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Sudden Infant Death Syndrome: Understanding the Research and Reducing Risk

WHAT IS SUID AND SIDS?

The term SUID, “sudden unexpected infant death” is defined as death in infants less than 1 year of age that occurs suddenly and unexpectedly, where the cause of death is not immediately obvious prior to investigation. With a thorough case investigation, many of these sudden unexpected infant deaths can be explained. Explainable causes for SUID include poisoning, metabolic disorders, hyper or hypothermia, suffocation, neglect and homicide (Figure 1). When cases of SUID remain *unexplained* after a complete autopsy, examination of the death scene and review of the clinical history the death is classified as “sudden infant death syndrome” or SIDS. It is a diagnosis of exclusion. In the United States there are approximately 4600 SUID cases per year. Of those deaths, about 2300 are classified as SIDS. It is the leading cause of death in infants one month to one year of age. SIDS occurs suddenly, without warning, often during periods of sleep. About 90% of SIDS deaths occur before 6 months of age, and the peak incidence is 2 to 4 months. SIDS is not caused by vaccines or a virus, and it’s not caused by abuse or neglect. There is a higher incidence among African American, Native American and Alaskan Native infants than Caucasian infants. However, no race, religious, ethnic or socioeconomic group is immune to SIDS. Babies with the following risk factors are at greatest risk: low birth weight (<2500g); premature (<37 weeks); maternal smoking during pregnancy and smoke exposure after birth; multiple births; maternal age younger than 18 years; maternal drug and alcohol abuse; and <18 months between births. The cause of SIDS remains unknown.

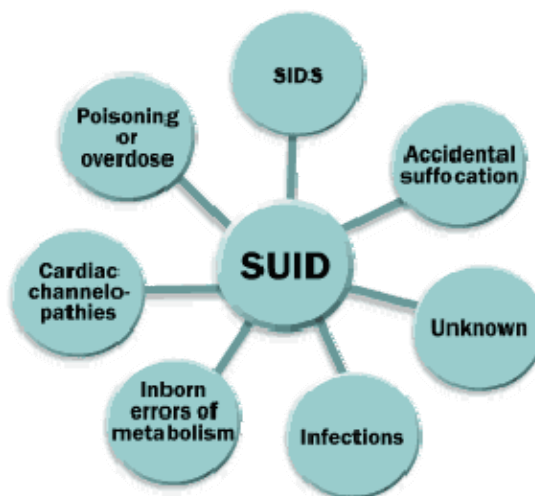


Figure 1: Possible causes for SUID

RESEARCH AND THE TRIPLE RISK MODEL

Since 1982, research theories regarding the cause of SIDS have been centered on the hypothesis of defective cardiorespiratory control as the mechanism of death. Researchers are beginning to understand how sleep and homeostasis are influenced by environmental and genetic risk factors and possible abnormalities in the developing brain. One widely accepted research model is the Triple Risk Model for SIDS (Figure 2). This model, proposed in 1994, emphasizes the interaction of multiple factors in the pathogenesis of SIDS. According to this model there are three factors present simultaneously when SIDS occurs: a critical period of development (first 6 months of life); an underlying vulnerability (possible brainstem abnormality); and exogenous or environmental stressors (prone/side sleep position, nicotine exposure, soft bedding, overheating, bed sharing). The authors propose that SIDS does not cause death in normal infants but only in vulnerable infants with an underlying abnormality. When the exogenous or environmental stressor, for example prone sleeping is removed, the baby passes through the critical period of development unharmed. Much of the current research is focused on discovering this underlying vulnerability. The major focus has been on the brain stem, where control of respiration, chemosensitivity, autonomic function, sleep and arousal are mediated. Researchers have reported abnormalities in various neurotransmitters or their receptor sites in relevant regions of the brainstem of infants with SIDS. The most compelling evidence for a neurochemical abnormality in the brainstem comes from research on the serotonergic system. Four independent studies on the medullary 5-hydroxytryptamine system found that 50-75% of infants with SIDS appear to have abnormalities in this system. This system in the brainstem regulates many homeostatic functions such as ventilation, gasping, responses to carbon dioxide and oxygen, thermoregulation and arousal from sleep. The research suggests that for vulnerable infants the protective responses to exogenous stressors during sleep may fail resulting in SIDS. Research efforts are ongoing to develop a way of identifying infants that may have an underlying vulnerability to SIDS. At this time we don't know which infant are more vulnerable to SIDS. We can't predict or prevent SIDS, but research shows that a baby's risk for SIDS can be reduced by following the safe sleep recommendations from the American Academy of Pediatrics.



