Positioning and SIDS

AAP Task Force on Infant Positioning and SIDS

SUMMARY STATEMENT

Based on careful evaluation of existing data indicating an association between Sudden Infant Death Syndrome (SIDS) and prone sleeping position for infants, the Academy recommends that healthy infants, when being put down for sleep, be positioned on their side or back. The most common position currently used in the United States is prone.

This recommendation is made with the full recognition that the existing studies have methodologic limitations and were conducted in countries with infant care practices and other SIDS risk factors that differ from those in the United States (eg, maternal smoking, types of bedding, central heating, etc). However, taken as a group the studies are convincing. No reports show an advantage to the prone position with regard to SIDS incidence and there are no data proving, or even strongly suggesting, that sleeping in the lateral or supine position is harmful to healthy infants. Thus, assessment of the risk/benefit balance for prone vs nonprone positioning for such infants favors the latter. It should be stressed that, the actual risk of SIDS for an infant placed prone is still extremely low.

There are still good reasons for placing certain infants prone. For premature infants with respiratory distress, for infants with symptoms of gastroesophageal reflux or with certain upper airway anomalies, and perhaps for some others, prone may well be the position of choice. A nonprone sleeping position is recommended for healthy infants only.

REPORT

Health care professionals frequently are asked how it is best to place an infant down for sleep, prone or supine. With lack of scientific studies clearly showing advantages of one position over another, professionals have tended to offer advice that seems most logical and to be guided by general custom. However, there is a growing body of literature reported from Europe, Australia, and New Zealand that suggests that the prone sleeping position may be associated with the Robin Anomaly.

