, soft tissue swelling, recurrent laryngeal nerve injury)
- Dyspnea (hematoma, laryngeal fractures, soft tissue swelling, phrenic nerve injury)
- Subcutaneous emphysema (tracheal/laryngeal rupture)

History of and/or physical exam with:

- No LOC (anoxic brain injury)
- No visual changes: "spots", "flashing light", "tunnel vision"
- No petechial hemorrhage
- No soft tissue trauma to the neck
- No dyspnea, dysphonia or odynophagia
- No neurological signs or symptoms (i.e. LOC, seizures, mental status changes, amnesia, visual changes, cortical blindness, movement disorder, stroke-like symptoms)
- And reliable home monitoring

Recommended Radiographic Studies to Rule Out Life-Threatening Injuries* (including delayed presentations of up to 6 months)

- CT Angio of carotid/vertebral arteries (GOLD STANDARD for evaluation of vessels and bony/cartilaginous structures, less sensitive for soft tissue trauma) *or*
- CT neck with contrast (less sensitive than CT Angio for vessels, good for bony/cartilaginous structures) *or*
- MRA of neck (less sensitive than CT Angio for vessels, best for soft tissue trauma) *or*
- MRI of neck (less sensitive than CT Angio for vessels and bony/cartilaginous structures, best study for soft tissue trauma) *or*
- MRI/MRA of brain (most sensitive for anoxic brain injury, stroke symptoms and intercerebral petechial hemorrhage)
- Carotid Doppler Ultrasound (NOT RECOMMENDED: least sensitive study, unable to adequately evaluate vertebral arteries or proximal internal carotid) *References on page 2

Discharge home with detailed instructions to return to ED if: neurological signs/symptoms, dyspnea, dysphonia or odynophagia develops or worsens

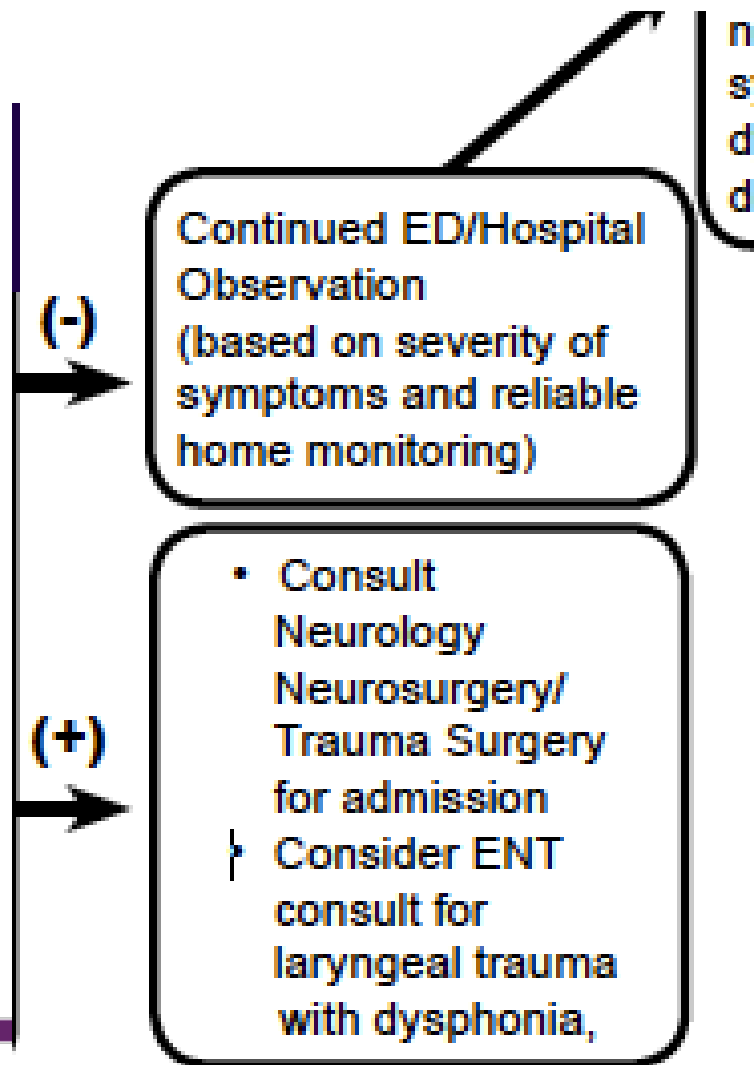
(-) Continued ED/Hospital Observation (based on severity of symptoms and reliable home monitoring)

(+) Consult Neurology/Neurosurgery/Trauma Surgery for admission
Consider ENT consult for laryngeal trauma with dysphonia

Recommended Radiographic Studies to Rule Out Life-Threatening Injuries* (including delayed presentations of up to 6 months)

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Disposition?



