Conventional Pulse Oximetry is Unreliable During Helicopter Transport

A full term infant with a primary diagnosis of persistent pulmonary hypertension of the newborn (PPHN) requiring ventilatory support with 100% oxygen was being air-lifted to our facility for potential placement on extracorporeal membrane oxygenation. A prototype pulse oximeter containing Masimo Signal Extraction Technology was placed on the left big toe (post-ductal) using a Masimo SET LNOP® neonatal sensor. The patient was also monitored with two Nellcor N-200 pulse oximeters using neonatal sensors on the right hand (pre-ductal) and right big toe (post-ductal). During takeoff, the N-200 monitoring pre-ductal immediately began to not correlate with ECG, rendering %SpO_2 unreliable. The N-200 monitoring post-ductal "zeroed-out" and was unable to acquire %SpO_2 or pulse rate during the entire flight. %SpO_2 and pulse rate were accurately and reliably monitored throughout takeoff, flight and landing by the Masimo SET prototype as evidenced by the correlation with ECG, and the clinical appearance of the patient. Below is a sample of notations made during transport:

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Takeoff:	**SpO_2**	**Rate**
Nellcor N-200 (Pre-Ductal)	91%	236
Nellcor N-200 (Post-Ductal)	0%	0
Masimo SET (Post-Ductal)	100%	124
ECG (control)		124

8 Minutes:	**SpO_2**	**Rate**
Nellcor N-200 (Pre-Ductal)	97%	128
Nellcor N-200 (Post-Ductal)	0%	0
Masimo SET (Post-Ductal)	98%	126
ECG (control)		126

17 Minutes:		
Nellcor N-200 (Pre-Ductal)	99%	150
Nellcor N-200 (Post-Ductal)	0%	0
Masimo SET (Post-Ductal)	99%	150
ECG (control)		150

Landing:		
Nellcor N-200 (Pre-Ductal)	89%	154
Nellcor N-200 (Post-Ductal)	0%	0
Masimo SET (Post-Ductal)	99%	126
ECG (control)		126

Discussion: Accurate pulse oximetry of patients during transport is made difficult if not impossible because of motion artifact. The Masimo SET pulse oximeter maintained continuous %SpO_2 and pulse rate monitoring despite challenging conditions that render conventional pulse oximeters useless. Indeed, the Masimo SET pulse oximeter continuously read %SpO_2 and pulse rate even though the sensor was placed in the poorly perfused, post-ductal position. Post-ductal monitoring of infants with PPHN is especially difficult in the first 24-48 hours but vital to management of extreme pulmonary hypertension, e.g., the titration of inhaled nitric oxide (INO) therapy. A paradox of conventional pulse oximetry has been that it fails frequently in those patients who would most benefit from monitoring their oxygenation status continuously, the hypoxic with poor peripheral perfusion. Before Masimo SET technology, continuous, accurate and reliable pulse oximetry during transport of critically ill infants was difficult if not impossible.