Association Between Sleeping Position and SIDS

A possible relationship of the prone position and SIDS was suggested as early as the 1960s and early 1970s. Since then, a variety of publications have supported this relationship. Most studies involved retrospective interviews of parents after their infant had recently died of SIDS or prospective interviews of parents with children at high risk of SIDS. We have categorized the studies according to six criteria that we found to be essential for appropriate evaluation and comparison (Table 1), and further grouped them into three categories of study design: (1) those examining "usual" sleeping position (Table 2); (2) those examining how the infant was...
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<th>Studies Meeting Criteria</th>
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<th>No. of Infants</th>
<th>Controls Matched for</th>
<th>Time from Infant’s Death to Interview With Parents</th>
<th>No. in Prone Position</th>
<th>Odds Ratio (95% CI)*</th>
<th>Comments</th>
<th>Failed-Criteria Code†</th>
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<tr>
<td>Frogha</td>
<td>Ireland</td>
<td>1965–67</td>
<td>148</td>
<td>148</td>
<td>Sex, DOB, county of birth</td>
<td>2–3 wk</td>
<td>10/148 (7%)</td>
<td>6/148 (4%)</td>
<td>1.71 (0.55–5.47)</td>
</tr>
<tr>
<td>Nicholl and O’Cathain</td>
<td>United Kingdom</td>
<td>1976–79</td>
<td>304</td>
<td>273</td>
<td>DOB, residence</td>
<td>1–3 wk</td>
<td>111/265 (42%)</td>
<td>68/273 (25%)</td>
<td>2.17 (1.48–3.19)</td>
</tr>
<tr>
<td>McGlashan</td>
<td>Tasmania</td>
<td>1980–86</td>
<td>164</td>
<td>329</td>
<td>Sex, DOB, hospital</td>
<td>About 5 wk</td>
<td>96/164 (59%)</td>
<td>141/329 (43%)</td>
<td>1.88 (1.27–2.80)</td>
</tr>
<tr>
<td>Lee et al</td>
<td>Hong Kong</td>
<td>1986–87</td>
<td>21</td>
<td>…</td>
<td>Sex, DOB</td>
<td></td>
<td>7/16 (44%)</td>
<td>2/32 (6%)</td>
<td>11.67 (1.71–100.6)</td>
</tr>
<tr>
<td>Dwyer et al</td>
<td>Tasmania</td>
<td>1988–90</td>
<td>23</td>
<td>2592</td>
<td>High-risk score for SIDS at birth</td>
<td>5 wk</td>
<td>9/15 (60%)</td>
<td>837/2592 (32%)</td>
<td>3.15 (1.02–9.95)</td>
</tr>
<tr>
<td>Mitchell et al</td>
<td>New Zealand</td>
<td>1987–88</td>
<td>128</td>
<td>503</td>
<td>Age</td>
<td>About 4 wk</td>
<td>95/128 (74%)</td>
<td>221/503 (44%)</td>
<td>3.67 (2.33–5.80)</td>
</tr>
<tr>
<td>Hoffman</td>
<td>United States</td>
<td>1978–79</td>
<td>757</td>
<td>757</td>
<td>BW, race, city of birth</td>
<td></td>
<td>580/716 (81%)</td>
<td>576/752 (77%)</td>
<td>1.30 (1.10–1.69)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Studies Not Meeting Criteria</th>
<th>Location</th>
<th>Years</th>
<th>No. of Infants</th>
<th>Controls Matched for</th>
<th>Time from Infant’s Death to Interview With Parents</th>
<th>No. in Prone Position</th>
<th>Odds Ratio (95% CI)*</th>
<th>Comments</th>
<th>Failed-Criteria Code†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carpenter and Shaddick</td>
<td>United Kingdom</td>
<td>1958–61</td>
<td>110</td>
<td>196</td>
<td>Sex, age, residence, season</td>
<td>3–7 d</td>
<td>52/73 (71%)</td>
<td>25/63 (40%)</td>
<td>3.76 (1.74–8.23)</td>
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<tr>
<td>Kahn et al</td>
<td>Belgium</td>
<td>1977–81</td>
<td>95</td>
<td>…</td>
<td></td>
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<tr>
<td>Cameron and Williams</td>
<td>Australia</td>
<td>1980–82</td>
<td>225</td>
<td>411</td>
<td>DOB, age, hospital of birth</td>
<td>About 3 wk</td>
<td>144/208 (69%)</td>
<td>161/393 (41%)</td>
<td>3.24 (2.24–4.71)</td>
</tr>
<tr>
<td>Senegal et al</td>
<td>France</td>
<td>1984–85</td>
<td>20</td>
<td>318</td>
<td></td>
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<td></td>
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<tr>
<td>de Jonge et al</td>
<td>Netherlands</td>
<td>1980–86</td>
<td>62</td>
<td>254</td>
<td>Sex, age</td>
<td></td>
<td>57/62 (92%)</td>
<td>149/254 (59%)</td>
<td>8.03 (2.96–23.6)</td>
</tr>
<tr>
<td>Nelson et al</td>
<td>Australia</td>
<td>1986–87</td>
<td>49</td>
<td>0</td>
<td>None</td>
<td>&lt;255 d</td>
<td>28/42 (67%)</td>
<td>7/95 (14%)</td>
<td>13.91 (4.0–49.6)</td>
</tr>
<tr>
<td>Dwyer et al</td>
<td>Tasmania</td>
<td>1988–91</td>
<td>56</td>
<td>110</td>
<td>BW, age</td>
<td>5 wk</td>
<td>7/55</td>
<td>7/110</td>
<td>5.04 (2.29–11.11)</td>
</tr>
</tbody>
</table>

* The abbreviations used are: SIDS, sudden infant death syndrome; CI, confidence interval; DOB, date of birth; BW, birth weight; ALTE, apparent life-threatening event.
† See Table 1.
"last put down" prior to death (Table 3); and (3) those asking how the infant was "found" following death (Table 4).

