



TRAINING INSTITUTE on STRANGULATION PREVENTION

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Dear Medical Provider:

The Training Institute on Strangulation Prevention has been asked to provide you with information about our *Recommendations for the Medical/Radiographic Evaluation of Acute Adult/Adolescent Non/Near Fatal Strangulation* (Guidelines). A copy is attached, which includes pertinent references. In essence, it is the opinion of the Medical Advisory Committee of the Training Institute on Strangulation Prevention that the arterial vessels in the neck of victims of non-fatal strangulation assaults should be evaluated for potential vascular injuries. When a strangled victim/patient presents with a history neck compression and even minimal or brief symptoms or signs consistent with impaired oxygen delivery to the brain, we believe that medical imaging (CTA or MRA) is indicated to exclude latent arterial injury. Summarized below is the information the Medical Committee considered in creating the Guidelines and making clinical recommendations.

Current State of Medical Knowledge Regarding the Risks of Non-Fatal Strangulation

The basic medical facts about the pathophysiology strangulation have been known for a long time. The brain requires a continuous supply of oxygen. The brain is the most sensitive organ to oxygen deprivation. Without adequate oxygen, brain cells quickly malfunction and die. Brain cells do not heal or regenerate. Strangulation is defined as external compression to the neck that interrupts blood flow to the brain and/or airflow to the lungs.

Strangulation impedes oxygen delivery to the brain in several ways. Neck compression can temporarily close the airway or damage airway structures preventing oxygen from getting to the lungs so, even with adequate blood flow, there is inadequate oxygenation of blood to sustain brain cells. The reverse is also possible. Oxygenation of the blood remains adequate, but neck compression of the cervical arteries prevents the oxygenated blood from reaching the brain cells. A third mechanism involves simultaneous external compression of all four jugular veins in the neck preventing return of deoxygenated blood to the heart and lungs. The deoxygenated blood remains trapped in the brain creating stagnant hypoxia which can be fatal.

Signs and symptoms (during assault or after; current or resolved) consistent with potentially life-threatening strangulation include [\[Green \(2020\)\]](#):

- Findings of neck trauma
- Geographic petechiae
- Subconjunctival hematoma
- Altered mental status



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- Loss of consciousness
- Incontinence
- Visual loss or disturbance
- Inability to breathe
- Inability to speak
- Hoarseness or voice change
- Shortness of breath or difficulty breathing
- Painful or difficulty swallowing
- “Danger to Life” criteria on neck MRI
- Vascular injury on CTA

The risk of neck arterial injury from strangulation compression has only been recently recognized a serious threat. But for decades, trauma surgeons have been dealing with a very similar issue. Severely injured multiple trauma patients are at risk of neck arterial injury that is initially latent or “silent” until they experience stroke hours, days or even months after the original accident. The risk of blunt cerebrovascular injury (BCVI) in the trauma population is historically 1-3% [\[Bruns \(2013\), Jacobson \(2015\)\]](#) but has increased with more effective screening [\[Hundersmarck \(2021\), Black \(2020\)\]](#). Even though none of these trauma center patients were strangled, the forces on the arteries are identical in both settings: compression, twisting or stretching. The trauma surgeons worked diligently for 30+ years to find screening criteria to predict which patients needed a CTA and which did not [\[Biffi 2023\]](#). In the final analysis, all the various screening criteria (clinical prediction rules) missed a significant number of patients who were found to have vascular injuries when liberal CTA screening was employed. Three recent studies involving a total of over 15,000 trauma patients seen at Level 1 trauma centers used liberal screening criteria (“adult blunt trauma activations”, “following blunt trauma” [isolated extremity trauma excluded] and “suspicion of major trauma”) and found many vascular injuries that would have been missed by any current clinical screening criteria [\[Black \(2020\), Leichtle \(2020\), Muther \(2020\)\]](#).

