A NEW TECHNIQUE FOR TWO-HAND BAG VALVE MASK VENTILATION

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SUMMARY

A method of bag valve mask ventilation (BVM) in which the resuscitator compresses the self-inflating bag between the open palm and body was compared with both standard single resuscitator and two-resuscitator BVM ventilation. Eighteen subjects ventilated a modified recording mannikin using each method in random order. The tidal volume (VT) was greater with the open palm (mean 684 (sd 182) ml) than standard single resuscitator ventilation (mean 520 (152) ml). The difference was greater in the nine subjects with small hands (mean 196 (103) ml). VT was less than with two-resuscitator ventilation (mean VT 953 (236) ml).

KEY WORDS

Ventilation: bag valve mask

Ventilation with bag valve mask (BVM) systems is often inadequate when performed by a single resuscitator. One reason for this is that it is difficult to squeeze a self-inflating bag with one hand. We have postulated that this problem could be overcome by compressing the self-inflating bag between the resuscitator's open palm and his/her rib cage or iliac bone (an open-palm manoeuvre).

METHOD AND RESULTS

We studied 18 subjects who had received previous training in basic life support. Fourteen of the subjects were students, one was a nurse, and three were technical staff. In order to estimate hand size, the distance between the tip of the thumb and the fifth finger was measured on the dominant hand with the hand outstretched and the thumb fully abducted. The subject's height, age and sex were recorded also. The subject was asked to ventilate a Laerdal resuscitator-or-a—two-resuscitator technique was used. The two-resuscitator technique was made possible by having one of the investigators hold the face mask with both hands while the subject used both hands to squeeze the self-inflating bag.

The order in which the techniques were used was randomized by the use of a sealed envelope system. Three sets of the six possible combinations in which the techniques could be used were contained in 18 sealed envelopes, one of which was given to each subject at random. Subjects were allowed to practise each technique for a few minutes before the start of the study, and at least 5 min elapsed between each set of measurements.

The number of breaths delivered to the mannikin was measured at the expiratory port of the mannikin using an Abbirico spiroflow electronic flow meter. The output signal was calibrated using a Hamilton 1-litre gas syringe (Hamilton Incorporated, Whittier, CA), and was recorded using a commercial software package [2] on a personal computer. The total expired volume was measured using a Dräger Series 2000 Minute Volume Meter, which was also placed on the expiratory port of the mannikin. Mean tidal volume (VT) was obtained by dividing the expired volume by the total number of breaths. A repeated measures analysis of variance was used to determine if VT differed significantly between the three methods of ventilation. The Scheffé test was then used to determine which of the techniques differed significantly from each other. The tests were repeated for all subjects and for the two sub-sets of large and small hands. The Pearson correlation coefficient (r) was used to determine if VT and hand size were associated with each other for each of the three techniques. Significance was set at the level of 5%.

Twelve of the subjects studied were male and six female; mean age was 25.7 (sd 5.3) yr; mean weight 67.1 (15.7) kg and mean height 171 (11.3) cm. All of the subjects who started the study completed it in full. The mean hand span of all 18 subjects was 20.8 (1.7) cm, in the nine subjects with the smaller hand size, the mean span was 19.6 (1.4) cm and in the nine subjects with the larger hand size it was 22.0 (1.0) cm. Mean VT (with SD) for each technique, together with the correlation coefficient for the relationship between hand span and VT, and ventilatory frequency are shown in table 1.
Table I. Tidal volume (Vt) for all resuscitators and according to hand size for each method of ventilation. Ventilatory frequency (f) and correlation coefficients (r) for the relationship between hand size and Vt for each method of ventilation are also shown. (Mean values (SD))

<table>
<thead>
<tr>
<th></th>
<th>Single resuscitator (standard)</th>
<th>Single resuscitator (open palm)</th>
<th>Two-resuscitator</th>
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<tbody>
<tr>
<td>Vt (ml)</td>
<td>All resuscitators</td>
<td></td>
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<td></td>
<td>520 (152)</td>
<td>684 (182)</td>
<td>953 (236)</td>
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<tr>
<td></td>
<td>Small hands</td>
<td>445 (136)</td>
<td>641 (167)</td>
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<tr>
<td></td>
<td>Large hands</td>
<td>595 (133)</td>
<td>726 (196)</td>
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<tr>
<td>f (b.p.m.)</td>
<td>12 (3)</td>
<td>12 (3)</td>
<td>12 (1)</td>
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<tr>
<td>r</td>
<td>0.64</td>
<td>0.17</td>
<td>0.42</td>
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</table>

Vt was significantly greater using the open palm technique than the standard single resuscitator technique. The two-resuscitator technique, however, was superior to both single resuscitator methods and was the only technique with which the average Vt exceeded AHA guidelines. The relationship between hand size and Vt was significant only for the standard single resuscitator technique—a result which is in accordance with previously published work [3]. The difference between the single resuscitator techniques was significant in the nine subjects with the smallest hand size (mean difference 164 ml), but did not reach significance in the nine subjects with larger hands (mean difference 131 ml).

COMMENT

Our study emphasizes the well recognized inability of most resuscitators to deliver an adequate tidal volume using the standard technique of compressing a self-inflating bag. We have also confirmed the very considerable improvement that can be made by using a two-resuscitator technique [4, 5]. Unfortunately, two resuscitators are not always available to provide ventilation during life support and it is in this situation that the open-palm method of ventilation is a useful alternative, particularly when used by resuscitators with small hands. Although variations of open-palm ventilation are probably used quite widely, we could find only one previous description of any method of ventilation similar to that we have described [6]. This method can be modified by allowing the resuscitator to place one flexed knee next to the patient's head and compressing the self-inflating bag between the open palm and the anterior aspect of the thigh; this may be useful if the patient is on the floor or on a bed but with the head not at the end of the bed.

REFERENCES