

Performance of Masimo SET® Pulse Oximetry in a Child with Meningococemia

A 2 month old male with meningococemia was admitted to the pediatric intensive care unit (PICU) of a 242 bed regional medical center. Following admission, he developed respiratory failure, septic shock and DIC (disseminated intravascular coagulation), which progressed to renal failure. He required hemodialysis and significant inotropic support, including dopamine, epinephrine and dobutamine. The patient received multiple infusions of fluid, FFP, PRBC's, and platelets and repeat doses of calcium, bicarbonate, Ampicillin, Claforan and Solumedrol.

As a result of deteriorating respiratory function, he was sedated, intubated with a 3.5 mm ETT and mechanically ventilated with a Siemens Servo 300 in pressure control mode. Ventilator settings were optimized according to ABGs with $F_{i}O_2$ ranging from 0.5 to 1.0, PIP from 24 - 50, PEEP from 4 - 13, frequency from 30 - 40 and I: E ratios from 1:1.5 - 1:1. The patient remained hemodynamically unstable and required continuous resuscitation efforts as described above.

Initial ABGs indicated a moderate metabolic acidosis (pH 7.31, PCO_2 37, PO_2 333, HCO_3 18, base deficit -7, SaO_2 98%) that continued to worsen to severe acidosis (pH 6.87, PCO_2 84, PO_2 29, HCO_3 16, base deficit -18, SaO_2 23%) despite maximum medical management efforts.

Upon arrival in the PICU, pulse oximetry monitoring of SpO_2 was attempted without success. Due to poor tissue perfusion and unstable hemodynamics, patient monitoring with oximetry, capnography, and transcutaneous O_2 monitoring continued to be sporadic and not consistent with ABG results. The initial pulse oximetry device used was a Siemens SC9000 oximetry module with a Nellcor disposable sensor. Monitoring from several different sites was attempted with poor signal quality as evidenced by the plethysmographic waveform and only occasionally valid SpO_2 readings. Monitoring with a Nellcor N180 oximeter was then initiated and monitoring at various sensor sites showed no improvement in monitoring performance. Monitoring with a Novamatrix 520A pulse oximeter and a Dura-Y sensor provided improved plethysmographic waveforms but was unable to provide consistently accurate SpO_2 readings.

Monitoring with the Masimo Radical pulse oximeter was then initiated with the pediatric finger sensor applied to the left index finger. Within the first minute, a plethysmographic waveform and SpO_2 data became available for the first time in several hours. Over the next five minutes the SpO_2 data varied from 96% - 71%. ABGs were drawn (pH 7.14, PCO_2 45, PO_2 76, HCO_3 15, base deficit -13, SaO_2 93%) and the Masimo SET oximeter reading corresponded at 91%. The ECG heart rate and the pulse rate displayed by the Radical oximeter correlated within 2-3 beats per minute. The Novamatrix pulse oximeter continued to be used for comparative purposes but was consistently unable to provide oximetry readings. The Masimo Radical pulse oximeter continued to read accurately consistent with ABGs and patient condition. When the arterial systolic pressures consistently fell below 90 mmHg and the pH remained <7.0 no pulse oximeter was able to provide oximetry readings. Eventually life support was terminated and the patient expired 26 hours after admission.

DISCUSSION: Masimo SET pulse oximeter was able to provide clinically relevant and apparently accurate oximetric data in the challenging situation of severe acidosis, varying degrees of hypoxemia, and degrading hemodynamics when other devices were unable to perform. During the final hours of the patient's life, no pulse oximeters were able to provide reliable information.

The Masimo Radical pulse oximeter provided accurate monitoring of desaturation in a clinical situation where other brands of oximetry were only able to provide intermittent data readings, and were not able to reliably monitor during desaturation events. The accuracy of the oximetry readings available from the Masimo Radical was superior to other oximetry devices when used on a severely ill pediatric patient with extreme acidosis, hypoxemia, and low perfusion.

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