Non-Accidental Strangulation of Children

Cathy Baldwin-Johnson MD FAAFP
Medical Director
Alaska CARES, Anchorage
The Children’s Place, Wasilla
907-561-8301
Cathy.Baldwinjohnson@providence.org
Pediatric Strangulation: Challenges

• More likely to be under-appreciated by law enforcement, medical providers, prosecutors, judges/juries
• More likely to be under-reported
• More likely to have delay in care
• More vulnerable to injury
• Less able to protect themselves
• Less likely to clearly articulate what happened – language development
• Less research
Literature Review

• Can’t take adult literature and apply across the board to children

• Most pediatric strangulation literature:
  • Accidental hangings (including choking game)
  • Suicidal hangings
Child Abuse Strangulation

• Strangulation victims <18 years of age occasionally mentioned in some articles
• 2 part article - strangulation injuries in children, none identified as due to assault
• Majority of articles related to inflicted pediatric strangulation are case reports
• Fatalities primarily due to:
  • Acute asphyxia
  • Hypoxic ischemic encephalopathy
  • Cerebral infarction
  • Carotid artery injury less commonly reported
Research on Cervical Artery Dissection in Children

• 21 articles found – mostly case reports, 2 reviews
• Age range 1 month to 18 years
• Onset of symptoms minutes to months
• Etiologies reported:
  • Strangulation – one case report
  • Head/neck trauma (only one mentioned child abuse as potential cause)
  • “Vigorous physical activity” (including stretching the neck)
  • Underlying medical condition
  • “Spontaneous”
• Imaging used/recommended:
  • MRA/MRI
  • CTA
Vulnerability to Injury

Differences in anatomy, physiology, mechanisms
Airway differences

• Bigger head
• Larger tongue
• Weaker neck

• Funnel shaped airway located higher in neck
• Narrower, softer epiglottis
  • Until age 4-5
• Smaller cricoid cartilage
• Mucosal edema will severely compromise airway
Pressures Required Likely Less

Adults:
• ~4# to occlude jugular
• ~11# to occlude carotid
• ~33# to occlude airway
• ≥ 33# to fracture cartilage, bone
Other Differences:

- Infants: much easier to obstruct airway
- Cartilage less calcified: less likely to find fractures
- May be at greater risk of:
  - Pulmonary complications
  - Cerebral edema (especially late)
  - Severe hypoxic-ischemic encephalopathy
Mechanism May be Different

• May be manual, choke hold, ligature

HOWEVER:
• Easier to lift children off the ground:
  • By neck
  • By clothing

• Female caregivers as perpetrators
• Motivation (of perpetrator) may be different
How Kids Present
Clinical Presentation

• May present for care days to weeks after strangulation
  • Just like other forms of child abuse

• Clinical spectrum range from mild self-limiting symptoms to severe neurologic sequelae or death

• Some symptoms in adults may not be as helpful in young children (i.e. incontinence)

• May describe symptoms in ways different than adult but that are developmentally appropriate
Presentation

• May present due to physical findings noted by:
  • Teachers
  • Daycare providers
  • Neighbors
  • Family members

• Report then made to child protection and/or law enforcement
Typical Symptoms Reported by Children:

• Voice changes
• Sore throat or neck pain
• Difficulty breathing
• Problems swallowing
• Dizziness
• Loss or near loss of consciousness
• Older children: urinary and/or fecal incontinence
Other ways children may present:

• Hypoxic brain injury resulting in:
  • Seizures or altered level of consciousness
  • Altered mental status including agitation or confusion
  • Respiratory depression
• Respiratory distress due to:
  • Acute lung injury
  • Aspiration
• Ischemic stroke symptoms from carotid occlusion or dissection
Physical findings reported in children:

• Petechiae of face, neck, conjunctivae
• Bruising of neck
  • May be patterned from fingers, thumb, ligatures, clothing
• Swelling in neck, face
• Defensive scratch marks on neck
• Abrasions or patterned injury from jewelry worn by child or assailant
• Injuries elsewhere on child’s body
SIGNS AND SYMPTOMS OF STRANGULATION

NEUROLOGICAL
- Loss of memory
- Loss of consciousness
- Behavioral changes
- Loss of sensation
- Extremity weakness
- Difficulty speaking
- Headaches