Figure 2: Triple Risk Model for SIDS

MODIFIABLE RISK FACTORS FOR SIDS & REDUCING RISK

SLEEP POSITION:

Since the Back-to-Sleep Campaign was initiated in 1994 and the public was educated about the dangers of prone (stomach) sleeping, the incidence of SIDS in the United States has declined more than 50%. Studies suggest that prone sleeping may increase the baby's risk for SIDS through several mechanisms: it increases the probability of re-breathing exhaled carbon dioxide, it may cause upper airway obstruction and it interferes with the dissipation of body heat and may lead to overheating. Compared to back sleepers, babies who sleep on their stomach are less reactive to noise and they experience sudden decreases in heart rate and blood pressure. They also experience less movement, higher arousal thresholds and longer periods of deep sleep. Prone sleepers have a 5-7 times greater risk of SIDS. For unaccustomed stomach sleepers (babies who usually sleep supine), their risk of SIDS when placed prone to sleep is increased by 20%. In 2005, the American Academy of Pediatrics' Task Force on Sudden Infant Death Syndrome determined that infants sleeping in the side-lying position were also at greater risk for SIDS. Side-lying is an unstable position for sleeping because the baby is at risk for rolling onto his stomach. When California researchers compared the two sleeping positions in 2003, they found that the risk for SIDS with side sleeping was similar to prone sleeping. Unfortunately, as the incidence of prone sleeping decreased in this country, the incidence of side sleeping increased. In 2008, researchers found that 30-50% of infants with SIDS were still being found in the prone position. A significant number of these babies were put down to sleep on their sides. The current recommendation from the AAP regarding sleep position is as follows: "Infants should be placed for sleep in a supine position (wholly on the back) for every sleep. Side sleeping is not as safe as supine sleeping and is not advised." They also warn consumers to avoid commercial products marketed to maintain sleep position or prevent re-breathing. Swings, car seats and bouncy chairs are not safe for infants to sleep in as their risk for airway obstruction and overheating is increased. The Iowa SIDS Foundation reported data from Iowa SIDS deaths in 2008 and 2009. Of the 91 infants who died suddenly and unexpectedly during sleep, 63 infants were found either on their stomach, side, or seated in a car seat or swing.

Recommendations from Iowa SIDS Foundation:

- *"Infants should ALWAYS be placed flat on their back alone in a safe crib for ALL sleep, naps and nighttime. If baby falls asleep in a swing, car seat, bouncy chair or other surface while at home or child care, immediately remove baby and place them flat on their back in a safe crib."*
- *"...Do NOT use commercial devices marketed to reduce the risk of SIDS."*
- *"Encourage supervised tummy time when baby is awake to assist in developing head and neck control."*

OVERHEATING:

Several studies in the early to mid 1990's demonstrated that overheating increases the infant's risk for SIDS. Over bundling can predispose the infant to an increased core body temperature and overheating. It is important for the baby's head to remain uncovered because a significant amount of heat is eliminated from the face and head. The AAP recommends a bedroom temperature that is comfortable for a lightly clothed adult, 65-71°F is appropriate. If the baby feels cool to touch, add a layer of clothing. Wearable blankets and sleep sacks are recommended for warmth instead of loose blankets. The infant should not feel hot to touch, and parents should be advised to check his core temperature if there is a question of fever. Fever can be a sign of illness, but fever and sweating are

also signs of overheating. Babies can easily become overheated in car seats and carriers, so parents should be advised to use caution with car seat covers and blankets placed over the car seat.

Recommendation from Iowa SIDS Foundation:

- *“To avoid overheating, baby should be lightly clothed for sleep and the room temperature should be kept comfortable to a lightly clothed adult.”*

SOFT SLEEP SURFACES & BEDDING:

Soft sleep surfaces and soft bedding in the infant’s sleep environment have been identified as risk factors for SIDS in several recent studies in the United States. Soft bedding in the crib or parents’ bed may trap exhaled air and increase the baby’s risk of re-breathing carbon dioxide instead of oxygen rich air. The AAP recommends that soft objects such as pillows, quilts, comforters, sheepskins and stuffed toys be kept out of the crib. The recommended sleeping surface is a firm mattress covered by a sheet with nothing underneath. As an alternative to loose blankets, parents should consider using wearable blankets or sleep sacks. Adult mattresses, waterbeds and sofas (couches) are not safe sleep surfaces for infants. Of the 91 babies who died of SIDS in Iowa in 2008 and 2009, 71% had soft bedding, such as bumper pads, blankets, toys, or pillows in their sleep environment.

New Crib Safety Standards

Beginning June 28, 2011 the Consumer Product Safety Commission requires that all cribs manufactured and sold (including resale) must comply with new and improved federal safety standards. The new rules, which apply to full-size and non full-size cribs, prohibit the manufacture or sale of traditional drop-side rail cribs, strengthen crib slats and mattress supports, improve the quality of hardware and require more rigorous testing. The details of the rule are available on the CPSC website at www.cpsc.gov/businfo/frnotices/fr11/cribfinal.pdf. By December 28, 2012, child care centers must use only compliant cribs that meet the new federal safety standards.

