Child Death Scene Investigation: Sudden Infant Death and Unsafe Sleep Practices

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Disclosure Information for Vincent Tranchida, MD

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- There are no relevant financial relationships related to this presentation/program
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- The content being presented will be fair, well-balanced and evidence-based
- Learners who wish to receive Continuing Education Credit (CME/CLE/CE) must complete and turn in evaluations to successfully complete this program

Introduction

- Sudden unexpected infant deaths
  - Among the most tragic, sensitive, and complex deaths investigated.
  - By their very name (sudden, unexpected nature) they fall under the jurisdiction of law enforcement/ME/Coroner
  - Often have no clear autopsy findings to explain death.
    - **Ancillary studies** and **investigation** are **key** to determine cause and manner of death!

Epidemiology

- Congenital abnormalities (20.1%).
- Complications of premature birth and low birth weight (16.6%).
- SIDS (8.0%).
- Newborn affected by maternal pregnancy complications (6.1%).
- Unintentional injuries (3.8%).

National Vital Statistics Reports, 2004 Compiled Data, published 2007.

Pediatric Autopsy

(To be discussed in another lecture)

Should be done in /every/ unexplained infant death!

The Hospital Investigation

- For most investigations, this will be the first site of investigator contact with decedent.
- Sudden, unexpected infant deaths may present as:
  - DOA's (most common)
  - Infant found unresponsive (reason unknown)
    - Often with resuscitation
    - Anoxic encephalopathy
  - Acute, undiagnosed, minor illness of a short duration followed by death (I.e., "sniffles", "fussiness", "diarrhea").

The Hospital Investigation

- Information to be obtained
  - Identification of infant and NOK
  - Details about presentation
    - Was the child dead on arrival?
    - Was the child well-groomed? Soiled? Dehydrated?
  - Results of physical examination
    - Including radiology and laboratory results
  - Differential diagnosis, clinical course, and therapeutic interventions.
  - Time of pronouncement of death
  - Ask physicians about any known previous medical history!

The Hospital Investigation

- Effective for documenting early postmortem changes:
  - Body temperature
  - Distribution, strength of rigor mortis
  - Pattern, distribution, and state of fixation of livor mortis
  - Degree of putrefaction
    - Can be the most useful evidence when comparing to the scene story later!
    - Is it consistent/inconsistent with the caretakers' accounts? Does it seem like there was a significant delay in seeking aid?

The Hospital Investigation

- Note evidence of injury
  - Facilitates early notification of law enforcement and child protection agencies.
  - Changes your entire approach to the case.
  - Early documentation of injuries is key
    - Record radiology and procedures performed
    - Names of primary medical personnel responding to infant
    - Request medical records at later date

The Scene Visit

- Interview the NOK regarding the medical and social history of the infant and family
- Should be done as soon as possible
- All people who were in the home when the infant was found unresponsive should be asked to be present at the scene visit.

Ask the Parent/Caregiver

- What happened?
- When was the child last known alive?
- Where did you find the child?
- In what position?
- Were there any deviations from “normal” or “routine” infant behavior or activity in the last 24 hours?

Ask the Parent/Caregiver

- Obtain a detailed medical history of the infant (part I):
  - Prenatal care
  - Gestational age at delivery
  - Method of delivery and any complications
  - Medical problems
  - Hospitalizations (reasons, dates, and locations)

Ask the Parent/Caregiver:

- Obtain a detailed medical history of the infant (part II):
  - Vaccination history
  - Recent symptoms of illness
    - Has the child been ill?
  - Types, amounts, and times of medications given
  - Feeding method (breast versus bottle versus solid food), and last time
    - When was the child last fed?
    - What was the child last fed?
  - Remember to get pediatrician name and contact information!

Ask the Parent/Caregiver:

- Obtain a general medical and social history of the family
  - Recent ill symptoms of those in contact with the infant
    - Are there other children in the household? Are they well?
  - Drug, alcohol, and smoking history of those responsible for caring for the infant
    - Specifically ask about usage/intoxication at the time of the incident.
  - Recent travel history involving infant

Interview with Caregiver

- Note the caregiver's state of mind at the time of death (e.g., agitated? Depressed? Frustrated? Exhausted?)
- Is the reaction to the death appropriate?
- Ask about the infant's temperament, behavior, and daily care requirements
- Does the caregiver have a previous diagnosis of depression or other mental illness? (Ask family, friends, and acquaintances of caregiver).