SCALP
- Petechiae (tiny red spots)
- Bald spots (from hair being pulled)
- Swelling on the head (from blunt force trauma or falling to the ground)

EYES & EYELIDS
- Petechiae to eyeball
- Petechiae to eyelid
- Bloody red eyeball(s)
- Vision changes
- Droopy eyelid

EARS
- Ringing in ears
- Petechiae on earlobe(s)
- Bruising behind the ear
- Bleeding in the ear

MOUTH
- Bruising
- Swollen tongue
- Swollen lips
- Cuts/abrasions
- Internal Petechiae

FACE
- Petechiae
- Scratch marks
- Facial drooping
- Swelling

CHEST
- Chest pain
- Redness
- Scratch marks
- Bruising
- Abrasions

NECK
- Redness
- Scratch marks
- Finger nail impressions
- Bruising (thumb or fingers)
- Swelling
- Ligature or Clothing Marks

VOICE & THROAT CHANGES
- Raepy or hoarse voice
- Coughing
- Unable to speak
- Nausea
- Trouble swallowing
- Dripping
- Painful to swallow
- Sore throat
- Stridor

BREATHING CHANGES
- Difficulty breathing
- Respiratory distress
- Unable to breathe

Short & Long Term Risks
Neck Injuries

• Case series with imaging:
  • Up to 25% pediatric strangulation deaths had fractures of bony & cartilaginous structures in neck
  • Including thyroid cartilage & hyoid bone
• Other studies (living victims) found bone/cartilage injuries less common in children than adults
• Soft tissue edema in neck more common in children
Severe Delayed Effects of Strangulation Reported in Children:

- Vocal cord paralysis
- Hypoxic-ischemic encephalopathy
- Cerebral edema
- Cerebral infarction
- Aspiration pneumonia
- Behavioral changes
- Cognitive deficits
- Injury to the carotid artery
- Thyroid storm reported as life-threatening complication in adults
Severe Delayed Effects

• Death
  • Most due to cerebral asphyxia from carotid occlusion
  • Early & delayed deaths due to carotid hematomas, cerebral infarction
  • Possible role of cardiac dysrhythmias - unlikely
Poor Prognostic Signs

• Coma
• Seizures
• Need for ventilator support
• Elevated intracranial pressure
• Diabetes insipidus
• Blood sugar >300 on admission
Differential Diagnosis

Choking Game
• Activity in which persons strangle themselves or others to achieve euphoria through brief hypoxia
• Majority of deaths in boys; mean age 13.3, youngest age 6

Accidental
• Infants and young children are especially vulnerable
• Entanglement in furniture, ropes/cords, clothing, playground equipment
• Careful history, scene investigation, re-enactment critical
Differential Diagnosis

Suicide
• May be challenging to distinguish strangulation suicide from the “choking game” or auto-erotic asphyxiation
  • Age distribution older
• Careful history, scene investigation critical

Medical
• Facial and conjunctival petechiae from significant Valsalva maneuvers
• Underlying bleeding diathesis
• Thorough medical evaluation critical
Recommended Medical Evaluation of Strangled Children
Location of Evaluation

• May depend on:
  • Where child presents
  • Medical stability of child
  • Medical provider availability
  • Availability of Child Advocacy Center

• Where available, consider use of CAC
Gathering Information

Forensic Interview
- Structured conversation with child
- Obtains information to assist in criminal investigation
- Assesses safety of child’s home
- Helps assess needs for medical evaluation (including diagnostic testing) and treatment

Medical History
- Information from child, parent, medical records, other sources
- Includes past medical history, family medical history, review of systems
- Assesses need for diagnostic and forensic testing as well as treatment
- Assesses for alternative explanations for symptoms and exam findings
Medical History

• Situation in which strangulation occurred
• Method of strangulation
• Symptoms the child experienced during and after strangulation
• Current symptoms
• Time elapsed between strangulation episode and presentation to care
• Presence or absence of witnesses
• Presence of any medical conditions that might predispose child to petechiae
• Child’s developmental level
Medical History, continued

• Description of symptoms may be very different than an adult but developmentally appropriate
  • “I talked like a duck”
  • “I saw sparkles in my eyes”
  • “I fell asleep”

