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Dear colleagues,

**T-piece device pressure overshoot**

In a paper published in the January issue of Archives of Disease in Childhood Fetal and Neonatal Edition, Hinder and colleagues provided bench test data on the performance of newborn T-piece resuscitators (GE Panda, Drager Resuscitaire and Fisher and Paykel Neopuff) 1. They simulated a small low compliance newborn lung, as may be present in an extremely preterm infant at birth. They found that two of the devices in their study (GE Panda and Draeger Resuscitaire) had a pressure limiting system that allowed a brief spike in inflation pressure to be generated at the start of inflation that was well in excess of the set inflation pressure. In their simulation the pressure spike produced a spike of flow and volume. They were unable to comment on the clinical significance of the observation. They did not demonstrate an overshoot in pressure, flow or volume with the Neopuff. Their paper included a single clinical example of data from the stabilisation of a 28 week gestation preterm infant with birthweight 750g, where large pressure, flow and volume spikes were apparent on a Phillips NM3 respiratory monitor.

The clinical significance of their finding was questioned in a letter to the editors by Katie Hunt and colleagues2. They felt that the observation was explained by lack of inertia in the test lung and would not be translated into an overshoot in tidal volume in a fluid-filled newborn lung. However they did not discuss the clinical example in the paper where a volume effect was demonstrated during resuscitation of a 750g infant.

In the Royal Infirmary of Edinburgh we have GE Panda resuscitaires and we also have Fisher and Paykell Neopuffs. We replicated the above study, making the measurements with a Phillips NM3 respiratory monitor similar to the one used by Hinder and colleagues to generate their clinical example.

We found that at all clinically feasible combinations of flow and set inflation pressure, the T-piece system on the GE Panda produced a pressure spike greatly in excess of the set inflation pressure. The figure below shows the pressure spike to 39cmH20 when the dial was set to deliver an inflation pressure of 30cmH20. There was no difference between set and delivered pressure with the Neopuff.



We recorded the peak pressure delivered by the Panda and Neopuff over a range set inflation pressures. The results are in the table below.

|  |  |  |
| --- | --- | --- |
| **Set PIP** | **Neopuff delivered pressure** | **GE Panda delivered pressure** |
| **15** | 15 | 21 |
| **20** | 20 | 27 |
| **25** | 25 | 32 |
| **30** | 30 | 39 |
| **35** | 35 | 45 |
| **40** | 40 | 51 |

We asked for feedback from GE and they sent us a document detailing their own simulation. The data presented were limited to the delivered pressure. There was no information about flow and volume. The simulation provided by GE resulted in a delivered pressure at the airway of 25cmH20 at a set pressure of 20cmH2O, as illustrated below. There was not much transmission of the pressure to the lungs with the resistance of the model that they used.



GE expressed a view that the high resistance to flow in the lungs of a small infant would prevent the pressure spike reaching the lungs.

Like Hinder and colleagues we are uncertain of the clinical significance of these observations. We note the data in the clinical example they provided and felt that it was worth highlighting the issue to clinical colleagues who may not have been aware of the paper.

Kind regards

Ben Stenson

1. Hinder KM et al. T-piece resuscitators: can they provide safe ventilation in a low compliant newborn lung? Arch Dis Child Fetal Neonatal Ed. 2021 Jan;106(1):25-30.
2. Hunt KA et al.Arch Dis Child Fetal Neonatal Ed2020; 106 110-110 Published Online First: 12 Aug 2020. doi: 10.1136/archdischild-2020-320205