



The Variation in the Quality of Ventilation by the Pressure Site of a Bag-Mask Using a Flowmeter

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Abstract

Background/Objectives: This study aimed to determine the quality of ventilation according to the pressure site of a bag-mask using a flowmeter.

Methods/Statistical analysis: The participants in this study were those who had completed a regular course in basic life support, understood the purpose of this study, and consented to the participation. They were divided into three groups: Groups A, B, and C. Analysis was performed using SPSS for Windows 12.0 Version.

Findings: Ventilation was at a proper level of 500-600ml in Group A close to the mask and in Group C remotest from the mask. In Group B, the upper and lower pressure exceeded 600ml, which was not excessive. To put these results together, it was within the normal scope in Groups A and C and was slightly beyond the proper scope in Group B.

Improvements/Applications: On the basis of the results, it is necessary to give pressure to the bag according to the guidelines and apply the method of Group C. Ventilation by a bag-mask using a flowmeter is expected to be useful either to those unfamiliar with a bag-mask or to novice trainees.

Key Words : Bag-mask, Ventilation, Pressure, Breathing, Quality

1 Introduction

AHA [1] indicated that cardiopulmonary resuscitation (CPR) required five sessions of chest compression and artificial breathing at a 30:2 ratio: 30 compressions and 2 breaths. AHA [1] and KACPR [2] suggested one-second artificial respiration, which should be performed at a six-second interval when respiration involved a visible chest rise and when airway intubation was given. They indicated that care should be taken not to give artificial respiration so excessively that it might cause hyperventilation. They suggested that a proper tidal volume be given through compression to a 2 L bag for adults by about a third.

Uhm and Jung [3] noted that an artificial respiration aid—a bag-valve-mask—was used to reduce the aversion to body contact during CPR. KACPR [2] indicated that one needed lots of training to apply a bag-mask and could apply it more effectively together with another person than by himself, and suggested that adults be given about 500-600 ml of a tidal volume by using a bag-mask (1-2 L).

Thomas et al. [4] noted that a tidal volume depended on the size of hands in giving pressure to the bag-mask; Larsen et al. [5] and Valenzuela et al. [6] warned that hyperventilation and a high

volume could increase intrathoracic pressure. They indicated that airway management was an important skill and that good airway maintenance was an important factor for recovery of the normal functions and dysfunction as well as for survival and mortality of patients [7].

Kang and Tak [8] found that finger indication pressure increased a tidal volume by about 200mL. However, they indicated that the patient's gender or hand size had no effect on a tidal volume. Kang and Tak [8] suggested that it be better to give artificial respiration using finger indication pressure until the thumb touched the middle finger around the bag than to give pressure to the bag by about a third, as recommended by the guidelines. Shin et al. [9] suggested the need to give 1/3 bag pressure ventilation based on intubation and on a bag-valve-mask for two persons with the aim of giving effective ventilation in case of cardiac arrest.

Jo and Jung [10] found variation neither in the experience of using a bag-mask nor in a tidal volume. As Holmberg et al. [11] and Holmberg et al. [12] analyzed the quality of ventilation by the chest compression site for CPR, research on the effects of the hand shape and the finger position in applying a bag-mask on the quality of ventilation has been conducted [4, 8, 9].

This study aimed to determine the quality of ventilation by the pressure site of a bag-mask using a flowmeter. The guidelines suggest giving pressure to a 2 L bag for adults by a third for the purpose of a proper tidal volume. However, little research has been conducted on the appropriateness of the quality of ventilation in terms of the pressure site. This study divided the bag pressure sites into three areas, each of which had upper and lower parts. This aimed to give pressure to both upper and lower parts of each area on the bag and determine the quality of ventilation in terms of the pressure site. This study is expected to be useful in effective bag-mask skills. It is also expected to provide basic data that can help develop a skill program using a bag-mask.

2 Materials and Methods

2.1 Subjects

The participants in this study were those who had completed a regular course in basic life support, were given explanation of the purpose and methods of this study, and consented to the participation. The 90 participants were divided into three groups. With the exception of 7 dropouts, there were 83 participants. The number of participants is as presented in Table 1.

