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

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#1

- Acute Death
  - Compression of blood vessels: jugular veins (2.86 - 4.4 pounds of pressure), carotid artery (11 pounds of pressure) and vertebral arteries (16.5 - 66 pounds of pressure)
  - anoxic/hypoxic brain cell death

Kornblum RN, Medical Analysis of Police Choke Holds and General Neck Trauma Part 2, Trauma, 1986, 1:13-64
#2

• Acute Death
  – Compression/occlusion of trachea: minimum of 34.5 pounds of pressure on trachea
  – anoxic/hypoxic brain cell death

Kornblum RN, Medical Analysis of Police Choke Holds and General Neck Trauma Part 1, Trauma, 1986, 5:7-64
• Acute Death
  – Vagal stimulation from pressure on baroreceptors in the carotid sinus and carotid body results in a significant decrease heart rate, blood pressure or development of cardiac arrhythmia
  – Anoxic/hypoxic brain cell death. Unable to perfuse the brain

• Delayed Death
  – Anoxic/hypoxic brain cell death
  – Multisystem organ failure
  – Hours to days to months post strangulation/”choke hold”
  – Many victims appeared “normal”

Dooling EC, Richardson EP: Delayed Encephalopathy After Strangling: Arch Neurol 1976;33;196-9
• Acute Ischemic Stroke
  – Blockage of the carotid arteries results in brain cell death
  – Blockage of a single artery kills 32,000 neurons/second, 230 million synapses/second and 218 yards of myelinated fibers/second (X2 for two arteries)

JL Saver, “Time is Brain-Quantified”; Stroke, 2006;37:263-266
#5 (Cont.)

- Acute Ischemic Stroke
  - Kentucky police officer developed acute stroke symptoms within 10 minutes after lateral vascular neck restraint training (tapped out while still conscious)*
  - Florida Police Academy instructor developed stoke symptoms after lateral vascular neck restraint training

*Law enforcement officer evaluated by Dr. Bill Smock, 2015
Brain MRI of a Kentucky police officer who developed stroke symptoms 10 minutes after participation in lateral vascular neck restraint training. The MRI demonstrates acute brain infarctions.
• Delayed Cryptogenic Strokes
  – Cerebral infarcts from prior anoxic brain damage
  – Occur months to years after the anoxic damage from strangulation or “choke hold”

• Acute Anoxic Encephalopathy
  – Brain damage from blockage of blood flow to and from brain
  – Brain damage from decrease oxygen levels in circulating blood
  – “cytotoxic brain edema within seconds to minutes”

#7 (Cont.)

• Acute Anoxic Encephalopathy
  – Hippocampus, parieto-occipital-temporal cortex, cerebellar purkinje cells, amygdala, caudate nucleus, lentiform nucleus, thalamic nuclei most sensitive
  – Brainstem (medulla-breathing center), hypothalamus and basal forebrain more resistant

Wolstenholme N, Moore, B: The Clinical Manifestations of Anoxic Brain Injury; Progress in Neurology and Psychiatry;8-13
#8

- Delayed Anoxic Encephalopathy
  - Brain damage manifests days to weeks after strangulation/choke hold:
    - Blindness
    - Choreoathetosis (movement disorder)
    - Dystonia (movement disorder)
    - Psuedobulbar paralysis
    - Victim appeared “normal”

Dooling EC, Richardson EP: Delayed Encephalopathy After Strangling: Arch Neurol 1976;33;196-9
#9

- Cervical Spine Injury
  - Tear of anterior and posterior longitudinal ligaments
  - Spinous process fractures
  - Epidural spinal cord hemorrhage
  - Spinal cord contusion

Kornblum RN, Medical Analysis of Police Choke Holds and General Neck Trauma
Part 2, Trauma, 1986, 1:13-64
• Cervical Spine Injury
  – Vertebral body fracture/dislocation (victims were lifted off the ground while in lateral vascular neck restraint)

Kornblum RN, Medical Analysis of Police Choke Holds and General Neck Trauma Part 2, Trauma, 1986, 1:13-64
#10

