OCTOBER 2017
VOLUME 62
NUMBER 10
ISSN 00989142-RECACP

RESPIRATORY CARE

A MONTHLY SCIENCE JOURNAL
—ESTABLISHED 1956
RCJournal.com

Reprinted from:
Respiratory Care 2017; 62(10): OF14

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Chad E. Weagraff, Kathleen Deakins

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Evaluation of the Accuracy of Tidal Volume, PIP and PEEP Using a Novel T-piece Resuscitator for Pediatric And Adult Patients.

Chad E. Weagraff, Kathleen Deakins; Pediatric Respiratory Care, UH Rainbow Babies & Children's, Chardon, OH

BACKGROUND: Hyperventilation from high tidal volume (Vt) or respiratory rate increases intrathoracic pressure, reduces right heart function and cardiac output during resuscitation.[1] Breath sizes are dependent on size of the bag, flow rate, (flow inflating bag) and the size of caregiver's hands. Reducing variability in volumes may help reduce hyperventilation. A novel pediatric-adult resuscitation device: the Resusa-Tee T-piece Resuscitator (Mercury Medical, Clearwater, FL) provides consistent pressure and tidal volume for pediatric to adult patients when applied at suggested respiratory rate, I: E and flow rate. The purpose of this study is to validate the consistency of measured and estimated tidal volumes, PIP and PEEP delivery for use in resuscitation. METHODS: A Resusa-Tee T-piece Resuscitator circuit was attached to a 1L Drager test lung (Drager Medical Telford, PA). Using an I:E ratio of 1:2 at flow rates of 5 (f 20/min) 17 (f 20/min) and 22 lpm (f 12/min), tidal volume (Vt), PIP and PEEP were recorded from a pediatric-adult flow sensor attached to a NICO monitor (Respironics, Wallingford, CT) every two minutes for 15 minutes at each setting. Caregiver I:E and RR were analyzed for consistency at each level. Tidal volume, PIP and PEEP were analyzed using paired t-test with a significance level set at $p<0.01$. RESULTS: There was no statistically significant difference in measured parameters using the device at a stable I:E and frequency. Mean values and standard deviations at each setting are displayed in the table below. CONCLUSION: Precise tidal volumes, PIP and PEEP are accomplished using a pediatric resuscitator at a stable I:E and frequency. If used as intended, t-piece resuscitation in pediatric and adult patients may provide consistent tidal volume delivery that may impact resuscitation efforts by stabilizing and controlling the volume component that contributes to hyperventilation during resuscitation. [1] Henlin, T Michalek P, Tyll T, Hinds JD, Dobias M. Oxygenation, ventilation and airway management in and out of hospital cardiac arrest: a review. Bio Med Internat 2014: doi.org/10.114=55/2014/37861

Sponsored Research - None

Measured Vt, PIP and PEEP

Mean values and (standard deviations)	Tidal volume	PIP	PEEP
Flow rate 5 LPM Frequency 20 bpm = Vt70	61.8 mL (10.2184) p=0.2384	9.5467 cm H2O (0.2438) p=1.0000	4.8333 cm H2O (0.1234) p=1.0000
Flow rate 17 LPM Frequency 20 bpm = Vt 280	256.22 mL (0.3253) p=07747	16.9567 cm H2O (0.2599) p=1.0000	4.9867 cm H2O (0.513) p=1.0000
Flow rate 22 LPM Frequency 12 bpm 545.5 mL (94.2871) p=0.4228	545.5 mL (94.2871) p=04228	22.4 cm H2O (1.60) p=0.9989	5.123 cm H2O (0.2838) p=1.0000