Interview with Caregiver

- Assess the caregiver's potential mental health stressors
  - Single parent
  - Lack of education
  - Young age
  - Lack of family support system
  - Financial instability

Interview with the Caregiver

- Try to get a sense of the caregiver's use of drugs or alcohol
- Document employment history
- Document religious or ethnic affiliations or practices
  - Any religious objection to autopsy?
  - Any holistic or alternative medical practices?
- Note any criminal history or previous contacts with Child Protection agencies!

Warning Signs at the Hospital or Scene Interview

- Child with serious injury but no history of preceding trauma.
- History that is inconsistent with the severity, mechanism, or timing of the injury.
- Delay in seeking medical care for a significant injury.
- History that changes during the course of the evaluation.
- History of recurrent injuries, especially those that are poorly explained.

Remember:

- Children who are **sick** can be:
  - Irritable
  - Stubborn
  - Hyperactive
  - Inconsolable
  - Sleepy
  - Excessive wetting/soiling
  - Have perplexing symptoms (poor feeding, little weight gain, etc.)
- Children who are **abused** can be:
  - Irritable
  - Stubborn
  - Hyperactive
  - Inconsolable
  - Sleepy
  - Excessive wetting/soiling
  - Have perplexing symptoms (poor feeding, little weight gain, etc.)

Conduct the External Body Examination

- Document the infant's physical characteristics (e.g., height, cleanliness, state of hydration)
- Document the presence, condition, and cleanliness of clothing
- Document the presence of body rashes
- Document the presence or absence of marks or scars
- Document the presence or absence of injury/trauma (e.g., grab marks, bite marks, burns)
- Document treatment or resuscitative efforts
- Document postmortem changes

Postmortem changes

- Livor: Color, location, blanchability, tardieu spots
  - Is it consistent or inconsistent with the position of the body?
- Rigor: Stage, intensity, location of the body, broken
  - Is it consistent or inconsistent with the position of the body?
- Algor: Measure body temperature and environmental temperature
  - Avoid rectal temperatures until a thorough evaluation of the genital/rectal area has been done!
- Degree of putrefaction: Is it consistent with the caretakers' accounts?

The Examination of the Scene

- Provide written **and photographic** documentation for state of cleanliness and furnishing
- Note:
  - Temperature of living space
  - Obvious environmental hazards
    - Are there toys/objects appropriate for the child's age?
    - Are there prescription medications/drugs of abuse, ETOH or other weapons?
  - What's the condition of the residence?
    - Are there animals, roaches, or rodents? Is the home neat, cluttered, dirty, or in disarray?
  - Physical measurements of distances pertaining to suspected injuries (use and photograph with tape measure)

The Examination of the Scene

- Clothing of infant, if available
  - Is the clothing appropriate for the child's age?
- What's in the cabinets and refrigerator? Are there food and beverage items appropriate for the child's age?

Evidence Collection at the Scene

- Consider collecting:
  - Remnant of last bottle feeding (refrigerate!)
    - Especially if caretakers have a history of substance abuse.
  - Child-bearing objects suspected to have played specific part in death:
    - Ex: Bedding, carseats, defective cribs.
    - Defective products associated with death should be reported to the Consumer Product Safety Commission

Evidence Collection at the Scene

- With law enforcement, the investigator should also try to secure any suspicious items that may be related to trauma:
  - Weapons
  - Belts
  - Rods
  - Sticks
- Tools
- Utensils
- Medications
- Drug paraphenalia
- Cigarettes

The Scene Re-enactment

- Provide written and photographic documentation of the position of the infant when last known to be alive and when found unresponsive.
  - If possible, photograph the infant as found and the immediate scene.
    - Be prepared: Finding an infant in its actual found position is extremely uncommon
      - Caregivers initiate resuscitation and disrupt scene
      - Emergency response personnel further alter scene

The Scene Re-enactment

- Doll re-enactments extremely useful!!
  - Use a newborn-sized doll
  - Use/describe all of the original bedding, objects, and bed-sharers
  - Do the re-enactment ASAP
  - Try to use a featureless doll or doll of a different race
  - Dress doll in gender-neutral clothes
  - Hand THE CARETAKER the doll
  - Compassion, patience, and persistence is key!

