

# Mask Ventilation during Induction of General Anesthesia

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## ABSTRACT

**Objective:** To determine the efficacy of ventilation using face mask induction of general anesthesia.

**Study Design:** Cross-sectional study.

**Place and Duration of Study:** This study was conducted at the in collaboration with Rashid Latif Hospital, Lahore and Lahore General Hospital Lahore from October 2019 to March 2020.

**Materials and Methods:** Eighty patients were enrolled. Average age of patients was 25 to 60 years, with a BMI lower than 30. Subsequently, the patients were arranged to divide into two groups Group A and Group B. In the group A, ventilation was performed using the standard mask ventilation with 100% oxygen for 4 minutes. And in other group B, ventilation was undertaken through an anatomical nasal mask. The mean expiratory volume, mean SpO<sub>2</sub>, mean end tidal CO<sub>2</sub> (Et CO<sub>2</sub>) and mean airway pressure were measured, recorded and compared in both groups. Once placed on the operating table, 100% oxygen were provided to the patients using a face mask for 4 minutes, after which medication (anesthesia) were arranged.

**Results:** The ventilation parameters, maximum airway pressure after starting of mask ventilation in the face mask group is higher than the nasal mask group (15.1±1.8 and 11.8±1.4 during the 3rd minute respectively, p< 0.001) and the face mask group (94.5±2.1 and 96.1±4) is lower than the SpO<sub>2</sub> at this time respectively (p< 0.001). There is no any significant difference related to other parameters.

**Conclusion:** The ventilation with a face mask is less effective than the nasal mask which is more efficient with a BMI less than 30 and is observed by a minimum amount of complications and risk.

**Key Words:** Mask, Ventilation, Induction, Anesthesia.

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## INTRODUCTION

General anesthesia may expose patients to aspiration of gastroesophageal contents because of disappearance of pharyngeal reflexes and can result in morbidity and mortality attributable to aspiration pneumonitis.<sup>1,2</sup> In addition, in spite of full abstinence and fasting prior to surgery<sup>3,4</sup>, patient pain, delayed gastric emptying (DGE) and other factors often increase the risk of vomiting and aspiration. In this study used techniques, for preventing vomiting and aspiration during general anesthesia can be discussed as follows: cricoid pressure, the use of postural changes, pre-oxygenation without inflation of lung, and the placement of gastric tube preoperatively.<sup>5</sup>

These techniques give us a relatively clear indication that the most effective way to reduce the occurrence of vomiting and aspiration is closely related to lowering gastric pressure during general anesthesia. During the apnoea phase between tracheal intubation and pre-oxygenation, it is resulted that some patients can become hypoxic.<sup>6</sup> In this process RSII hypoxia can be as high as 35.9% (SpO<sub>2</sub> <95%).<sup>7</sup> In this stage hypoxia is especially prevalent in those separately with lower apnoea tolerance which may include infants, obese patients, and pregnant women. The patient whose weight is over using oxygen desaturation during RSII was observed earlier to receive succinylcholine versus rocuronium. In this inspection, it was described by excessive metabolism secondary to succinylcholine fasciculations.<sup>8</sup>

## MATERIALS AND METHODS

This cross-sectional study was carried out in collaboration with Rashid Latif Hospital, Lahore and Lahore General Hospital Lahore from 1<sup>st</sup> October 2019 to 31<sup>st</sup> March 2020 and comprised 80 patients. The age including 25-60 years and BMI lower than 30kg/m<sup>2</sup> were included. We arranged to divide patients into two groups with equal numbers. In the patients, there was no any deformity or chronic lung disease. Ventilation was performed using the standard mask ventilation with