-hospital

Discharge home with detailed instructions to return to ED if:
neurological signs/
symptoms, dyspnea,
dysphonia or odynophagia
develops or worsens

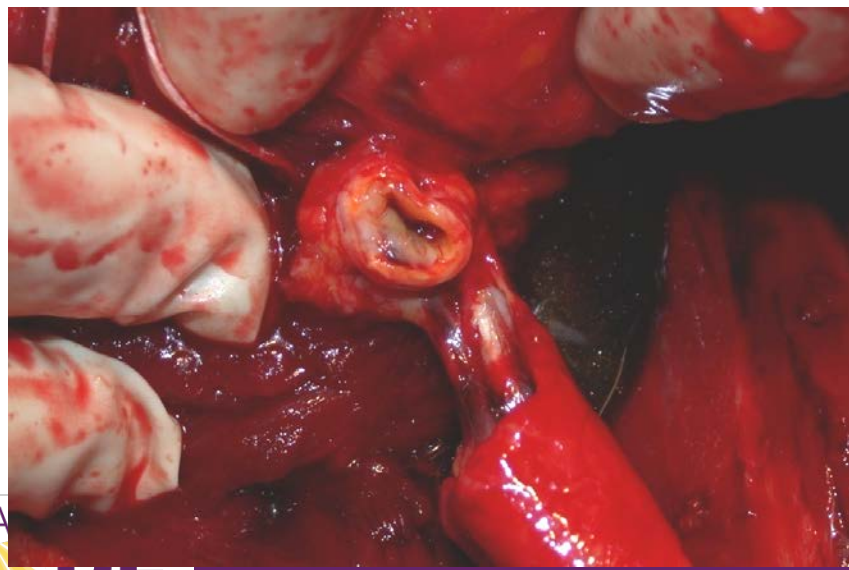


Table 1 Literature review of carotid artery dissection.

Case No.	Authors and Year	Age/Sex	Epiology of Dissection	Side	Treatment	Time Interval after Onset	Initial Symptoms
1	Anne et Al, 2002	24/f	motor vehicle accident	bilateral	anticoagulation	1 day	GCS 8, Lt hemiplegia
2	Anne et Al, 2002	25/f	motor vehicle accident	bilateral	anticoagulation	6 days	drowsiness, Rt hemiparesis, Rt Honer
3	Bejjani et Al, 1999	53/m	direct blow	rt	stenting	3 months	Lt hemiparesis
4	Bejjani et Al, 1999	18/m	gunshot	rt	stenting	8 days	Lt hemiparesis
5	Bejjani et Al, 1999	33/f	motor vehicle accident	lt	stenting	1 day	Rt hemiplegia
6	Bejjani et Al, 1999	55/f	lift a heavy load	rt	stenting	2 weeks	Lt neck pain, headache
7	Doi et al., 2004	21/m	motor vehicle accident	rt	stenting	2 hours	GCS 20, Lt hemiparesis
8	Duncan et Al, 2000	39/m	motor vehicle accident	bilateral	anticoagulation	a few hours	Lt hemiplegia
9	Fabrizio et Al, 2004	17/m	motor vehicle accident	bilateral	stenting	?	Lt hemiparesis
10	Khaqan et Al, 1996	41/f	motor vehicle accident	bilateral	anticoagulation	1 day	Lt lower limb paresis
11	Malek et Al, 2000	37/f	domestic abuse	bilateral	stenting	3 months	Rt hand weakness and numbness
12	Malek et Al, 2000	43/f	domestic abuse	bilateral	stenting	3 months	Lt hemiparesis
13	Malek et Al, 2000	24/f	domestic abuse	bilateral	anticoagulation	6 months	GCS 300
14	Malek et Al, 2000	37/f	hanging injury	lt	stenting	3 months Rt	hemiparesis, leg numbness, and dysphagia
15	Malek et Al, 2000	44/f	motor vehicle accident	lt	stenting	4 months	dysphasia, Rt arm weakness, and numbness
16	Noguchi et Al, 1992	50/f	hanging injury	rt	carotidendoarterctomy	2 years	Lt arm 4/5, hypoesthesia
17	Okada et Al, 1999	30/f	motor vehicle accident	lt	bypass surgery	7 months	Rt hemiparesis
18	Okada et Al, 1999	42/f	motor vehicle accident	rt	bypass surgery	2 days	Lt hemiparesis
19	Okada et Al, 1999	58/f	motor vehicle accident	rt	bypass surgery	10 years	Lt hemiparesis
20	Okada et Al, 1999	41/f	hanging injury	rt	bypass surgery	2 years	dizzines
21	Okada et Al, 1999	42/m	direct blow	rt	bypass surgery	2 years	Lt hemiparesis
22	Okuchi et Al, 1999	29/m	motor vehicle accident	rt	anticoagulation	11days	GCS 200
23	Scavee et Al, 2001	53/m	motor vehicle accident	rt	stenting	6 weeks	dizziness, neck pain
24	Stahlfeld et Al, 2002	39/m	ride on a rollar coaster	rt	anticoagulation	3 weeks	headache, Lt eye pain, Lt temporoparietal numbness

Dr. Smock's Top 25 Medical Consequences Resulting from Strangulation and Lateral Vascular Neck Restraint

