Sudden Infant Death Syndrome: Research and Risk Reduction

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No Conflicts of Interest to Disclose
“And this woman's son died in the night ...”

1 Kings 3: 19
(950 B.C.)
The sudden unexpected death of an infant, under one-year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy, and review of the circumstances of death and the clinical history.

What Shall We Call them?

- From blaming parents, Ancient Greece and Rome through the Middle Ages.
- To natural causes, Late 1800’s and early 1900’s.
- To blaming parents again, Early to mid 1900’s.
- To natural causes again, Late 1900’s and early 2000’s.
- Now to unsafe, accidental causes.

When diagnosing the cause of death in an infant dying suddenly and unexpectedly during sleep, the following terms are considered synonymous:

- SIDS
- SUID
- SUDI
- Undetermined

They all mean the same thing; that the infant’s death is *unexpected* and *unexplained*.

Deaths per 1000 Live Births

- AI/AN
- Non-Hispanic Blacks
- Non-Hispanic Caucasians
- Hispanic
- API

https://www.cdc.gov/sids/data.htm

393,216 total infants
165 SIDS victims

Altitude of Residence (feet)

- <6000
- 6000-8000
- >8000

SIDS Rate per 1000 live births
SIDS Autopsy Findings

• No identifiable cause of death.
• No signs of severe illness.
• No signs of significant stress.
• Diagnosis of exclusion
How Are We to Understand SIDS?

Imagine a car driving up a steep mountain road.

The car has stopped.

Why can’t the car continue up the hill?

Modified after Professor Jacopo P. Mortola. McGill University
Imagine a car driving up a steep mountain road. The car has stopped. Why can’t the car continue up the hill?

**Medical Model.**

- There is a flat tire.
- Identify the problem.
- Find a solution to the problem.
- Fix the problem.

Modified after Professor Jacopo P. Mortola. McGill University.
A Traditional Medical Model of SIDS

- Cardiac causes.
- Respiratory causes.
- Arousal disorders.
- Metabolic disorders.
- Infections.
- Vitamin deficiency.
- Environmental toxins.
How Are We to Understand SIDS?

Imagine a car driving up a steep mountain road. The car has stopped. Why can’t the car continue up the hill?

A New Way of Thinking.

• There are too many passengers.
• The engine is not powerful enough.
• The road is too rocky.
• The road is too steep.

Modified after Professor Jacopo P. Mortola, McGill University.
Infant Vulnerability

Development

Environment

SIDS

Any system in transition is intrinsically unstable.

Infant cardiorespiratory physiology undergoes rapid changes in the first 3-6 months of life.

Thus, infant physiological responses are immature and do not function optimally.

The CHIME Study

- Clinical Sites.
  - Los Angeles, California.
  - Chicago, Illinois.
  - Honolulu, Hawaii.
  - Cleveland, Ohio.
  - Toledo, Ohio.
- Clinical Trial Operation Center.
- Data Coordinating and Analysis Center.
- NICHD.

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<table>
<thead>
<tr>
<th>Group</th>
<th>Monitoring Details</th>
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<tbody>
<tr>
<td>Healthy Term Infants</td>
<td>Home monitoring up to 66 wks PCA (age 6 months).</td>
</tr>
<tr>
<td>Preterm Infants</td>
<td>Home monitoring up to 56 wks PCA (age 4 months).</td>
</tr>
<tr>
<td>ALTE Infants</td>
<td>Until infant has no real alarms for 3-months.</td>
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<tr>
<td>SIDS Siblings</td>
<td>Until 66 wks PCA, or 4 wks past age of death of SIDS.</td>
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The CHIME Study

- Respiratory Inductance Plethysmography.
- Central and Obstructive Apneas.
- Electrocardiogram.
- Pulse Oximeter.
- Body Position.
- Computer to record events and normative data.

The CHIME Home Monitor (Non Invasive Monitoring Systems, Miami, Florida, U.S.A.)

Is SIDS a Catastrophic Physiologic Crisis?

• If normal infants do not precisely control breathing, heart rate, and oxygenation …

• Then SIDS may not have to be a catastrophic physiological crisis.

• Maybe it just needs to be a small problem which nudges or pushes a vulnerable infant over the edge.
Rate of at least 1 extreme event

PCA (weeks) at beginning of 4-week observation period

SIDS


Brainstem Serotonin Concentration (pmol/mg)

<table>
<thead>
<tr>
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<th>Raphe Obscurus</th>
<th>PGCL</th>
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<tbody>
<tr>
<td>SIDS (n=35)</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td>Controls (n=5)</td>
<td>70</td>
<td>50</td>
</tr>
<tr>
<td>Hospitalized (n=5)</td>
<td>80</td>
<td>70</td>
</tr>
</tbody>
</table>

P <0.05
P <0.04
5-HT$_{1A}$ Receptor Binding Density in SIDS Brainstems

5-HT$_{1A}$ Receptor Binding Density in SIDS Brainstems

Sudden death without Asphyxia
Sudden death with Asphyxia
Known Cause of Death

Accidental Asphyxia or Suffocation

Sudden Death with Asphyxia

Sudden Death without Asphyxia

Brain Abnormality

None

Intermediate

Severe

Asphyxial Insult

Severe

Intermediate

None


Infant Vulnerability may have Many Causes

Imagine a car driving up a steep mountain road. The car has stopped. Why can’t the car continue up the hill?