Scene Investigation

- Don't forget to ask if there are pets in the home.
- Consider non-human overlays.

Scene Investigation

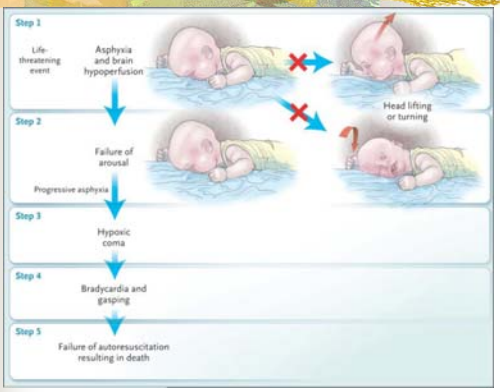
- Remember, infants are small and easily pushed/shifted/knocked aside by a larger force.
- Most infants also begin to be mobile (crawl) by 9 months!

Document Bedding

- Even if doll re-enactment is not possible, thorough documentation of the bedding is extremely valuable.
- Document/photograph the location of purge or soiling on the bedding
- Try to obtain information on all the original bedding
  - Type of bed (adult bed, crib, bassinet, etc.)
  - Mattress
  - Blankets
  - Pillows
  - Stuffed animals/toys
  - Clothes
  - Etc.

Prone, Face Down Sleep Position

- Adopted by most healthy, prone infants able to roll at some point in their sleep cycle.
- Causes measurable hypercapnia (excessive carbon dioxide in the blood)
  - Chiodini et al, 1993
  - Kemp et al, 1993
  - Waters et al, 1996
- Normally aborted after a few minutes (infants roll to back)
  - Waters et al, 1996.
- MOST children able to lift head from a prone position and roll by four months; infants laid prone prior to this age by caretakers may be unable to alter their position if they shift to obstruct their airway.
  - A proposed theory is that some infants (especially sleeping ones) are more susceptible to hypercapnia, and become unresponsive before they can turn/roll to free their airway.



The Theory of the "Hypoxic Microenvironment"

- Soft bedding which has a molding effect around the infant's head is associated with rebreathing (Kemp et al, 1991).
- Infants sleeping in a prone position on soft, natural fiber mattresses have a nearly 20-fold higher risk of "SIDS" than those sleeping on firm mattresses (Posonby et al, 1993).

Challenging a Scene Story

- I.e., caretaker states child laid supine when scene suggests child was prone
  - Lividity in the early hours after death may be the best evidence that a scene story is not accurate
  - Address discrepancies directly
  - Perform a second scene investigation when necessary
    - Look for:
      - Purge fluid stains
      - Impressions in bedding

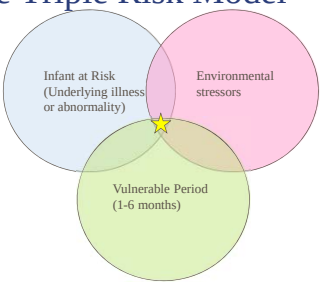
SIDS in History

- Term coined in 1969 by the National Institute of Health.
  - Implies a NATURAL death for which the cause cannot be determined.
  - Many SIDS cases had little or no corresponding scene investigation.
  - Many were ruled without even an autopsy!

Epidemiology of Sudden Infant Death Syndrome (SIDS)

- Peak incidence at 2-4 months of age.
- Increasingly uncommon after 6 months of age.
- Approximately 50% more common in males than females.
- Affects Black and Native American infants more than White infants.

