Letter to the Editor

Simultaneous ventilation of two healthy subjects with a single ventilator

Sir,

In the event of an influenza pandemic critical care services may be overstretched. The influenza A (H5N1) virus can cause respiratory failure with a high incidence of progression to acute lung injury/acute respiratory distress syndrome. During the outbreak of H5N1 in Vietnam in January 2004 a review of 10 patients showed that 90% required mechanical ventilation within 48 h of hospital admission. A number of factors may limit the availability of critical care beds including staff and equipment. The possibility of a lack of ventilators has led to some states in the US stockpiling them. Lack of critical care facilities could necessitate rationing on an unprecedented scale. In such conditions standards of care may have to be reduced. One study has shown that sheep can be ventilated simultaneously but as far as we know this has not been tested in humans. We conducted a volunteer study to investigate whether this was a possibility.

Approval was obtained from the local research and ethics committee for the recruitment of two volunteers subject to a short exposure. Two subjects were ventilated simultaneously, awake, via facemasks (Intersurgical size 4 anaesthetic mask). The inspiratory and expiratory limbs of a Draeger Evita XL ventilator were split using Y-connectors. The paired ends were joined with Y-connectors to create two circuits (Intersurgical 2.4 m anaesthetic circuits) (Fig. 1). These were connected to the subjects mask via a catheter mount (Intersurgical). Pressure controlled ventilation was used with an inspiratory pressure of 30 cmH₂O, a positive end-expiratory pressure of 2 cmH₂O and a mandatory rate of 18 breaths per minute. Inline capnography (Hewlett Packard) was attached to each subject’s mask to measure inspiratory and end tidal partial pressure of carbon dioxide (ETCO₂). Subjects were ventilated for 10 min. The identified end point was ETCO₂ at 10 min.

Both subjects were comfortable making no spontaneous respiratory movements. The ventilator functioned normally throughout.

ETCO₂ values at 10 min were 4.7 and 5.7 kPa. We noted an inspired carbon dioxide partial pressure of 0.65 kPa in one subject suggesting re-breathing. Combined tidal volume was 2–2.2 l, giving an expired minute ventilation of 36–40 l min⁻¹.

We have shown that two subjects can be ventilated simultaneously using a single ventilator. We used a high pressure and rate in order to try to abolish any spontaneous respiratory efforts. We chose pressure controlled ventilation so that in subjects with normal compliance both would achieve similar ventilation. Although the subjects achieved different ETCO₂ partial pressures both of them were acceptable and well tolerated.

If this technique were to be used patients would have to be matched such that both could tolerate the chosen pressures and the inspiratory pressure selected to achieve acceptable tidal volumes in each. Only patients on continuous mandatory ventilation could share ventilators. A suitable filter should be placed between each patient and the ventilator circuit to reduce the risk of cross-infection. This technique should not be used routinely but could be considered in times of major crisis when demand for ventilators far outstrips availability.

Conflicts of interest

Neither author has either financial or non-financial competing interests in the publication of this paper.

References


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