Comparison of Postoperative Respiratory Monitoring by Acoustic and Transthoracic Impedance Technologies in Pediatric Patients at Risk of Respiratory Depression.

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BACKGROUND: In children, postoperative respiratory rate (RR) monitoring by transthoracic impedance (TI), capnography, and manual counting has limitations. The rainbow acoustic monitor (RAM) measures continuous RR noninvasively by a different methodology. Our primary aim was to compare the degree of agreement and accuracy of RR measurements as determined by RAM and TI to that of manual counting. Secondary aims include tolerance and analysis of alarm events.

METHODS: Sixty-two children (2-16 years old) were admitted after tonsillectomy or receiving postoperative patient/parental-controlled analgesia. RR was measured at regular intervals by RAM, TI, and manual count. Each TI or RAM alarm resulted in a clinical evaluation to categorize as a true or false alarm. To assess accuracy and degree of agreement of RR measured by RAM or TI compared with manual counting, a Bland-Altman analysis was utilized showing the average difference and the limits of agreement. Sensitivity and specificity of RR alarms by TI and RAM are presented.

RESULTS: Fifty-eight posttonsillectomy children and 4 patient/parental-controlled analgesia users aged 6.5 ± 3.4 years and weighting 35.3 ± 22.7 kg (body mass index percentile 76.6 ± 30.8) were included. The average monitoring time per patient was 15.9 ± 4.8 hours. RAM was tolerated 87% of the total monitoring time. The manual RR count was significantly different from TI (P = .007) with an average difference ± SD of 1.39 ± 10.6 but were not significantly different from RAM (P = .81) with an average difference ± SD of 0.17 ± 6.8. The proportion of time when RR measurements differed by ≥4 breaths was 22% by TI and was 11% by RAM. Overall, 276 alarms were detected (mean alarms/patient = 4.5). The mean number of alarms per patient were 1.58 ± 2.49 and 2.87 ± 4.32 for RAM and TI, respectively. The mean number of false alarms was 0.18 ± 0.71 for RAM and 1.00 ± 2.78 for TI. The RAM was found to have 46.6% sensitivity (95% confidence interval [CI], 0.29-0.64), 95.9% specificity (95% CI, 0.90-1.00), 88.9% positive predictive value (95% CI, 0.73-1.00), and 72.1% negative predictive value (95% CI, 0.61-0.84), whereas the TI monitor had 68.5% sensitivity (95% CI, 0.53-0.84), 72.0% specificity (95% CI, 0.60-0.84), 59.0% positive (95% CI, 0.44-0.74), and 79.5% negative predictive value (95% CI, 0.69-0.90).

CONCLUSIONS: In children at risk of postoperative respiratory depression, RR assessment by RAM was not different to manual counting. RAM was well tolerated,

had a lower incidence of false alarms, and had better specificity and positive predictive value than TI. Rigorous evaluation of the negative predictive value is essential to determine the role of postoperative respiratory monitoring with RAM.