

Small manometers improve bag and mask ventilation: a manikin study



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Introduction:

Self-inflating bags (SIB) remain widely used for neonatal resuscitation. Insufflation pressures from SIB are difficult to assess and can be inadequate. Ventilation monitoring improves pressure control, but is not accessible to most resuscitators.

Small **spring manometers** or a pressure line to a **needle and dial manometers** can be connected through a side port on the SIB. Those devices are cheap and easily available, but their **efficacy needs to be assessed**.

However, the observation of the manometer could also be considered as a distraction, with increased risk of leak or inadequate insufflation rate as possible consequences.

We therefore aimed to evaluate the effect of mechanical manometers on the quality of insufflations with a SIB.

Methods:

Participants to the 2015 Belgian Paediatric Society meeting * were invited to ventilate a manikin with a 300 ml SIB. The leak-free manikin was modified with a flow-meter at tracheal level connected to a neonatal test lung. Participants had to aim for a 25 mbar pressure and a rate of 40-60 during 3 sequences of 45 seconds.

A spring (S), a dial (D) manometer or nothing (N) was added to the SIB in random sequence. Pressure data from the SIB and flow data from the manikin were obtained through a SLE2010 ventilation monitor linked to a computer recording those data with Spectra software.

Peak pressure (PIP), tidal volume (VTi), and insufflations rate (RR) were calculated for each breath.

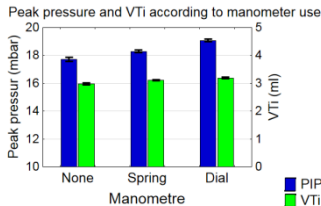
Theoretical leak was evaluated by subtracting real from theoretical volumes derived from the pressure-volume relation during a leak free calibration (facemask taped on manikin). Data were analyzed with ANOVA and posthoc Bonferroni.

*(We thank the organisers)

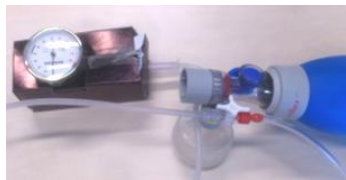
Results:

Five neonatologists, 15 paediatricians and 11 residents ventilated the manikin for a total of 5279 insufflations.

Manometer use was associated with a moderate increase in PIP. Changes in VTi and RR (77-82 bpm) were small. Leaks were slightly lowers with spring manometers (N 34%, S 31%, D 32%)



* p<.05 vs None; # p<.05 vs Spring

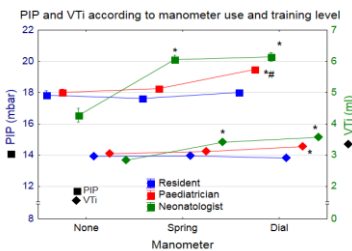


Methods:

Spring manometer (up) and dial manometer connected to self inflating bag. Pressure line to recorder.

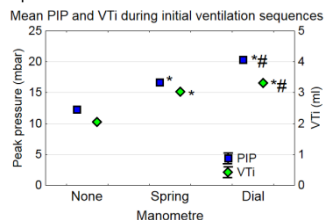
Results (2): Expertise

The effect of manometer use on PIP, VTi and leak was more important with Neonatologists (PIP-N: 16 ± 7 mbar; S and D: 20 ± 4 mbar*) and paediatricians. With residents, no change occurred in PIP (~17 mbar), Vti (2.9 ml) or leak (31-35%).



Results (3): "Naïve" ventilation

During first sequences of ventilation, without previous experience of the manikin respiratory mechanics, manometer use was associated with higher PIP, closer to the aim, higher Vti, and lower theoretical leaks (N: 38 ± 16%; S: 27 ± 12%; D: 34 ± 13%*). This observation for first sequences was found in all 3 categories of providers.



* p<.05 vs None; # p<.05 vs Spring

Conclusions:

- Scientific meetings offer the opportunity to run specific-task simulation studies with participants from various background.
- Bag and mask ventilation remains difficult. In this model, the addition of a manometer is associated with improved pressures and VTi, and with decreased theoretical leak. This effect is predominant for initial ventilation with a dial manometer, and is also related to operator experience. Small, inexpensive manometers have the potential to improve ventilation of newborn infants with self inflating bags.