

Brainstem abnormalities found in 'SIDS' infants, in both safe and unsafe sleep environments

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Investigators at Boston Children's Hospital report that infants dying suddenly and unexpectedly, in both safe and unsafe sleep environments, have underlying brainstem abnormalities and are not all normal prior to death.

The researchers also point to the need to detect and treat this underlying vulnerability early, the focus of their current work. They report their findings in the December issue of *Pediatrics*.

The investigators, led by Hannah Kinney, MD, a neuropathologist at Boston Children's, have shown over the past two decades that infants who die suddenly, unexpectedly and without explanation—whose deaths are generally attributed to [sudden infant death syndrome](#) (SIDS)—have differences in brainstem chemistry that set them apart from infants dying of other causes.

These abnormalities impair brainstem circuits that help control breathing, heart rate, blood pressure and temperature control during sleep, and, the researchers believe, prevent sleeping babies from rousing when they rebreath too much carbon dioxide (due to inadequate ventilation) or become overheated (from overbundling).

At the same time, epidemiologic studies have shown that infants dying suddenly and unexpectedly are often found in unsafe sleep

environments, such as sleeping face down with their face in the pillow, or sleeping with another person in the bed.

In the new study, Kinney and colleagues asked if these infants are truly normal. They reexamined their data, reviewing the cases of 71 infants who died suddenly and unexpectedly, were autopsied at the San Diego County Medical Examiner's office from 1997 to 2008, and had brainstem samples available for analysis. The researchers grouped the infants according to sleep circumstances—those considered safe (asphyxia not likely) or unsafe (asphyxia likely) based upon death-scene investigation reports.

In the end, they compared 15 infants with SIDS whose deaths were deemed not to involve asphyxia (group A), 35 SIDS infants whose deaths were possibly asphyxia-related (group B) and 9 infants who clearly died from other causes (controls). They excluded the other infants, who either had insufficient data or had evidence of other clear risk factors for death, such as exposure to drugs or extremes of temperature.

Brainstem neurochemical abnormalities—involving serotonin, serotonin receptors, GABA receptors and 14-3-3 (a protein that regulates serotonin)—were found in both group A and group B. Neurochemical measures didn't differ significantly between the two groups, but each group differed significantly from the controls.

"Even the infants dying in unsafe sleep environments had an underlying brainstem abnormality that likely made them vulnerable to sudden death if there was any degree of asphyxia," Kinney says. "The abnormality prevents the brainstem from responding to the asphyxial challenge and waking."

The investigators believe these findings confirm that sudden unexplained death in infants is associated with underlying vulnerabilities, and that not

all infants who die in compromised sleep environments are normal.

"Certainly, there are unsafe sleeping environments that can cause any baby to die, such as entrapment in the crib, but if it's just sleeping face down, the baby who dies may have an underlying brainstem vulnerability," says Kinney. "We have to find ways to test for this underlying vulnerability in living babies and then to treat it. Our team is focused now upon developing such a test and treatment.

"Safe sleep practices absolutely remain important, so these [infants](#) are not put in a potentially asphyxiating situation that they cannot respond to," she adds.

Provided by Children's Hospital Boston

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