Table 1: Number of participants

		A Group (N=28)	B Group (N=27)	C Group (N=28)
Gender	Male	13(46.4)	15(55.6)	14(50.0)
	Female	15(53.6)	12(44.4)	14(50.0)

2.2 Measurement

The rescuer took the over-the-head position from the patient. In the over-the-head position, the rescuer is right at the center over the patient's head. The rescuer, who was over the patient's head, applied a mask with one C-shaped hand. He used another hand to give ventilation by compressing the bag.

The participants were divided into three groups: 1) Group A, with pressure put on the front of the bag-mask; 2) Group B, with pressure put on its middle part; and 3) Group C, with pressure put on its back. Compression in the three groups was based on the 2015 CPR guidelines suggested by AHA [1] and KACPR [3].

Measurement was performed in a lecture room, where a table of proper height was placed to fix a respiratory-system manikin firmly. In using a bag-mask to give ventilation, a flowmeter was placed between the bag and the mask to measure a tidal volume during bag compression. The bag-mask assessment was based on the standards suggested by AHA [1] and KACPR [3]; the proper range of ventilation was 500-600 ml. The participants were cautioned not to see the monitor of the flowmeter during bag compression. The

researcher covered the monitor so that they could not see it during compression.

They practiced it three times with those who consented before starting measurement. After the practice, explanation about how to apply a flowmeter was given; then, measurement was performed from November 15 to 17, 2017.

This study obtained the approval from the Institutional Review Board (IRB) of C University (Human-003-20171110-2nd). The participants were informed that they could withdraw the participation by expressing their intention to give up. The procedure is as shown in Figure 1.

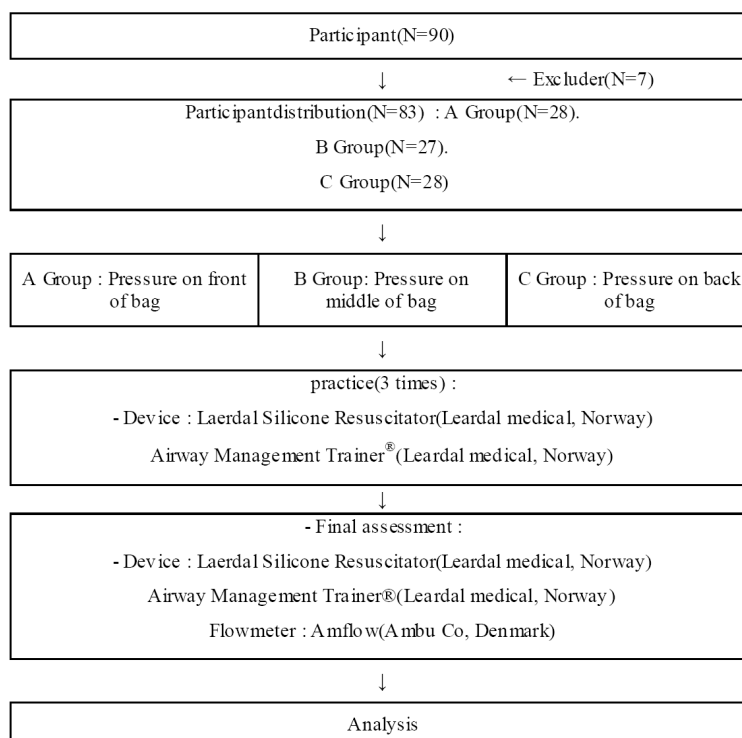


Figure 1: Procedures of Research

2.3 Instrument and Analysis

A bag-mask (Laerdal Silicone Resuscitator, Leardal Medical, Norway) and a flowmeter (Amflow, Ambu Co, Denmark) were used to perform measurement.

The bag-mask was composed of a bag, a valve, and a mask. During bag compression, a one-way valve puts air into the patient. It prevents air for the patient from coming back into the ventilation bag. The bag, which was very likely to swell again, was made of silicon. The 1,600 ml bag was equipped with a non-rebreathing valve. It was 22 cm in length and 12 cm in height. The ventilation manikin was Airway Management Trainer® (Leardal medical, Norway) made by Laerdal.

A flowmeter is a device to measure the inflow of air provided to the patient. It is placed between the inlet of the bag and the mask. The inflow is measured on the monitor of the flowmeter during bag compression. The instruments of the bag-mask and the flowmeter are as shown in Figures 2 and 3. Analysis was performed using SPSS for Windows 12.0 Version, with the statistical significance set at $p < 0.05$.