In addition to the valuable information regarding the risk analysis of latent cerebrovascular injury in trauma patients, literature focusing on the risk of neck vascular injury in cohorts of strangled patients and appropriate medical decision-making has recently emerged. Since the committee first addressed the issue in 2015-2016, several large studies on strangled patients who received CTA have shown that the risk of neck arterial injury after strangulation is about 2% [\[Matusz \(2019\), Zuberi \(2019\), Bergin \(2022\), MacDonald \(2021\)\]](#). As with the trauma patients, there are no reliable clinical predictors of who has a vascular injury and who does not [\[Jacobson \(2015\)\]](#). We also know that there is frequently a “latent”



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or symptom/sign-free period between the time of arterial injury and stroke. This gives opportunity to diagnose and treat the tear before neurologic disaster occurs. In addition, we now have proven (thanks to the trauma surgeons) that modern CTA (64 slices or greater) is the screening gold standard for identifying or excluding vascular injury [\[Roberts \(2013\), Paulas \(2014\)\]](#). If the blunt cerebrovascular injury is identified in the latent period, anti-thrombotic therapy (including oral anti-platelet agents) is extremely effective in significantly reducing the risk of post-injury stroke [\[Edwards \(2007\), Cothorn \(2009\), Rutman \(2018\)\]](#).

One of the arguments raised against liberal CTA screening of strangled patients is the radiation risk for thyroid cancer. The thyroid gland is the most radiosensitive organ in the neck. The estimated risk of thyroid cancer from a single CTA of the neck is 0.00013%. [\[Alkhorayef \(2017\)\]](#). Compare that risk to the 2% risk of missing an undiagnosed cerebrovascular artery injury in the latent period that, if treated, could likely prevent a life-altering or life-ending stroke. The patient should be allowed to weigh this risk-benefit analysis. Another frequently promoted argument against liberal CTA screening for strangulation involves the cost of a negative CTA. An internet search of New Choice Health revealed that a nation-wide sampling of the retail cost for a neck CTA varied from about \$500 to \$5000. Obviously, the actual cost to the patient will depend on many factors including insurance status, specific provider and location. Compare that expense to the aggregate costs and resources needed to care for one stroke patient (in the strangulation context, many victims are young, so care would be required for decades). Providers involved in the care of the strangled patient should also consider the potential medical malpractice risk of failing to diagnose (and therefore failure to treat) a serious condition with a known risk of 2% that is amenable to effective screening and prophylaxis. Another potential provider vulnerability in failing to adequately evaluate the strangled patient is a potential EMTALA (Emergency Medical Treatment and Labor Act) statute violation. Under EMTALA, physicians have a general obligation to evaluate the patient with a sufficient index of suspicion toward the detection of any emergency condition that might be present, to diagnose such conditions when they have occurred, and to render or refer elsewhere for appropriate definitive care [\[Gaddis \(2022\)\]](#).

This briefly summarizes the data and arguments considered by the medical committee that informed the development (and revision) of the *Recommendations for the Medical/Radiographic Evaluation of Acute Adult/Adolescent Non/Near Fatal Strangulation* and our staunch support for liberal screening.



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We appreciate your consideration for our efforts to heighten awareness regarding non-fatal strangulation assaults and potential patient consequences. We hope you found this information helpful. The Medical Advisory Committee stands ready to answer any questions, provide specific consultation or dialog further with you or your colleagues. We also welcome your support in bringing awareness to your medical community regarding the benefits of using appropriate imaging for the strangled patient in order to improve detection of latent cerebrovascular injury and promote the best possible patient outcomes.

Respectfully,

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Note: The original intention of this document was to be sent to specific individuals in response to complaints/concerns received by the Institute from local community members (law enforcement, advocates, medical care givers, and others who have received Institute training on strangulation) regarding perceived inadequacies in the evaluation and care of near/non-fatal strangulation victims in that local community. The most likely recipients were anticipated to be physicians (Emergency Department directors, individual ED physicians and physician administrators involved in authorization decisions for imaging, and perhaps primary care providers). This document was never intended to be for general educational purposes. Many Medical Committee members (and others within the Institute) feel strongly that such a general education document on NFS should be developed. That is a worthy objective and it could be integrated into the many other resources already developed by the Institute, but that is a different project and requires further discussion.