• Some children may be able to articulate that they thought they were going to die
Not Just One Bad Thing

• Always consider (and look for) concurrent additional types of child abuse:
  • Sexual abuse/assault
  • Abusive head trauma
  • Other forms of physical abuse
Physical Exam

• Complete head to toe exam with specific attention to:
  • Vitals including pulse oximetry
  • Complete survey of all skin surfaces:
    • Petechiae
    • Bruising
    • Bites
    • Redness
    • Tenderness
    • Patterned marks (from ligatures, fingers, clothing, etc)
Physical Exam, continued

• Assessment for intraoral injury
  • Frenular tears
  • Petechiae
  • Bruising
  • Tongue injuries
• Assessment for respiratory distress, stridor, difficulty swallowing or speaking, voice changes, cough, hemoptysis
• Neck circumference (if admitted)
Physical Exam, continued

• Eye exam for petechiae, conjunctival hemorrhage
  • Consideration for dilated retinal exam
• External exam of anal-genital area
• Neurologic exam including:
  • Age appropriate mental status assessment
  • Presence of irritability or lethargy
  • Behavioral changes
  • Seizures
  • Localizing findings
Forensic evidence in pediatric strangulation

• If applicable (depending on time elapsed, interim hygiene activities, other forms of abuse):
  • Collect debris or foreign material
  • Swab child’s neck for possible assailant epithelial cells left on skin
  • Additional forensic evidence collection as indicated
    • For example: strangulation occurred during sexual abuse or sexual assault
Next Steps

• Consider admission for minimum 12-24 hours of observation if:
  • History of loss of consciousness or other neurologic signs or symptoms
  • Facial/conjunctival petechiae, hemorrhage
  • Soft tissue injury to neck
  • Incontinence (if age appropriate concern)
  • Voice changes
  • Respiratory distress
  • Indicated by other injuries
  • Or if you are not sure the child is going home to a safe place
Next Steps, continued

• Consider ENT consult/laryngoscopy
  • If voice changes, neck swelling, any difficulty breathing
• Unilateral vocal cord paralysis may go unrecognized clinically
  • But risk of aspiration, recurrent pulmonary infection
• Soft tissue edema more likely to cause airway obstruction
Imaging Recommendations
First do no harm

• Radiation risks
• Need for sedation
  • Risks
• Costs to family
Imaging Guidelines

• Adult literature:
  • CT angiogram for carotid/vertebral arteries considered gold standard by many to evaluate vessels, bony/cartilaginous structures; not as sensitive for soft tissue trauma
  • Zuberi et al Emergency Radiology May 2019:
    • 2.1% of 142 non-fatal strangulation cases had vascular injuries identified
• Little current guidance on imaging modalities/recommendations in the pediatric population
RECOMMENDATIONS for the MEDICAL/RADIOGRAPHIC EVALUATION of ACUTE ADULT, NON-FATAL STRANGULATION
Prepared by Bill Smock, MD and Sally Sturgeon, BSN, SANNE-A
Office of the Police Surgeon, Louisville Metro Police Department
Endorsed by the National Medical Advisory Committee: Bill Smock, MD, Chair, Cathy Baldrick, MD, William Green, MD, Dean Hawker, MD, Ralph Rivelli, MD, Heather Russo, MD, Steve Stajciczyk, MD, Glen Tellamo, MD, Michael Reeves, 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/ear/soft tissue 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)
- 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)

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

*References on page 2
Other Imaging Options

• CT of the neck with contrast
  • Less sensitive for vasculature injury
• MRA of the neck
  • Less sensitive for vascular injury
  • Best for soft tissue neck trauma
• MRI of the neck
  • Less sensitive for vasculature and bony/cartilaginous injury
  • Best for soft tissue neck trauma
• MRI/MRA of the brain
  • Best for anoxic brain injury, stroke symptoms and intracerebral petechial hemorrhage
• Carotid doppler ultrasound
  • Don’t do this; limited study and not sensitive
What to do for kids?

• Older adolescents: follow adult protocol
• Younger children presenting acutely with symptoms or exam findings:
  • Low threshold for admission for close observation
  • Brain imaging probably the priority
    • MRI best
  • Consider MRI/A neck
What to do for kids? Cont.