Wherever possible, we have calculated from the published data the odds ratio21 of SIDS occurring if the infants were prone versus the number of infants prone in the control group. An odds ratio of greater than 1.0 describes a positive relationship of prone and SIDS for the particular population studied, while an odds ratio of less than 1.0 would describe an inverse relationship (i.e., a protective effect of prone). The range listed in parentheses denotes the 95% confidence interval for the odds ratio. If the lower limit of the confidence interval is greater than 1.0, than 1.0 describes a positive relationship of prone position and SIDS for the particular population studied, while an odds ratio ranging from 1.3 to 11.7. Three studies that examined the infant's position through parental interviews, but estimated "usual" position via a mail survey.) When considered together, however, the studies present substantial evidence of an association of prone position and SIDS, independent of other variables. In three of these studies, the odds ratio increased further after accounting for confounding effects of other variables.22-24 No published report has suggested the converse—i.e., a reduced incidence of SIDS with the prone position.

Several investigators have called attention to the apparent relationship of predominant sleeping position and SIDS incidence when one country is compared to another. Such comparisons must be viewed very cautiously because of numerous other coexisting cultural differences and variances in data collection. For example, the SIDS rates among Asians, for whom supine position is the norm, appear to be very low,14,25-28 however, numerous variables such as swaddling, lack of central heating, and increased frequency of the infant sleeping in the same bed with the parents29 are also quite different when compared to most Western countries.

### Change in SIDS Associated with Change in Sleeping Position

During the 1970s, infant sleeping position in the Netherlands reportedly changed from predominantly supine to predominantly prone. An abrupt increase in SIDS was noted soon afterward.19 In the mid 1980s, after several retrospective analyses had noted a relationship between SIDS and prone position, the lay press and a few investigators began to advocate supine or lateral positioning rather than prone in other

<table>
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<tr>
<th>Studies</th>
<th>Years</th>
<th>Location</th>
<th>Author(s)</th>
<th>Studies Meeting Criteria</th>
<th>Time From Death to Interview</th>
<th>Controls Matched for</th>
<th>Odds Ratio (95% CI)</th>
<th>Comments</th>
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<td>Studies</td>
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<td></td>
</tr>
<tr>
<td>France</td>
<td>1984-85</td>
<td>20</td>
<td>318</td>
<td>Sex, age, BW, mater smoking</td>
<td>17.70 (85%)</td>
<td>97/318</td>
<td>12.91 (20%)</td>
<td>Controls &quot;usual&quot;: SIDS last put down*</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1980-86</td>
<td>62</td>
<td>254</td>
<td>Sex, age, BW, mater smoking</td>
<td>17.70 (85%)</td>
<td>197/254</td>
<td>14.76 (47%)</td>
<td>Controls &quot;usual&quot;: SIDS last put down*</td>
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* The abbreviations used are: SIDS, sudden infant death syndrome; CI, confidence interval; DOB, date of birth; BW, birth weight.


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<th>Odds Ratio (95% CI)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beal and Porter77</td>
<td>South Australia</td>
<td>1985-89</td>
<td>100</td>
<td>220</td>
<td>None</td>
<td>&lt;48 hr</td>
<td>83/100 (83%)</td>
<td>53/182 (29%)</td>
</tr>
<tr>
<td>Bergman et al87</td>
<td>United States</td>
<td>1965-68</td>
<td>168</td>
<td>...</td>
<td>&lt;2 wk</td>
<td>85/168 (51%)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Beal and Blundell88</td>
<td>South Australia</td>
<td>1974-78</td>
<td>108</td>
<td>...</td>
<td>About 1 d</td>
<td>71/123 (58%)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Jorgensen et al99</td>
<td>Denmark</td>
<td>1956-71</td>
<td>139</td>
<td>...</td>
<td>...</td>
<td>41/88 (47%)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Nelson et al95</td>
<td>Australia</td>
<td>1986-87</td>
<td>49</td>
<td>...</td>
<td>&lt;255 d</td>
<td>34/42 (81%)</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Tonkin70</td>
<td>New Zealand</td>
<td>1972-82</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>51/91 (56%)</td>
<td>580/1882 (31%)</td>
<td>2.86 (1.87–4.38)</td>
</tr>
</tbody>
</table>

* The abbreviations used are: SIDS, sudden infant death syndrome; CI, confidence interval.
† See Table 1.
countries. Subsequently, very preliminary reports from New Zealand and the United Kingdom noted decreases in the incidence of SIDS by more than 50%, coincident with a change in sleeping position from mostly prone to predominantly supine or lateral. It is quite possible that other variables were also changing during this time.

