

## RESEARCH LETTER

## Evaluating hypoxia during air travel in healthy infants

## ABSTRACT

Up to a third of ex-preterm infants flying near term exhibit pulse oxygen saturation (SpO<sub>2</sub>) of less than 85% during air travel. A hypoxia challenge test (HCT) is recommended to evaluate the requirement for in-flight supplemental O<sub>2</sub>. The validity of the HCT in healthy, term infants has not been reported. This study aimed to characterise the in-flight hypoxia response and the accuracy of the HCT to predict this response in healthy, term infants in the first year of life. Infants (n=24: (15 male)) underwent a HCT prior to commercial air travel during which parents monitored SpO<sub>2</sub>. Thirty-two flights were undertaken with six infants completing multiple flights. The median in-flight SpO<sub>2</sub> nadir was 87% and significantly lower than the HCT SpO<sub>2</sub> nadir (92%: p<0.001). Infants on seven flights recorded SpO<sub>2</sub><85% with one infant recording a HCT with a SpO<sub>2</sub> less than 85%. There was marked variability in the in-flight SpO<sub>2</sub> in the six infants who undertook multiple flights, and for three of these infants, the SpO<sub>2</sub> nadir was both above and below 85%. We report that in healthy term infants an in-flight SpO<sub>2</sub> below 85% is common and can vary considerably between flights and that the HCT poorly predicts the risk of in-flight hypoxia (SpO<sub>2</sub><85%). As it is common for healthy term infants to have SpO<sub>2</sub> less than 85% during air travel further research is needed to clarify whether this is an appropriate cut-off in this age group.

Commercial aircrafts are pressurised to a maximum altitude of 2400 m during air travel resulting in a partial oxygen (O<sub>2</sub>) pressure equivalent to 15–17% compared with 21% at sea level.<sup>1</sup> In healthy children and adults pulse oxygen saturation (SpO<sub>2</sub>) declines to 89–94% during flight.<sup>2</sup> There are only limited reports of the in-flight hypoxia response in healthy infants.

The hypoxia challenge test (HCT) is used to evaluate the requirement for in-flight supplemental O<sub>2</sub> and involves monitoring SpO<sub>2</sub> while inhaling a fractional inspired O<sub>2</sub> concentration of ~15%.<sup>1</sup> Preterm infants less than 1 year should use in-flight supplemental O<sub>2</sub> if the SpO<sub>2</sub> decreases to <85% during the HCT.<sup>1</sup> We have reported that preterm neonates flying near term exhibit hypoxia and that the HCT is unreliable.<sup>3</sup> The validity of the HCT in older infants has not been reported. This study aimed to characterise the in-flight hypoxia response and the accuracy of the HCT in healthy infants in the first year of life.

We recruited 24 healthy term infants (15 male) aged 2.3–44.6 weeks. Infants underwent a HCT<sup>3,4</sup> prior to commercial air travel. Parents monitored in-flight SpO<sub>2</sub> (WristOx 3100; Nonin, Minnesota, USA) and activity state. Ethical approval was received (Princess Margaret Hospital for Children Ethics Committee: 1533/EP) and written consent obtained.

Thirty-two flights were undertaken with six infants completing multiple flights. Activity was recorded in 26 (81%) flights with 14 infants being asleep and the remainder being awake with no differences in the in-flight SpO<sub>2</sub> nadir in sleeping infants compared with awake infants (data not shown). The median (range) HCT SpO<sub>2</sub> nadir was 92% (82–98%) with one infant recording a SpO<sub>2</sub><85%. The median in-flight SpO<sub>2</sub> nadir was 87% (78–94%) and significantly lower than the HCT SpO<sub>2</sub> nadir (Wilcoxon signed rank test: p<0.001). Infants on 25 flights were classified as passing the HCT and maintaining their in-flight SpO<sub>2</sub> above 85%. Infants on seven flights (21.9%) recorded SpO<sub>2</sub><85%, with only one infant recording a HCT with a SpO<sub>2</sub><85%. There was marked in-flight SpO<sub>2</sub> variability in the six infants who undertook multiple flights (table 1). One infant (infant 1) maintained SpO<sub>2</sub> >85% on two flights with the remaining infants recording SpO<sub>2</sub> nadirs from 78% to 90%. In this study, healthy term infants recorded in-flight SpO<sub>2</sub> below 85% in seven of 32 flights (22%).

In those infants with multiple flights, the SpO<sub>2</sub> nadir varied between flights and for three (50%) infants the SpO<sub>2</sub> nadir was both above and below 85%. Additionally, the HCT only correctly predicted one of seven infants as at risk for in-flight hypoxia (SpO<sub>2</sub><85%). The impact of postnatal changes to oxygen transport through a reduction in oxygen affinity and oxygen carrying capacity<sup>5</sup> may play a role in the variable in-flight behaviour of young infants and further research should explore these changes. As it is common for healthy term infants to have SpO<sub>2</sub> less than 85% during air travel (without symptoms), further research clarifying the appropriateness of this cut-off is required.

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**Table 1** In-flight SpO<sub>2</sub> nadir in healthy infants monitored during multiple flights

	Infant 1	Infant 2	Infant 3	Infant 4	Infant 5	Infant 6
HCT result	97	93	89	91	92	90
Flight 1	87	78	79	88	85	83
Flight 2	93	80	88	80	90	85
Flight 3	–	90	–	–	90	–

Data presented as the lowest pulse oxygen saturation (SpO<sub>2</sub>) recorded during the hypoxia challenge test (HCT) and during air travel in the six infants with multiple flights.

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