- Seizures
  - Anoxic convulsions: tonic clonic contraction of muscle groups within 1-3 seconds after loss of consciousness*
  - Abnormal brainwave activity, Delta waves, are seen with the onset of loss of consciousness

Hypoxic Seizures: “Choking Game”
   —“Sleeper hold”
   —“Cerebral anoxia”
   —“this often results in loss of consciousness and sometimes an hypoxic seizure”*

*Clinical Pediatrics, 49(3)274-279
#11

- Sphincter Incontinence
  - Anoxia of at least 15 seconds resulted in loss of bladder sphincter tone (involuntary urination)
  - Anoxia of at least 30 seconds resulted in loss of rectal sphincter tone (involuntary defecation)

Carotid Artery Dissection

- Unilateral and bilateral
- Pressure applied to the carotid arteries during strangulation and “choke holds” results in damage (tears) within the vessel
- Death, stroke, long-term therapy

• Carotid Artery Hematoma
  - Rupture of the carotid artery permits leakage of blood into the surrounding tissue, creating a hematoma
  - Rupture of the hematoma can cause rapid death, days to weeks after strangulation or “choke hold”

#14

• Jugular Venous Thrombosis
  – Damage to the jugular vein results in the formation of a thrombus (blood clot) within the vessel

• Airway Swelling/Respiratory Failure
  —Pharyngeal, supraglottic, subglottic and laryngeal edema has created life-threatening airway obstruction
  —Respiratory failure secondary to swelling >36 hours post strangulation or application of “choke hold”

• Thyroid Storm
  – Compression of the thyroid gland can cause the release of excess thyroid hormone resulting in thyrotoxicosis
  – Life-threatening symptoms: agitation, hyperthermia, tachycardia, multi-system organ failure

Ramirez J et al, Thyroid Storm Induced by Strangulation, Southern Medical Journal, 2004:97(6);608-610
#17

- Vocal Cord Paralysis (Aphonia)
  - Unilateral or bilateral injury to the recurrent laryngeal nerve from pressure applied during strangulation
  - Aphonia can be temporary or permanent

#18

- Fracture of the Hyoid Bone
  - Fractures of the hyoid bone occur from the application of pressure to the area above the larynx
  - Hyoid fractures are seen in both surviving and fatal victims of strangulation

• Thyroid Cartilage Fracture
  – Fractures of the thyroid cartilage occur from the application of pressure on the larynx
  – 34.76 pounds of pressure to fracture the thyroid cartilage
  – Life-threatening airway obstruction

#20

- Fracture of the Cricoid Cartilage
  - Fractures of the cricoid cartilage occur from the application of pressure on the larynx
  - 45.76 pounds of pressure to fracture the cricoid cartilage
  - Life-threatening airway obstruction

#21

- **Dysphagia/Odynophagia**
  - Difficulty swallowing, painful swallowing or inability to swallow after strangulation or application of a “choke hold”
  - Causes can include: fractures of: hyoid bone, cricoid or thyroid cartilage, hematoma, soft-tissue swelling

Briddel J et al, Dysphagia after strangulation; Ear, Nose & Throat Journal, 2012;91(9):30-31
Hypopharyngeal Rupture

- Tearing of the structures in the upper airway can result in leakage of air or secretions into the chest cavity
- Pneumopericardium (air surrounding the heart) has occurred during a strangulation-induced hypopharyngeal rupture

• Tinnitus (ringing in ears)
  – Aneurysm of carotid artery from a ligature strangulation resulted in nerve injury
  – Symptoms were present for 3 years after the strangulation

YadollahiKhales G et al, Tinnitus 3 Years After Strangulation, Journal of Nervous and Mental Disease;2015;203(2)154-55.
• Acquired Glottic and Subglottic Stenosis
  – Damage to the larynx and trachea during strangulation can result in the scarring and narrowing of the larynx and trachea

• Post Traumatic Stress Disorder
  – The emotional distress associated with life-threatening events, including strangulation, have long-term psychological consequences