



RECOMMENDATIONS for the MEDICAL/RADIOGRAPHIC EVALUATION of the PREGNANT ADULT PATIENT WITH NON-FATAL STRANGULATION

Prepared by Michael Weaver, MD and Barbra Bachmeier, JD, MSN, NP-C

Endorsed by the National Medical Advisory Committee: Bill Smock, MD, Chair; Cathy Baldwin-Johnson, MD; William Green, MD; Dean Hawley, MD; Sally Herin, MD; Ralph Riviere, MD; Heather Rozzi, MD; Steve Stapczynski, MD; Ellen Talliaferro, 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
 4. Evaluate/Monitor the fetus

Pregnant Strangulation patient presents to the Emergency Department

Evaluate per institution Trauma Pregnancy Protocol/ OB Consultation

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, unilateral headache, and bruit)
- **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**

Discharge home with detailed instructions including a lethality assessment, per institution Trauma Pregnancy Protocol/OB Consultation to return to ED if: neurological signs/symptoms, dyspnea, dysphonia or odynophagia develops or worsens

Recommended Radiographic Studies to Rule Out Life-Threatening Injuries* (including rare delayed presentations of up to 2 years)

- **CT Angio of carotid/vertebral arteries** - (**GOLD STANDARD** for evaluation of vessels and bony/cartilaginous structures, less sensitive for soft tissue trauma. **Safe for all stages of pregnancy and/or lactating patients.**) **or**
 - **CT neck with contrast** - (less sensitive than CT Angio for vessels, good for bony/cartilaginous structures. **Safe for all stages of pregnancy and/or lactating patients.**) **or**
 - **MRIs without gadolinium:**
 - **MRA of neck** (less sensitive than CT Angio for vessels) **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)
- Safe to perform during all trimesters for pregnant and/or lactating patients.**
- **MRIs with gadolinium** (**NOT RECOMMENDED:** Use should be limited to situations in which the benefits clearly outweigh possible risks.)
 - **Carotid Doppler Ultrasound** (**NOT RECOMMENDED:** Least sensitive study, unable to adequately evaluate vertebral arteries or proximal internal carotid.)
- *References on page 2

(-)

Continued ED/ Hospital Observation (based on severity of symptoms, reliable home monitoring, and a lethality assessment discussion)

(+)

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



RECOMMENDATIONS for the MEDICAL/RADIOGRAPHIC EVALUATION of the PREGNANT ADULT PATIENT WITH NON-FATAL STRANGULATION

PREGNANCY REFERENCES

(Recommendations based upon expert consensus, case reports, and cited medical literature)

1. Copel J, El-Sayed Y, Heine RP, et al. Guidelines for Diagnostic Imaging During Pregnancy and Lactation. *Obst Gyn* 2017; 130(4): e210-e216 *This document is endorsed by the American College of Radiology and the American Institute of Ultrasound in Medicine.*
2. Ray JG, Vermeulen MJ, Bharatha A, et al. Association Between MRI Exposure During Pregnancy and Fetal and Childhood Outcomes. *J Amer Med Assoc* 2016; 316(9): 952-961
3. Limanovich DE, Tack D, Lee KD, et al. Cardiothoracic Imaging in the Pregnant Patient. *J Thor Imag* 2014; 29(1): 38-49
4. Bekiesinka-Figatowska M, Romaniuk-Doroszevska A, Szkudlinska-Pawlak S, et al. Diagnostic Imaging on Pregnant Women: The Role of Magnetic Resonance Imaging. *Polish J Radio* 2017; 82: 220-226
5. Prola-Netto J, Woods M, Roberts VHJ, et al. Gadolinium Chelate Safety in Pregnancy: Barely Detectable Gadolinium Levels in the Juvenile Nonhuman Primate After in Utero Exposure. *Radio* 2018; 286(1): 122-128
6. Oh KY, Roberts VHJ, Schabel MC, et al. Gadolinium Chelate Contrast Material in Pregnancy: Fetal Biodistribution in the Nonhuman Primate. *Radio* 2015; 276(1): 110-118
7. Wieseler KM, Bhargava P, Kanal KM, et al. Imaging in Pregnant Patients: Examination Appropriateness. *RadioGraphics* 2010; 30: 1215-1233
8. Wang PI, Chong ST, Kielar AZ, et al. Imaging of Pregnancy and Lactating Patients: Part 1, Evidence-Based Review and Recommendations. *Ameri J Radio* 2012; 198: 778-785
9. Wang PI, Chong ST, Kielar AZ, et al. Imaging of Pregnancy and Lactating Patients: Part 2, Evidence-Based Review and Recommendations. *Ameri J Radio* 2012; 198: 785-792
10. Patel SJ, Reede DL, Katz DS, et al. Imaging for the Pregnancy Patient for Nonobstetric Conditions: Algorithms and Radiation Dose Considerations. *RadioGraphics* 2007; 27(6): 1705-1723
11. Wagner LK and Applegate KE. More Cautions on Imaging of Pregnant Patient. *RadioGraphics* 2011; 31(3): 891-895