STRANGULATION ASSESSMENT CARD

SIGNS	SYMPTOMS	CHECKLIST	TRANSPORT
<ul style="list-style-type: none"> ● Red eyes or spots (Petechiae) ● Neck swelling ● Nausea or vomiting ● Unsteady ● Loss or lapse of memory ● Urinated ● Defecated ● Possible loss of consciousness ● Ptosis – droopy eyelid ● Droopy face ● Seizure ● Tongue injury ● Lip injury ● Mental status changes ● Voice changes 	<ul style="list-style-type: none"> ● Neck pain ● Jaw pain ● Scalp pain (from hair pulling) ● Sore throat ● Difficulty breathing ● Difficulty swallowing ● Vision changes (spots, tunnel vision, flashing lights) ● Hearing changes ● Light headedness ● Headache ● Weakness or numbness to arms or legs ● Voice changes 	<p>S Scene & Safety. Take in the scene. Make sure you and the victim are safe.</p> <p>T Trauma. The victim is traumatized. Be kind. Ask: what do you remember? See? Feel? Hear? Think?</p> <p>R Reassure & Resources. Reassure the victim that help is available and provide resources.</p> <p>A Assess. Assess the victim for signs and symptoms of strangulation and TBI.</p> <p>N Notes. Document your observations. Put victim statements in quotes.</p> <p>G Give. Give the victim an advisal about delayed consequences.</p> <p>L Loss of Consciousness. Victims may not remember. Lapse of memory? Change in location? Urination? Defecation?</p> <p>E Encourage. Encourage medical attention or transport if life-threatening injuries exist.</p>	<p>If the victim is Pregnant or has life-threatening injuries which include:</p> <ul style="list-style-type: none"> ● Difficulty breathing ● Difficulty swallowing ● Petechial hemorrhage ● Vision changes ● Loss of consciousness ● Urinated ● Defecated <p>DELAYED CONSEQUENCES</p> <p>Victims may look fine and say they are fine, but just underneath the skin there would be internal injury and/or delayed complications. Internal injury may take a few hours to be appreciated. The victim may develop delayed swelling, hematomas, vocal cord immobility, displaced laryngeal fractures, fractured thyroid bone, airway obstruction, stroke or even delayed death from a carotid dissection, bloodclot, respiratory complications, or anoxic brain damage.</p> <p>Taliaferro, E., Hawley, D., McClane, G.E. & Strack, G. (2009), Strangulation in Intimate Partner Violence. <i>Intimate Partner Violence: A Health-Based Perspective</i>. Oxford University Press, Inc.</p> <p>This project is supported all or in part by Grant No. 2014-TA-AX-K008 awarded by the Office on Violence Against Women, U.S. Dept. of Justice. The opinions, findings, conclusions, and recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the Department of Justice, Office on Violence Against Women.</p>

ADVISAL TO PATIENT

- After a strangulation assault, you can experience internal injuries with a delayed onset of symptoms, usually within 72 hours. These internal injuries can be serious or fatal.
- Stay with someone you trust for the first 24 hours and have them monitor your signs and symptoms.
- Seek medical attention or call 911 if you have any of the following symptoms: difficulty breathing, trouble swallowing, swelling to your neck, pain to your throat, hoarseness or voice changes, blurred vision, continuous or severe headaches, seizures, vomiting or persistent cough.
- The cost of your medical care may be covered by your state's victim compensation fund. An advocate can give you more information about this resource.
- The National Domestic Violence Hotline number is **1-888-799-SAFE**.

NOTICE TO MEDICAL PROVIDER

- The Medical Advisory Board of the Training Institute on Strangulation Prevention has developed recommendations for the radiologic evaluation of the adult strangulation victim. In patients with a history of a loss of consciousness, loss of bladder or bowel control, vision changes or petechial hemorrhage the medical provider must evaluate the carotid and vertebral arteries, bony/cartilaginous and soft tissue neck structures and to the brain for injuries. The recommendations with the medical references is available at www.strangulationtraininginstitute.com
- Life-threatening injuries include evidence of petechial hemorrhage, loss of consciousness, urination, defecation and/or visual changes. If your patient exhibits any of the above symptoms, medical/radiographic evaluation is strongly recommended. Radiographic testing should include: a CT angiography of carotid/vertebral arteries (most sensitive and preferred study for vessel evaluation) or CT neck with contrast, or MRA/MRI of neck and brain.
- ED/Hospital observation should be based on severity of symptoms and reliable home monitoring.
- Consult Neurology, Neurosurgery and/or Trauma Surgery for admission.
- Consider an ENT consult for laryngeal trauma with dysphonia, odynophagia, dyspnea.
- Discharge home with detailed instructions to return to ED if neurological signs/symptoms, dyspnea, dysphonia or odynophagia develops or worsens.



StrangulationTrainingInstitute.com

Important to Remember

- **Victims may have NO visible injuries, with only transient symptoms-yet because of carotid injuries or brain damage from lack of oxygen during the strangling, victims have stroked or died up to several months later**
- **The carotid arteries, especially the internal carotids, must be evaluated if the patient has signs or symptoms related the application of significant external pressure to the neck**
- **Injuries can blossom in both the living and deceased, re-examine in 48-72 hours.**



Contact information:

www.strangulationtraininginstitute.com

Thank you – Queensland Centre for
Domestic and Family Violence Research