The Triple Risk Model



Filiano and Kinney (1994)

Current Working Definition

- "SIDS is the sudden death of an infant under one year of age which remains unexplained after a **thorough case investigation**, including performance of a complete autopsy, examination of the death scene, and review of the clinical history"

Willinger et al, 1991

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Willinger et al, 1991

For a Baby's Cause of Death to be SIDS:

- The autopsy and history must be negative/noncontributory
- The baby must be in a proper sleep environment for his/her age (no soft compressible bedding/pillows/toys, etc.)
- The baby cannot be cosleeping/bedsharing.
- The baby must be in a proper sleep position (on their back, mouth up)

Sudden Unexpected Infant Death (SUIDS) versus SIDS

- SUID
  - All SIDS deaths
  - **Includes unsafe-sleep related asphyxias**
  - Sudden infant deaths of undetermined causes.
- SIDS
  - Subset of SUIDS
  - No cause **after complete autopsy and investigation**

SIDS Reviews in the Literature: Detroit

- Wayne County Medical Examiner's Office in Detroit Michigan:
  - 2001-2004
  - 209 SUID cases were examined by Drs. Pasquale-Styles and Schmidt
  - Ages 3 days to 12 months

SIDS Reviews in the Literature: Detroit

- Reviewed for risk factors, including:
  - Bed sharing
  - Witnessed overlay
  - Wedging
  - Strangulation
  - Prone position
  - Obstruction of the nose and mouth
  - Coverage of the head by bedding
  - Sleeping on a couch

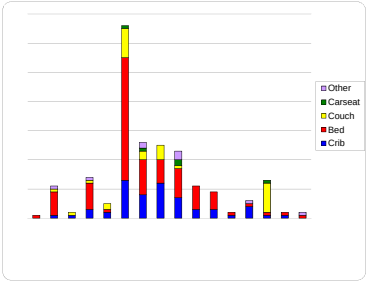
SIDS Reviews in the Literature: Detroit

- One or more risk factors were identified in 178 of 209 cases (85.2%)
  - Adult bed deaths (110/209):
    - 52.6% of deaths
    - 83.6% of adult bed deaths also had bed sharing
  - Couch deaths (25/209):
    - 12.0% of deaths
    - 84% of couch deaths also had bed sharing.

SIDS Reviews in the Literature: Detroit

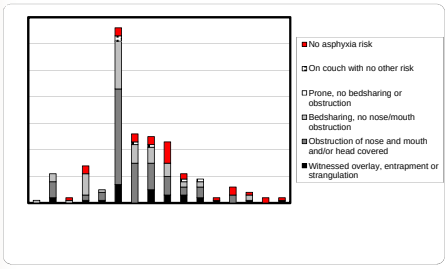
- Crib Deaths (60/209):
  - 28.7% of deaths
    - 40% of crib deaths prone and face down (nose/mouth blocked)
    - 16.7% of crib deaths prone with either partial or no nose/mouth blockage
    - 40% supine

Age and Location of Death



Pasquale-Styles et al, 2007

Age and Risk Factor of Asphyxia



Pasquale-Styles et al, 2007

SIDS Reviews in the Literature: St. Louis

- St. Louis and St. Louis County reviewed death scene investigation and medical examiners' investigation of deaths from 1/1/94 to 12/31 97.
- 119 infant deaths studied.
- Mean age: 109.3 days (range 6-350)

SIDS Reviews in the Literature: St. Louis

- Diagnoses:
  - SIDS in 88 deaths
  - Accidental suffocation in 16
  - Undetermined in 15

SIDS Reviews in the Literature: St. Louis

- Prone: 61.1% of cases.
- Found on sleep surface not designed for infants: 75.9% of cases.
- Head or face covered by bedding: 29.4% of cases.
- Shared sleep surface (bedsharing): 47.1%.
- Only 8.4% of SIDS deaths involved infants found nonprone and alone, with head and face uncovered.