GENERAL STRANGULATION REFERENCES

1. Christe A, Thoeny H, Ross S, et al. Life-threatening versus non-life-threatening manual strangulation: are there appropriate criteria for MR imaging of the neck?. *Eur Radiol* 2009;19: 1882-1889
2. Christe A, Oesterhelweg L, Ross S, et al. Can MRI of the Neck Compete with Clinical Findings in Assessing Danger to Life for Survivors of Manual Strangulation? A Statistical Analysis, *Legal Med* 2010;12:228-232
3. Yen K, Thali MJ, Aghayev E, et al. Strangulation Signs: Initial Correlation of MRI, MSCT, and Forensic Neck Findings, *J Magn Reson Imaging* 2005;22:501-510
4. Stapczynski JS, *Strangulation Injuries*, *Emergency Medicine Reports* 2010;31(17):193-203
5. Yen K, Vock P, Christe A, et al. Clinical Forensic Radiology in Strangulation Victims: Forensic expertise based on magnetic resonance imaging (MRI) findings, *Int J Legal Med* 2007;121:115-123
6. Malek AM, Higashida RT, Halback VV, et al. Patient Presentation Angiographic Features and Treatment of Strangulation-Induced Bilateral Dissection of the Cervical Carotid Artery: Report of three cases, *J Neurosurg* 2000;92(3):481-487
7. Di Paolo M, Guidi B, Bruschini L, et al. Unexpected delayed death after manual strangulation: need for care examination in the emergency room, *Monaldi Arch Chest Dis* 2009;Sep;71(3):132-4
8. Dayapala A, Samarasekera A and Jayasena A, An Uncommon Delayed Sequela After Pressure on the Neck: An autopsy case report, *Am J Forensic Med Pathol* 2012;33:80-82
9. Hori A, Hirose G, Kataoka, et al. Delayed Postanoxic Encephalopathy After Strangulation, *Arch Neurol* 1991;48:871-874
10. Iacovou E, Nayar M, Fleming J, Lew-Gor S, A pain in the neck: a rare case of isolated hyoid bone trauma, *JSCR* 2011;7(3)
11. Oh JH, Min HS, Park TU, Sang JL, Kim SE, Isolated Cricoid Fracture Associated with Blunt Neck Trauma; *Emerg Med J* 2007;24:505
12. Gill JR, Cavalli DP, Ely SF, Stahl-Herz J, Homicidal Neck Compression of Females: Autopsy and Sexual Assault Findings, *Acad Forensic Path* 2013;3(4):454-457
13. Sethi PK, Sethi NK, Torgovnick J, Arsura E, Delayed Left Anterior and Middle Cerebral Artery Hemorrhagic Infarctions After Attempted Strangulation, A case report; *Am J Forensic Med Pathol* 2012;33:105-106
14. Clarot F, Vaz E, Papin F, Proust B, Fatal and Non-fatal Bilateral Delayed Carotid Artery Dissection after Manual Strangulation, *Forensic Sci Int* 2005;149:143-150
15. Molack J, Baxa J, Ferda J, Treska V, Bilateral Post-Traumatic Carotid Dissection as a Result of a Strangulation Injury, *Ann Vasc Surg* 2010;24:1133e9-1133e11
16. Plattner T, Bollinger S, Zollinger U, Forensic Assessment of Survived Strangulation, *Forensic Sci Int* 2005;153:202-207
17. Miao J, Su C, Wang W, et al. Delayed Parkinsonism with Selective Symmetric Basal Ganglia Lesion after Manual Strangulation, *J Clin Neurosci* 2009;16:573-575
18. Purvin V, Unilateral Headache and Ptosis in a 30-Year-Old Woman, *Surv Ophthalmol* 1997;42(2):163-168
19. Nazzal M, Herial NA, MacNealy MW: Diagnostic Imaging in Carotid Artery Dissection: A case report and review of current modalities; *Ann Vasc Surg* 2014;28;739.e5-739.e9
20. Chokyu TT, Miyamoto T, Yamaga H, Terada T, Itakura T: Traumatic Bilateral Common Carotid Artery Dissection Due to Strangulation: A case report; *Interventional Neuroradiology*;12:149-154, 2006