Hypotheses Regarding Possible Mechanisms

Several hypotheses relating prone position and SIDS have been proposed, although they certainly have not been proven. Oropharyngeal obstruction has been demonstrated to precipitate apnea in preterm infants and perhaps in some infants through the first several months after birth. Posterior displacement of the mandible with resultant obstruction of the narrow, relatively vulnerable, pharyngeal airway of the infant may be precipitated by facial pressure, which is more likely to occur in the prone position. Obstruction may also be precipitated by distortion of the compliant nasal cartilage of the young infant when prone.

An animal model has been developed to explain how rebreathing, from a pocket formed in the infant’s bedding which would be more likely to occur in the prone position, may be responsible for a few cases of SIDS. Soft or porous sleeping surfaces may increase the likelihood of rebreathing. A proposal implicating a compromise of cerebral blood flow during cervical hyperextension (more likely to occur in prone infants) has been supported by studies with autopsy subjects. Both the airway obstruction and the blood flow compromise theories have been challenged by physiologic monitoring studies, involving small numbers of subjects during relatively brief time periods. Overheating, which may be more likely in prone infants for whom heat dissipation may be less effective, has been proposed by several investigators as a possible mechanism. Overheating has also been suggested as a possible explanation for some intercountry variations, perhaps reflecting differences in climate, heating conditions, and infant dressing customs.

Possible Deleterious Effects of Lateral or Supine Position

If one is to advocate changing the norm, which is the prone position in the United States, there must be relative assurance that the alternative lateral or supine position is not more hazardous for some other reason, perhaps unrelated to SIDS. Scoring systems have been developed for separating healthy infants into groups that are at high risk or low risk for SIDS; studies that have examined the effect of position have either not considered risk status or have considered only the high-risk population. Healthy infants at high risk for SIDS stand to benefit most from avoiding the prone position. There is a theoretical possibility that infants at low risk for SIDS may have a more adverse risk/benefit ratio. Future observations of infants with specific risk status may allow an identification of infants most likely to benefit from one position vs another.

Despite common beliefs, we discovered no evidence that aspiration is a more frequent complication in healthy infants lying supine when compared to other positions. Although we could find no controlled studies, aspiration is a very rare cause of infant death. One review of infant deaths that were not related to SIDS reports that the three infants who had aspirated prior to death had all been found prone.

There are several studies that suggest that symptomatic infants who have documented gastroesophageal reflux may reflux less in the prone position. Gastroesophageal reflux is common in healthy infants, but only a very small number are symptomatic and develop complications such as esophagitis, recurrent pneumonia, failure to thrive, or apparent life-threatening events. The proposed change in position is intended for healthy asymptomatic infants only.

Several investigations have demonstrated that healthy infants and preterm infants with respiratory distress have improved oxygenation and pulmonary function in the prone position, particularly if a depression has been cut in the mattress to facilitate abdominal excursions.

All of these observations may provide good rationale for placing some infants prone, as indicated under “Summary and Recommendations.” However, no convincing long-term beneficial effects or positive influences on decreasing mortality have ever been shown for the prone position in the populations studied.