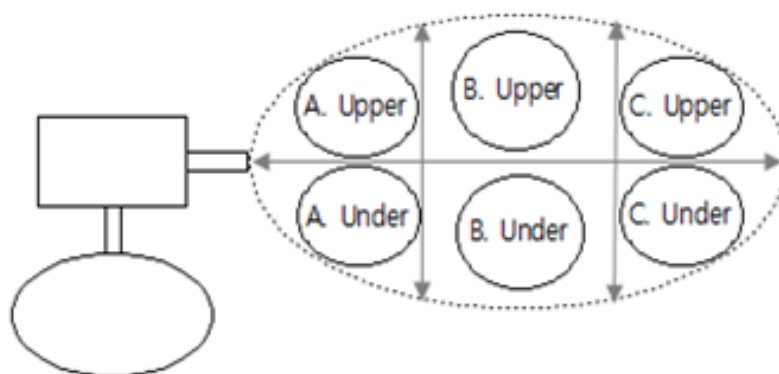


Figure 2: Bag-Mask



Figure 3: Flowmeter

3 Results and Discussion

1. Comparison of quality of bag-mask ventilation among three groups

The quality of bag-mask ventilation in the three groups is as presented in Table 2 and in Figure 4. Ventilation was at a proper level in Group A close to the mask; in Group B, the upper and lower pressure slightly exceeded 600 ml, which was not excessive. Group C showed proper ventilation like Group A. These results were due to several variables, including the rescuer's hand size, strength, pressure method, and hand position. Thomas et al. [4] noted that a tidal volume depended on the size of hands; Kang and Tak [8] noted that hand size had no effect on a tidal volume. Kang and Tak [8] also found that ventilation depended on pressure on the finger indication site. Shin et al. [9] suggested 1/3 bag compression in giving ventilation to cardiac arrest patients.

On the basis of these results, it is necessary to give pressure to the bag according to the guidelines and apply the method of Group C. Ventilation by a bag-mask using a flowmeter is expected to be useful either to those unfamiliar with a bag-mask or to novice trainees. However, it should be noted that reliance on a monitor alone can reduce good skills.

Table 2: Comparison of quality of bag-mask ventilation among three groups

		Mean	S.D	t	p
A. Group	Upper	552.83	117.52	24.89	.000***
	Under	601.44	128.01	24.86	.000***
B.Group	Upper	663.57	54.85	62.85	.000***
	Under	643.07	53.82	62.07	.000***
C.Group	Upper	534.85	63.75	44.39	.000***
	Under	507.51	37.47	71.65	.000***

***p<.001

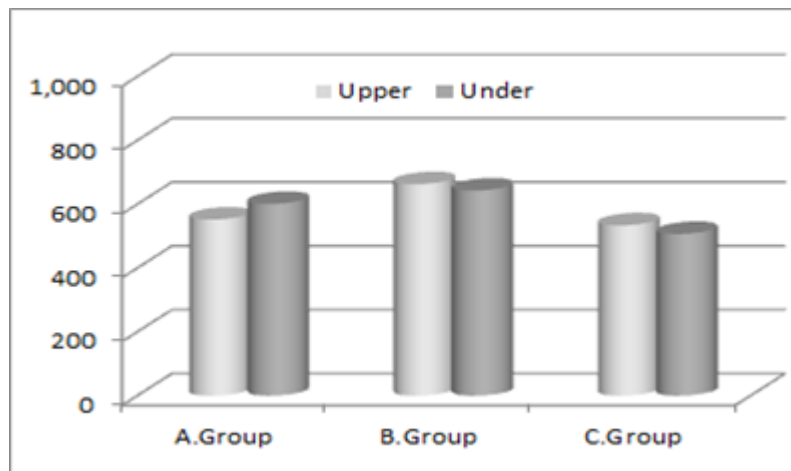


Figure 4: Flowmeter

4 Conclusion

Ventilation was at a proper level in Group A close to the mask; in Group B, the upper and lower pressure slightly exceeded 600 ml, which was not excessive. Group C showed proper ventilation like

Group A. These results were due to several variables, including the rescuer's hand size, strength, pressure method, and hand position.

On the basis of these results, it is necessary to give pressure to the bag according to the guidelines and apply the method of Group C. Ventilation by a bag-mask using a flowmeter is expected to be useful either to those unfamiliar with a bag-mask or to novice trainees. However, it should be noted that reliance on a monitor alone can reduce good skills.

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