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100 % oxygen for 4 minutes in group A. While in the group B, ventilation was undertaken through an anatomical nasal mask. The mean SpO<sub>2</sub>, the mean expiratory volume, mean airway pressure and mean end tidal CO<sub>2</sub> (Et CO<sub>2</sub>) were measured, documented and compared in both groups. Using the face mask detained near to the face for 4minutes, 100% oxygen were provided and anesthesia induction medication were arranged for all patients once placed in the operating table. Patients were pre-oxygenated for 3 minutes on the surgical table during the day of surgery, mask detained closed to the face using 100%oxygen. Subsequently, anesthesia induction medication together, a bolus injection IV injection of sodium thiopental 5 mg/kg, fentanyl 2 mc/kg, midazolam 0.03 mg/kg were provided to all the patients. We arranged to divide patients into two groups, and used computer software to randomize them. In the group A, 100% oxygen were provided for 3 minutes and ventilation was undertaken using the standard anatomical face mask and in the group B, ventilation was performed using the examiner new method with a nasal mask. We used anesthesia machine with 8 cc/kg tidal volume and a rate of twelve breaths/minutes for ventilation of patients. The mean expiratory volume, mean SpO<sub>2</sub>, mean end tidal CO<sub>2</sub> (Et CO<sub>2</sub>) and mean airway pressure in 3 successive breaths in the 3<sup>rd</sup> minute were observed after ventilation, recorded and differentiate in these groups. We used to secure the tube and arranged to connect patients with anesthesia machine; all the above mentioned parameters were observed in the 5<sup>th</sup> minute after endotracheal intubation. Hemodynamic changes occurred which includes heartbeat, diastolic and systolic blood pressure were also differentiate between these two types of groups. In distinct, the mean expiratory volume at this time was peculiarly differentiated to the mean volume of expiratory before intubation as the standard parameter. After this we extracted the data, categorized and added into the computer software. Statistical analysis was performed using SPSS version 22 software. This provided result, using T-test and analysis of variance by repeated differentiation, it was significantly considered  $p < 0.05$ .

## RESULTS

The mean age of  $40.78 \pm 10.86$  comprising of 21 males and 19 females were added in the face mask group and 40 patients including mean age of  $38.42 \pm 12.32$  years comprising of 22 males and 18 females in the nasal mask group (Table 1). There is no any demonstrate or significantly difference ( $p > 0.05$ ) between the participants including height, weight and BMI. The comparison between face mask and nasal mask groups. It is apparent, after ventilation during the 3rd minute the mean maximum airway pressure is significantly higher ( $p < 0.001$ ) in the face mask group ( $15.1 \pm 1.8$ ) than the nasal mask group ( $11.8 \pm 1.4$  respectively,  $p < 0.001$ ) The

level of SpO<sub>2</sub> is higher in the nasal mask group ( $94.5 \pm 2.1$  and  $96.1 \pm 4$ , respectively in the 3rd minute  $p < 0.001$ ) [Table 2].

**Table No.1: Attributes of members in groups**

Variable	Face Mask	Nasal Mask	P value
Age (years) male/female	$40.78 \pm 10.86$ (21/19)	$38.42 \pm 12.32$ (22/18)	0.45
Body mass index kg/m <sup>2</sup>	$33.24 \pm 6.89$	$32.01 \pm 5.34$	0.30
Weights (kgs)	$93.2 \pm 12.98$	$89.4 \pm 13.7$	0.320

**Table No. 2: Differentiation of variables related to feature of ventilation**

Variable	Face Mask	Nasal Mask	P value
Maximum airway pressure at 3 minutes	$15.1 \pm 1.8$	$11.8 \pm 1.4$	$< 0.001$
SpO <sub>2</sub> level at 3 minutes	$94.5 \pm 2.1$	$96.1 \pm 4.1$	$< 0.001$
Mean end tidal CO <sub>2</sub> at 3 minutes	$632 \pm 80.52$	$620 \pm 76.52$	$> 0.05$