Recent Recommendations Regarding Sleep Position in Other Countries

At least two countries have undertaken formal action to encourage parents to avoid placing their infants prone. The New Zealand Cot Death Prevention Programme began in March 1991; it advocates the lateral or supine sleeping position, discourages household and maternal smoking, and encourages breast-feeding. On October 31, 1991, the Chief Medical Officer for the Department of Health for the United Kingdom issued a press release advocating that “babies not (be) placed on their tummies when they are going to sleep.” Campaigns against the prone position have also been mounted by individuals or foundations in the Netherlands and in Australia.

**SUMMARY AND RECOMMENDATIONS**

Although prospective randomized clinical trials have not been performed, the weight of evidence implicates the prone position as a significant risk factor for SIDS. There is some concern that many of the studies have come from countries and regions with SIDS rates which are significantly higher than that of the United States. Nevertheless, the consistency of the results from a variety of countries makes it more likely that the data should be applicable to this country as well. In addition for the healthy infant, there appears to be little hazard associated with the lateral or supine positions. The preponderance of data have come from studies that asked about “usual” sleep position, as opposed to position “when found dead” or “last position seen.” Nevertheless, during the first
few months after birth, it appears as if the position in which the infant is first placed will substantially determine the position that the infant will maintain throughout sleep. Therefore, it appears reasonable to recommend that most healthy infants be placed in the lateral or supine position.

Many will advocate development of a carefully controlled clinical trial to test definitively the relationship of sleep position and SIDS. In view of the large population required for a study, the requirement for lay participation in any trial, and the bias that has already been introduced by previous publications and the lay press, it appears unlikely that such an impartial controlled trial could be conducted. However, there are techniques other than the controlled trial that can be used to evaluate this issue further. We encourage ongoing rigorous analysis of the relationship between sleeping position and SIDS in the United States. Subsequent increases or decreases of the incidence of SIDS in the United States may reflect a change in sleeping position or a change in some other variable. Watching for and reporting possible changes in selected regions during the next decade must be a high research priority for investigators and funding agencies.

Although not the subject of this review, it is important that society recognize that other potentially alterable factors have also been shown to be associated with SIDS. Maternal smoking and prematurity have both been identified as risk factors, breastfeeding has been associated with a decreased risk. Programs aimed at changing these variables may well lead to improved rates. Also, we want to emphasize that there are still good reasons for placing certain infants prone. For premature infants with respiratory distress, infants with symptoms of gastroesophageal reflux, infants with certain craniofacial anomalies or other evidence of upper airway obstruction, and perhaps some others, prone may well be the position of choice. It should be stressed that, although the relative risk of the prone position may be several times that of the lateral or supine position, the actual risk of SIDS when placing an infant in a prone position is still extremely low.

In conclusion, after evaluation of all available evidence to date, for the well infant who was born at term and has no medical complications, the Academy recommends that these infants be placed down for sleep on either their side or back.

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REFERENCES

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Pediatrics 1992;89;1120

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20. The ABCDs of Moles and Melanomas. New York, NY: Skin Cancer Foundation; 1985

ERRATA

In the American Academy of Pediatrics statement, "Positioning and SIDS," appearing in the June issue of Pediatrics (1992;89:1120–1126), part of a sentence was omitted from the end of the first paragraph on p 1122. The complete sentence should read: "If the lower limit of the confidence interval is greater than 1.0, then the P value for the odds ratio is less than .05."

In "Autistic and Dysphasic Children. II: Epilepsy" (Pediatrics. 1991;88:1219–1225), by Tuchman et al, the sentence beginning on line 6 of the second paragraph under "Electroencephalographic Data" (p 1222) should read: "In the autistic group with EEG data and without epilepsy (N = 141), 25 (18%) had an abnormal EEG including 11 children (8%) with epileptiform and 14 children (10%) with nonepileptiform abnormalities." Under "Regression of Language and Behavior and Epilepsy" (p 1222), the sentence beginning on line 3 of the first paragraph should read: "Epilepsy was present in 20% (20 of 100) of autistic and 36% (4 of 11) of dysphasic patients with regression."
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*Pediatrics* 1992;89;1120

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