

Monitoring in- and expiratory tidal volumes in the new Ventrain® emergency ventilation device

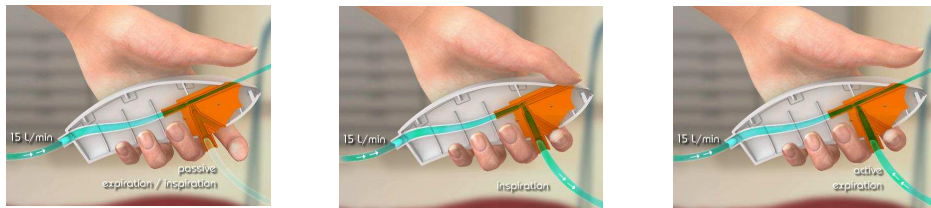
AR Schmidt^{1,2}, K Ruetzler², Th Haas¹, A Schmitz¹ and M Weiss¹

¹ Department of Anaesthesia, University Children's Hospital, Zurich Switzerland

² Institute of Anaesthesiology, University Hospital, Zurich Switzerland

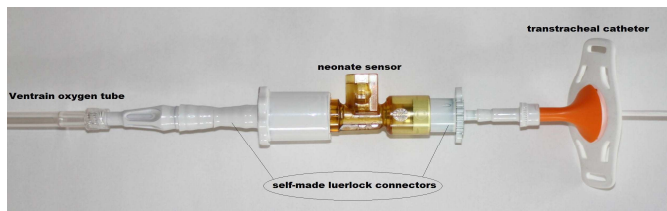
Background

The Ventrain® emergency ventilation device (Dolphys Medical, Eindhoven, Netherlands) allows active in- and expiration through transtracheal catheters or small paediatric tubings. This handheld device is driven by an external oxygen source, manually operated and ventilation is visually controlled by observing chest movements. Different studies have been published showing Ventrain®'s performance [1,2]. Monitoring of tidal volumes is not provided and the risk for inadequate ventilation (atelectasis/air-trapping) is likely. This study investigated the ability of a Respiration Function Monitor to monitor tidal volumes during ventilation of a simulated lung model with the Ventrain® device.



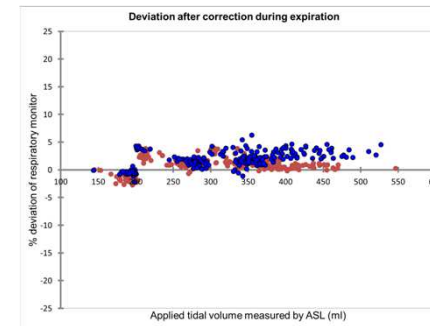
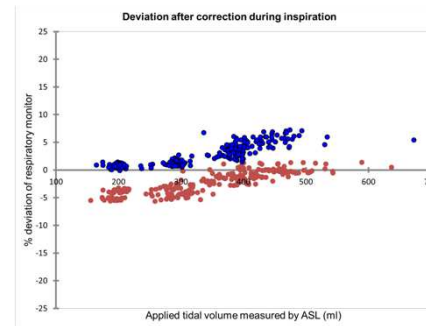
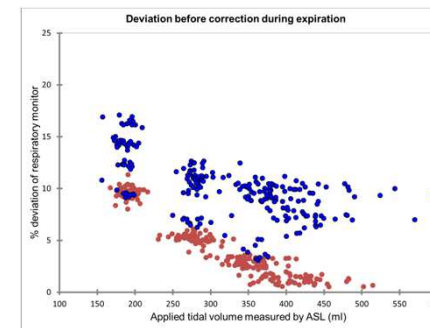
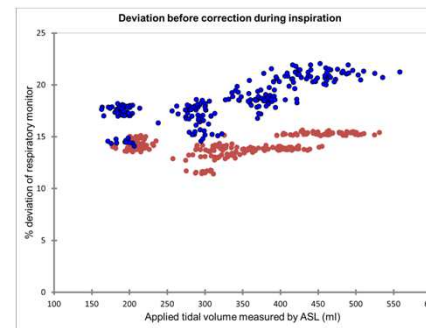
Methods

In an in-vitro setting the Florian Respiratory Monitor (FRM; Acutronic Medical Systems AG, Hirzel, Switzerland) was used with two neonatal sensors (dual hot wire; sensor A and B) each to monitor in- and expiratory tidal volumes applied by the Ventrain® ventilation device through a transtracheal cannula (Cricath®) to the ASL 5000 test lung (Active Servo Lung, IngMar Medical, Pittsburgh, PA, USA). Flows of 6, 9, 12 and 15 l/min were chosen to vary tidal volumes (RR 15/min – I:E = 1:1). In a first run the mean percental deviation for in- and expiration was measured. After a bias correction the tidal volumes measured by the FRM were then compared with those obtained from the ASL 5000. Data are mean [SD].



Integration of the neonatal sensor between Ventrain® and Cricath® with two self-made luerlock adapters.

Results



Deviation of the FRM measured during the calibration run. For inspiration constantly 16.27% [2.60%]. During expiration 11.51% [2.56%] for tidal volumes from 0 to 225ml, 7.41% [2.94%] for 226 to 325ml and 5.35% [3.57%] for over 325ml. Tidal volumes from 140 to 675 ml.

After bias correction tidal volumes were measured with a percental deviation as follows: sensor A for inspiration 2.59% [1.76%] and 1.30% [0.85%] for expiration and sensor B 2.59% [1.95%] and 2.03% [1.28%] respectively. The common deviation was 2.59% [1.86%] and 1.66% [1.14%].

Conclusion

These results show that the FRM is a device capable of monitoring ventilation with Ventrain® and making its use safer. The integration of the sensor must be enhanced and a corrected linearization table should be developed for real time monitoring in clinical practice. These efforts will be discussed with Acutronic Medical Systems and further studies will follow.

1. Hamaekers AE, Borg PA, Enk D. Ventrain: an ejector ventilator for emergency use. *Br J Anaesth* 2012; **108**: 1017-21.
2. Borg PA, Hamaekers AE, Lacko M, Jansen J, Enk D. Ventrain(R) for ventilation of the lungs. *Br J Anaesth* 2012; **109**: 833-4.