Pulse Oximetry Performance Can Affect Caregiver Time Utilization

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Introduction

Inaccurate, invalid and incorrect pulse oximetry consumes caregivers' time when they are forced to care for the monitor and not the patient. Recent interest in human error and patient safety has identified "untrustworthy alarms and indicators" as being one of many "latent conditions" leading to human error [1]. We investigated the impact of an oximeter using a new signal processing technology (Masimo SET®) on the frequency of oximeter malfunction (downtime and/or inaccurate alarm conditions) and potentially wasted caregiver time.

Methods

On arrival in the ICU, 48 post-operative CABG patients were monitored with both a conventional pulse oximeter (CPO) (Ohmeda 3740) and a Masimo SET® oximeter (MAS). The monitors' outputs were continuously recorded by computer, until 4 hours following extubation or for up to 24 hours. The display of only one device (randomly selected) was visible to the caregiver (caregiver device), the other display was covered and alarms muted. From the computer records, episodes of device failure (reading 0% saturation), inaccuracy as determined by coincidental ABG ($\Delta > 5\%$), and obvious artifacts were identified and tabulated as the total time the device was non-functional. The percentage of monitoring time during which each device was non-functional in each patient was determined.

Results

Total monitoring time per patient was 918 ± 413 minutes (mean ± SD). Non-functional time (when used as caregiving device): CPO 5.4 ± 6.6% (CI, 0.8-20.7%); MAS 0.3 ± 0.4% (CI, 0-1.0%) p=0.03. Non-functional time (blinded device): CPO 6.6 ± 8.1% (CI, 0.1-25.9%); MAS 0.4 ± 0.6% (CI, 0-1.2%), p=0.02.

Discussion

Increased non-functional monitoring time, which was significantly greater with the CPO device, resulted in caregivers needing to respond to the device failure, diverting them from patient care. It is important to note that the non-functional time reported was the actual time the device did not function. It is assumed that clinicians had to devote additional time evaluating or questioning the functionality of either device, however this could not be quantified in the current study. Masimo SET® pulse oximetry provides significantly less oximeter non-functional time than CPO and reduces the number of "untrustworthy alarms and indicators". This performance benefit existed regardless of blinding, implying the potential for improved monitor reliability in unattended settings. Recent studies on human error and patient safety point to caregiver cognitive overload and distraction (termed latent conditions) as one cause of patient injury or error. Data from this pilot study suggests larger studies may reveal the extent of the impact of these decreased latent conditions and the benefit of increased clinician confidence on human error and patient safety.

References: 1. BMJ 2000;320:768-70.