A New Way of Thinking:

- Some cars are Ferrari’s.
- Some cars are Jeep’s.

Modified after Professor Jacopo P. Mortola, McGill University
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The Majority of SIDS Victims Have ≥1 Risk Factor

244 SIDS victims from New Jersey, 1996-2000.

Number of Risk Factors (modifiable and nonmodifiable) present per case

How can we, as a population, reduce the risk of SIDS?
Most infants with risk factors will not die from SIDS.

Some infants without risk factors will die from SIDS.

However, infants with risk factors are at increased risk of dying from SIDS.
Sleep-Related Infant Deaths: Updated 2022 Recommendations for Reducing Infant Deaths in the Sleep Environment

Rachel Y. Moon, MD, FAAP; Rebecca F. Carlin, MD, FAAP; Ivan Hand, MD, FAAP

THE TASK FORCE ON SUDDEN INFANT DEATH SYNDROME AND THE COMMITTEE ON FETUS AND NEWBORN

Babies Should Sleep on their Backs for Every Sleep

New Emphasis in 2022:

• Infants should sleep on a flat surface (<10° incline); including infants with GERD.

• Preterm infants should sleep supine as soon as medically stable; generally by 32-weeks PCA.

• Infants who roll may stay in their preferred position, but infant should be placed supine until 1-year of age.

• Skin-to-skin recommended at birth if the mother is alert, and if she is able to respond to her baby.

Use a Firm, Flat, Non-inclined Sleep Surface to Reduce the Risks of Suffocation, Wedging, and Entrapment

Sitting Devices (Car Seats, Strollers, etc.) are Not Recommended for Routine Sleep

Feeding Human Milk is Recommended

Roomsharing, Without Bedsharing, is Recommended

New Emphasis in 2022:

- Couches, armchairs, and sofas are extremely dangerous.
- Inadvertent bedsharing may occur if a mother falls asleep while breastfeeding.
- Infants sleeping in a separate room from parents is associated with a 3-12 times increased risk of SIDS.
- Do not co-bed twins, triplets, etc.

Keep Soft Objects and Loose Bedding Out of the Crib

Consider Offering a Pacifier at Nap Time and at Bedtime

Avoid Cigarette Smoke Exposure and Vaping During Pregnancy and After Birth

Avoid Alcohol, Marijuana, and Illicit Drug Use During Pregnancy and After Birth

Avoid Overheating and Head Covering; Infants Should Not Feel Hot to Touch

Infants Should Be Immunized According to AAP and CDCP Advice

http://healthlevelup.com/vaccinations-and-children/
Avoid Use of Commercial Devices Inconsistent with Safe Infant Sleep

Do Not Use Cardiorespiratory Monitors to Reduce the Risk of SIDS

Encourage *Tummy Time* when the Infant is Awake and Being Observed.

http://healthlevelup.com/vaccinations-and-children/
Avoid Swaddling if …

- Prone sleeping position.
- Thick blankets.
- Face covered.
- For infants older than 3-months.

There is a danger when infants begin to roll from supine to prone, the swaddled infant can not regain the supine position.

Supine

Alone

Firm mattress

Empty crib
SIDS
Grief
Guilt
SIDS Parent Support
Public Health Nurse
Primary Care Physician

If You Have a SIDS Baby in Your Practice

• Meet with the parents.
• Refer them to a SIDS Parent Support group.
• As an authority on healthcare, tell them:
  • There is nothing they did to cause the death.
  • There is nothing they could have done to prevent the death.
• Recognize that health care professionals also feel guilty.

• SIDS is not hereditary.

• SIDS victims have a higher proportion of gene variants that may be associated with sudden death.

• Investigators do not think these caused death, but could they increase an infant’s vulnerability?

• Conventional wisdom is that subsequent siblings of SIDS are not at increased risk of dying from SIDS.

SIDS Siblings Odds Ratio for SIDS compared to No SIDS in Family

Diagnoses not accurate: Death Scene Investigation not in SIDS definition.

Subsequent Siblings of SIDS Victims

- Many of these studies had few SIDS; 2-18.
- Diagnoses not precise in all studies, except about half of those in Christensen et al.
- Some studies show death rates similar to siblings of children who died from other causes.

Subsequent Siblings of SIDS Victims

Odds Ratio for SIDS compared to non family members

- Siblings: 4.2
- 1st Cousins: 2.6
- Any Family Member: 2.2

Not clear if subsequent siblings of SIDS victims actually are at increased risk of recurrent SIDS.

Parents of subsequent siblings of SIDS are more likely to adhere to safe infant sleep, perhaps reducing their risk.

Even if risk is increased, recurrent SIDS is a rare event.

This may not be reassuring to a family who already experienced a SIDS death.

• No specific diagnostic tests or interventions are required.

• Home infant apnea-bradycardia monitors, used for over a decade, did not decrease the SIDS rate.

• Should adhere to Safe to Sleep recommendations, which is the only evidence-based strategy to reduce the risk of SIDS.

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Most common cause of sudden infant death between the ages of 1-month and 1-year.

Cause remains unknown.

Can not be predicted in infants prior to death.

Reduction in SIDS in populations through public health intervention.

SIDS has not been eliminated.