

Rubens D, Allen T

Seattle Children's Hospital/University of Washington , Seattle , WA, United states

INTRODUCTION: Sudden Infant Death Syndrome (SIDS) remains the leading cause of infant mortality in Western societies (Hauck FR, Tanabe KO 2008). A prior study identified an association between hearing suppression on the newborn hearing test and subsequent death from SIDS (Rubens DD et al 2008). This is the first finding of an abnormality in SIDS cases prior to death. Respiratory tracings and abnormalities in brainstem areas involved with cardio-respiratory control and arousal further support the view that a failure of the infant to arouse from a suffocating hypoxic environment is a key component of the terminal event in SIDS (Darnall RA et al 2010). The objective of the present study was to assess whether inner ear dysfunction not only weakens the hypercapnic response, but also plays a role in suppressing the arousal response to suffocating gas mixtures.

METHODS: Wild type mice (n=28) received intra-tympanic gentamicin (IT-Gent) injections bilaterally or unilaterally to precipitate inner ear hair cell dysfunction. Three control groups (n=22) received intra-tympanic saline (IT-Saline) bilaterally or unilaterally (right or left), or intra-peritoneal gentamicin (IP-Gent). The body movement arousal responses to severe hypoxia-hypercarbia combined (5% CO₂ in nitrogen) were tested under light anesthesia eight days following the administration of gentamicin or saline.

RESULTS: After injections, the bilateral and unilateral IT-Gent treated animals behaved similarly to controls, however the arousal movements in response to severe hypoxia-hypercarbia were suppressed in IT-Gent treated animals compared to control animals (P<0.05). Arousal movements were suppressed in the bilateral IT-Gent group (n=9) compared to bilateral IT-Saline controls (n=7, P<0.0001) and in the unilateral IT-Gent group (n=19) compared to unilateral IT-Saline controls (n=10, P<0.0001).

DISCUSSION: The findings support the theory that inner ear dysfunction could be relevant in the pathophysiology of SIDS. The inner ear appears to play a key role in arousal from suffocating gas mixtures that has not been previously identified. We also plan a large scale population based study to analyze the hearing difference found in SIDS cases in more detail.

1. Hauck FR, Tanabe KO. International Trends in Sudden Infant Death Syndrome: Stabilization of Rates Requires Further Action. *Pediatrics*. 2008 Sep;122(3):660-6.
2. Rubens DD, Vohr BR, Tucker R, O'Neil CA, Chung W. Newborn oto-acoustic emission hearing screening tests: preliminary evidence for a marker of susceptibility to SIDS. *Early Hum Dev*. 2008 Apr;84(4):225-9.
3. Darnall RA, McWilliams S, Schneider RW, Tobia CM. Reversible blunting of arousal from sleep in response to intermittent hypoxia in the developing rat. *J Appl Physiol*. 2010 Dec;109(6):1686-96.