• Younger children presenting non-acutely:
  • Get detailed history about event(s), symptoms & signs during/since
  • Low threshold for elective imaging of brain if:
    • LOC and/or neurologic symptoms
    • Behavior changes
    • Recurrent episodes of strangulation
Additional Diagnostic Studies to Consider:

• Skeletal survey in children <2-3 years of age
  • With consideration for children up to age 5
• EEG if concerns for abusive head trauma, hypoxic-ischemic encephalopathy
Additional recommendations

- Parent education
- Close out patient follow up if not admitted
PEDIATRIC STRANGULATION DISCHARGE INSTRUCTIONS

Because your child has reported being “choked” or strangled, we are providing you with the following instructions:

Consider a small ice pack to the neck area for relief of pain. Offer popsicles or offer fluids that are cooling to the throat. Kids like this. Make sure someone is with your child for the next 24-48 hours.

Please report to the nearest ER or call 911 immediately if you notice the following symptoms or changes in your child:

- Difficulty breathing or shortness of breath
- Loss of consciousness or “passing out”
- Changes in your child’s voice or difficulty speaking
- Difficulty swallowing, lump in throat, or muscle spasms in throat or neck
- Tongue swelling and/or drooling
- Swelling to throat or neck, new, worsening or persisting throat pain (“My throat still hurts”)
- Prolonged nose bleed (greater than ten minutes)
- Continues to cough or coughing up blood
- Continues to vomit or vomiting up blood
- Left or right-sided weakness, numbness, or tingling (child cannot use arm or leg)
- New or Worsening headache
- Seizures (Abnormal, rhythmic or shaking movements)
- Behavioral changes or memory loss
- Thoughts of harming self or others ie: (“I do not want to live”) (“I am going to hurt him”)

It is important that the above symptoms be evaluated by a physician.

After your child’s evaluation, keep a list of any changes in symptoms for your child’s physician and law enforcement.

If symptoms worsen, report to your child’s physician or nearest ER. You should follow-up with law enforcement regarding documentation of any and all information about your child’s symptoms.

It is important that you have a follow-up medical screening in 1-2 weeks at the clinic or with your child’s physician. Make sure to bring these discharge instructions with you.

IF you misplace these instructions call ______________ or your provider for a copy.

I have been made aware of and understand the importance of following the above outlined instructions.

________________________  ________________________  ________________
Patient/Parent Signature   Provider Signature          Date

1 copy patient file  1 copy patient

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Documentation

• Thorough standardized documentation
• Photodocumentation
• Voice recording if indicated

• Pediatric Photography Protocol Non Fatal Strangulation
  https://www.familyjusticecenter.org/resources/pediatric-non-fatal-strangulation-photodocumentation-protocol/
PhotoDocumentation

Pediatric Non-Fatal Strangulation PhotoDocumentation Protocol 2017

Supplemental Edition for Pediatric +Cases

*The children used in this protocol are child models. All photography sessions were done with and under parental supervision.

The examiner should always be sensitive to how the child may react in using this method and should follow what the child is comfortable doing. The examiner could also use a toy doll to have the child show what happened or even ask the child to draw a representation using a crayon and paper.

A good rapport with the child is important during this part of the examination. Communicating with a calm tone while giving the child specific and easy to understand instructions will help the examiner get better results. Example: “This is a teddy bear. Can you show me what happened to your?” In many places, it will be a forensic interviewer (child advocacy staff, law enforcement or even a child protection worker) who will be doing the interview rather than the forensic examiner. Take photos of the figure that might have been used if it is available. Follow your local protocol.

Sometimes children will not have the words to describe the incident but they are able to draw from memory what happened to them.
Other recommendations for medical care

• Primary care follow up
  • With education
    • Long term complications
    • Traumatic brain injury
• If concerns:
  • Neurodevelopmental evaluation
  • Elective brain imaging
• Mental health referral
Last recommendations

• Routinely ask possible child abuse victims about history of strangulation
• Keep child abuse strangulation in your differential for “spontaneous” cervical artery dissection in other healthy children
• Start tracking your pediatric cases and share your findings
Resources

• https://www.familyjusticecenter.org/resources/