## DISCUSSION

Many methods are applied in clinical practice to assess gastric volume, including epigastric auscultation, magnetic resonance imaging and ultrasound. Several studies have previously shown that the incidence of gastric insufflations increased with inspiratory pressure during the induction of general anesthesia, with a threshold of 20 cmH<sub>2</sub>O<sup>9</sup> in adults and 15 cmH<sub>2</sub>O<sup>10</sup> in children by epigastric auscultation. These values are significantly higher than those of this study, which used ultrasonography. Research shows that when auscultation is used, a large amount of diagnostic gas with a mask ventilation pressure of 20 cmH<sub>2</sub>O enters the gastric cavity.<sup>11</sup> This difference may be in part attributed to the fact that auscultation is far less sensitive than real-time ultrasound. Auscultation is easily disturbed by personal subjective factors, which can only be caught when the stomach intake accumulates quantitatively. In addition, one study described MRI examination of the stomach that was performed with a slice thickness of 6 mm without a gap, using an 8-channel and 8-element phased array coil that covered the entire stomach area.<sup>12</sup>

This detection can fully display the rhythmic movement of the stomach and quantitatively calculate the stomach volume, and is thus more accurate than ultrasonography. However, Magnetic Resonance Imaging is suitable for comprehensive preoperative evaluation of gastric function and fasting conditions. It is not possible to quickly monitor gastric intake during induction of general anesthesia. In this experiment, ultrasound as a noninvasive instrument can judge the stomach inlet quickly and efficiently. This study shows that CSA of all patients increased a certain extent more after ventilation than it did before ventilation. Hence,

ultrasound as a portable tool can judge the volume of the stomach quickly and efficiently. With the use of ultrasound in clinical anesthesia, real-time ultrasound is adopted to accurately and reliably predict CSA.<sup>6</sup> Studies have shown that  $CSA \geq 340 \text{ mm}^2$  is a risk threshold for diagnosis of pulmonary aspiration.<sup>8</sup> A tidal volume of 6 ml/kg is the minimum threshold for mechanical ventilation.<sup>9</sup> Therefore, this study used a  $CSA < 340 \text{ mm}^2$  and tidal volume  $\geq 6 \text{ ml/kg}$  to assess the appropriate mask ventilation pressure. In this study, the first patient received 15 cmH<sub>2</sub>O initial pressure and two patients who underwent anesthesia with the same pressure turned out to have the appropriate pressure.<sup>14</sup> However, the modified up-and-down method was used to conclude that the lower airway pressure was also suitable for lung ventilation. In the previous studies<sup>14,15</sup>, the mask ventilation pressure was artificially divided into equal groups, and the conclusions obtained may be biased. This improved method can improve the accuracy of the final estimator and reduce the mean squared error under normal tolerance distribution. It has also been proven to be much better than the random grouping method. The initial pressure is a valid measurement and the next test results prove that CSA is within the normal range. The modified up-and-down method was used to determine that the ED<sub>50</sub> and ED<sub>95</sub> of pressure for facemask ventilation were 12.31 cmH<sub>2</sub>O and 13.12 cmH<sub>2</sub>O, respectively. It is worth noting that the area of the gastric antrum was significantly rising after facemask ventilation, which proved that the facemask ventilation does increase the risk of aspiration pneumonia.<sup>16</sup> To prevent the patients' increased airway resistance caused by the tongue after entrance of mask ventilation gas into the gastric cavity, this study's mask ventilation was placed before the oropharyngeal airway by anesthesia doctors with more than 5 years of working experience. In this study, there were many limitations in our experiment. First, this research was conducted in a non-blind manner and the anesthesiologist knew about the group assignments, which may cause observer bias. Second, studies have shown that the correlation between CSA and gastric contents is stronger in the right lateral position.<sup>6</sup> However, because the right lateral position of the patient is not convenient for clinical operation after general anesthesia, the CSA is measured in the horizontal position. Third, excessive obesity and pregnancy status affected CSA measurement<sup>6,19</sup> and so this study excluded patients with a BMI of more than 30 kg/m<sup>2</sup>, which reduced the difficulty of traditional operation.

## CONCLUSION

The ventilation with a face mask is less effective than the nasal mask which is more efficient with a BMI less than 30 and is observed by a minimum amount of complications and risk.

## Author's Contribution:

Concept & Design of Study: Umer Iqbal  
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**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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