SIDS/Natural vs. Undetermined/Undetermined

- SIDS implies no contribution of injury (I.e., purely a natural death)
  - Should NOT be used in cases with:
    - Bed sharing
    - Prone position on soft bedding
    - Obstruction of the nose and mouth when found
    - Coverage of the head by bedding when found

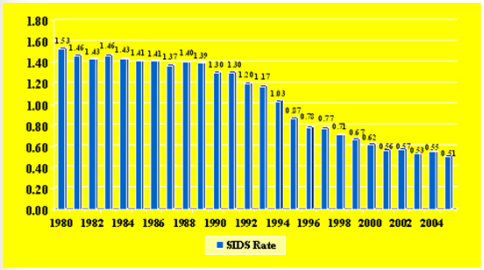
SIDS/Natural vs. Undetermined/Undetermined

- If scene shows risk factors for asphyxia, choices are:
  - Undetermined cause and manner of death
    - Recommend qualifying for public health:
      - I.e., "Cause of Death: Undetermined (Baby found dead in adult bed while co-sleeping with adults).
  - Asphyxia/Accident

What if You Have Competing Causes of Death?

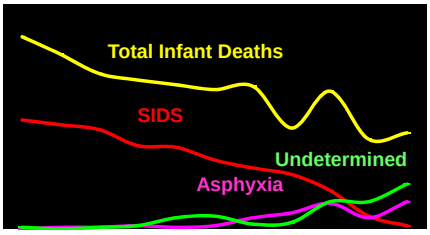
- I.e., Evidence of natural disease AND suspicion of asphyxia at the scene?
  - Findings of each case should be evaluated independently
  - Consider multifactorial cause of death
  - Asphyxia/Injury takes precedence when assigning manner of death!

Annual SIDS rate per 1000 births



Source: CDC and National Center for Health Statistics

Decreasing Infant Deaths and Diagnostic Shift



Wayne County Medical Examiner Office, Detroit, Michigan, Pasquale-Styles, et al., 2007

American Academy of Pediatrics 2005 Sleep Recommendations

- Infant placed to sleep on back (not side).
- Use a firm sleep surface.
- Keep soft objects and loose bedding out of crib.
- Do not smoke during pregnancy.
- Sleep separately but in close proximity.
- Consider using a pacifier at sleep time.
- Avoid overheating
- Avoid devices marketed to reduce SIDS
- Don't rely on home monitors to reduce SIDS
- Continue Back to Sleep campaign

Recommendations

- These recommendations are also strongly supported by (among others):
  - The national Institute of Child Health and Human Development (NICHD)
  - The Center for Disease Control and Prevention (CDC) Division of Maternal and Infant Health in association with the National Center for Health Statistics (NCHS).

Benefits Vs. Risks

- There are those who propose that there are benefits of co-sleeping/bedsharing with infants
- The increase in risk of sudden unexpected infant death (SUIDS, estimated at **40-50%** in infants of nonsmoking mothers) versus perceived benefits needs to be carefully evaluated!

Co-Sleeping/Bedsharing

- Not all co-sleeping/bedsharing is the same!
  - Intoxicated parents
  - "Deep" or "fitful" sleepers
  - Different body frames/sizes
  - Degrees of exhaustion
  - Sick caretaker
  - Sleep apnea
  - Pets in the bed
  - Number of people in the bed
  - Sleeping environment

Benefits vs. Risks

- Benefits:
  - Ease in breastfeeding/infant care
  - Increased caretaker-infant bonding
  - Cultural tradition
  - Family experience
  - "Cuteness" factor
- Risks: Infant death

Still…

- Asphyxia is NOT the final answer to the SIDS mystery!
- Many more potential causes out there that can have negative autopsy findings and negative investigations:
  - Cardiac channel anomalies
  - Congenital seizure disorders
  - Undiagnosed metabolic disorders
  - And many, many more…

Conclusion

- Most effective way to investigate sudden infant deaths:
  - Detailed interview
  - Thorough scene investigation will doll re-enactment
  - Complete autopsy
  - Review of clinical history
- Better information leads to:
  - Improved diagnoses
  - Reinforcement of education and preventive measures.

Free Manual Available Online

- Curriculum guide and manual for guidelines for the scene investigator developed by the CDC (Department of Health and Human Services).
- Endorsed by the:
  - American Board of Medicolegal Death Investigators
  - National Board of Medical Examiners
  - National Sheriffs' Association
- http://www.cdc.gov/sids/TrainingMaterial.htm

Thank you

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