Recommendations from Iowa SIDS Foundation:

- *“A firm mattress in a safety approved crib, covered by a tight fitting sheet, is the recommended sleep surface for baby.”*
- *Keep ALL soft objects and loose bedding out of the crib. Items such as pillows, blankets, bumper pads, wedges, blanket rolls, and toys create an opportunity for baby to rebreathe carbon dioxide that may build up around baby’s face.”*
- *“Consider a wearable blanket or sleeper to keep baby comfortable and eliminate the risk of baby’s head being covered.”*
- *“Keep baby’s crib free of all soft bedding and positioning devices....”*

NICOTINE EXPOSURE:

Maternal smoking before, during and after pregnancy continues to be a major risk factor for SIDS in many epidemiologic studies. A recent study suggests that infants with in utero exposure to cigarette smoke have an altered arousal response that may increase their risk of SIDS. In the Iowa data from 2008 and 2009, 58% of the 91 infants who died of SIDS were exposed to nicotine before or after birth. Exposure to second-hand smoke increases the risk for SIDS in a dose-dependent manner. In other words, every time the baby is exposed to nicotine his risk for SIDS increases. Educational materials regarding smoking cessation should be provided at every prenatal and postnatal visit for the mom who smokes. It’s important to note that when the smell of smoke is still present on clothing after parents or caregivers go outside to smoke, the toxins are still present. To avoid

exposing the infant to nicotine from third-hand smoke, parents should be advised to change their clothing before holding the baby.

Recommendation from Iowa SIDS Foundation:

- *“Provide a nicotine free environment for baby, before and after birth. If odor from second hand smoke is detectable on clothing or bedding, research shows toxins are still present that can be harmful to baby.”*

BED SHARING:

Bed Sharing is defined as baby sleeping with parent(s) in their bed or with other adults or children on a sleep surface that is not safe for infants. It has emerged as a major risk factor for SIDS in this country and in Iowa. Approximately 50% of sudden infant deaths occur when infants are sharing a bed, sofa or sofa chair with another person. According to the Iowa SIDS Foundation, of the 91 infants who died of SIDS in 2008 and 2009, 40 infants (44%) were sleeping with an adult or sibling at the time of death. Accidental suffocation from entrapment or overlaying is the most commonly reported cause of SIDS deaths associated with bed sharing. Bed sharing usually involves multiple risk factors, including soft bedding and risk of overheating. Several studies suggest that younger infants, <12 weeks old may be more susceptible to SIDS while bed sharing because they lack the motor skills to escape potential danger in their sleep environment. In 2003, researchers compared the risk of accidental suffocation for infants on sleep surfaces designed for infants (cribs) with the risk on adult beds. They concluded, “The most conservative estimate showed that the risk of suffocation increased by 20-fold when infants were placed to sleep in adult beds rather than cribs.” Iowa statistics from 2008 and 2009 confirmed that 40 of 91 babies who died of SIDS were sleeping with an adult or sibling at the time of death. The AAP recommends that infants not bed share during sleep. The recommendation is for “a separate but proximate sleeping environment” where the baby has his own bed positioned close to mom’s bed. Bed sharing often occurs to facilitate breastfeeding. Infants can be brought into the mother’s bed for nursing, but they should be returned to their own crib or bassinet when mom is ready to sleep. Several studies have demonstrated that sleeping with an infant on a couch or recliner is *extremely* hazardous.

Recommendation from Iowa SIDS Foundation:

- *“Parents may share a room with baby but NEVER a bed! A separate but close sleeping area is recommended. Sleeping with a baby in a bed, couch, recliner, or other sleep surfaces with adults or other children is NOT SAFE!”*

PROTECTIVE MEASURES

Pacifier Use: Several studies have reported a protective effect on the incidence of SIDS when pacifiers are used. The mechanism of protection is unclear, but a lowered arousal threshold has been suggested. The AAP recommends that a pacifier be offered at nap time and bed time for the first year of life. It’s not necessary to reinsert the pacifier once the baby falls asleep. If he refuses the pacifier, he should not be forced to take it. For breastfed infants, introduction of the pacifier can be delayed one month until breastfeeding is established.

Room Sharing: There is compelling evidence from several studies, including data from the European Concerted Action on SIDS study that room sharing (infant sleeping in the parents’ room) is associated with a decreased risk of SIDS. The AAP recommends that the infant’s crib or bassinet be placed in the parents’ bedroom.

RESOURCES

- The **Iowa SIDS Foundation**® is a statewide non-profit health organization dedicated to providing emotional support to SIDS families, educating the general public about SIDS and funding medical research into the causes of SIDS. (866) 480-4741; <http://www.iowasids.org>



**NEW!! "Safe Sleep for Iowa Babies" DVD and Educational Brochure:
Risk Reduction Recommendations for Infant Safe Sleep
(Based on the recommendations of the American Academy of Pediatrics)**

- **First Candle** is one of the nation's leading nonprofit organizations dedicated to safe pregnancies and the survival of babies through the first years of life. Their goal is to eliminate stillbirth, Sudden Infant Death Syndrome (SIDS) and other Sudden Unexpected Infant Deaths (SUID) with programs of research, education and advocacy. <http://www.firstcandle.org/>

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**Additional references available upon request*

SEND QUESTIONS OR COMMENTS TO:

Penny Smith, RNC-NIC, BSN

Neonatal Nurse Specialist

Iowa Statewide Perinatal Care Program

Department of Pediatrics

200 Hawkins Drive

Iowa City, IA 52242-1083

Phone: (319) 356-1855; Email: penny-smith@uiowa.edu