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Effect of Head Position on the Success Rate of Blind Intubation through Air Q Laryngeal Mask in Morbidly Obese Patients

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Abstract

Aim: To evaluate the effect of head positioning whether neutral or sniffing position on the conduct of intubation through air Q in morbidly obese patients. **Patients and method:** This study was conducted on 90 patients with body mass index equal or above 40 who were scheduled for surgery under GA and were randomly divided into 2 equal groups: Group N (Gn) in which blind intubation through air Q was done in neutral position. Group S (Gs) in which blind intubation was done in sniffing position. Proper airway assessment of the patients was done. Basic monitoring was attached; Induction of anaesthesia was achieved by Fentanyl 2 ug/kg, Propofol 1.5 - 2.5 mg/kg and Atracurium 0.5 mg/kg. Maintenance of anaesthesia was achieved by Sevoflurane, Atracurium, oxygen and air. When neuromuscular blockade was complete, the head of the patient was adjusted according to their group. The supraglottic device was inserted and connected to capnography, thereafter a well lubricated proper sized ETT was passed through the air Q. We recorded a baseline reading of HR, SBP, DBP, MBP, and oxygen saturation. A second reading was taken after induction of anesthesia, just before intubation. The third reading was recorded after intubation while further readings were measured 1, 3, 5, 10, 15 min after intubation. After ETT removal, we observed the patients in the recovery room at 0, 3 & 24 hours for possible postoperative complications. **Results:** There was no statistical difference between the two groups regarding the demographic data. Although the intubation in sniffing position has a higher success rate from the first time than the neutral position, the results were statistically insignificant, regarding the mean duration of blind intubation trials through the Air Q and postoperative complications. **Conclusion:** Although the sniffing position improves glottic visualization, the change of head position had no effect on the success rate of blind intubation through air Q in obese patients.

Keywords

Air Q, Head Position, Obese Patient, Intubation …

1. Introduction

In the practice of anesthesia, maintenance of the airway is one of the major concerns. Despite being the method of choice for endotracheal intubation is direct laryngoscopy, this technique still has a failure rate of 0.05% - 0.35% in patients who have an apparently normal airway [1].

According to the American Society of Anesthesiologists, the difficult airway is defined as problems with face mask ventilation, tracheal intubation, or placement of a supraglottic airway [2].

Obesity is an independent risk factor for problems with face mask ventilation, and so many morbidly obese patients would have a difficult airway [3] [4].

The intubating supraglottic airway device (SGAD) was specifically designed as both a primary airway and a conduit facilitating intubation either blindly or via fiberoptic intubation. It has been incorporated into difficult airway algorithms and guidelines from many anesthetic societies [5].

The neutral head position created without a pillow is the recommended position of choice for blind intubation. However, it was found that the fiberoptic glottis view is often improved in the head-elevated position aiming to achieve the sniffing position with the air-Q [6]. It is expected that the use of straight silicone wire-reinforced tube, might improve the success rate of blind intubation with the air-Q.

To date, there has been no study comparing the success rate of blind intubation in the sniffing position with the neutral position using the air-Q in the morbidly obese patients with the straight silicone wire reinforced tubes.

2. Patients and Methods

After approval from the Medical Ethical Committee of kasr El-Aini Hospital, Faculty of Medicine Cairo University and obtaining informed written consent from 90 patients ASA I-II, aged 18 - 65 years with body mass index equal or above 40 whom were scheduled for surgery under general anaesthesia with muscle relaxant. Those patients were allowed to fast for 8 hours before surgery.

Patients were randomly divided by computer generated numbers into 2 equal groups: Group N ($\mathbf{G}_N$) which included 45 patients in which blind intubation through air Q was done in neutral position. Group S ($\mathbf{G}_S$) which included 45 patients in which blind intubation was done in sniffing position.

Patients who suffered from respiratory or pharyngeal pathology, allergy to any drugs in the protocol, gastro-esophageal reflux disease, hiatus hernia or previous upper gastrointestinal tract surgery were excluded from the study.

All patients received an anti-emetic 1 hour before the operation and premedi-

cated with intravenous atropine 0.6 mg.

On arrival to the operating room patients were assigned to one of two groups according to the head position: pillowless (neutral position) and head-elevated positions (sniffing position). In the head-elevated group, the head position was achieved by use of a thick elastic surgical pillow positioned under the patient's head. In the neutral group, the patient's head was positioned on the operating table without a pillow. Basic monitoring was attached including; pulse oximeter, electrocardiogram, non-invasive blood pressure, and a peripheral nerve stimulator for neuromuscular junction monitoring.

The blood pressure, heart rate and arterial oxygen saturation were recorded as baseline reading. Another reading was recorded after induction and complete muscle relaxation. Third reading was just prior to intubation. Fourth reading was recorded after intubation. Then several readings were 1, 3, 5, 10, 15 minutes after intubation.

Induction of anaesthesia was achieved by approximate doses according to ideal body weight of Fentanyl 2 ug/kg, Propofol 1.5 - 2.5 mg/kg and *Atracurium* 0.5 mg/kg and Lidocaine 1 mg/kg before device insertion. Maintenance of anaesthesia was achieved by Sevoflurane, *Atracurium*, oxygen and air.

When neuromuscular blockade was complete (absence of response to train-of-four stimulus), the head of patient was then adjusted according to their group, either the head elevated (sniffing) position group or the pillowless (neutral) head position group. The Air Q supraglottic device was inserted connected to capnography. The size of the Air Q device was chosen according to the estimated ideal body weight of the patient. The tube was inserted till 16 cm depth (the distance to the epiglottis elevating bar). It was then gently advanced into the trachea without applying undue force, the cuff was inflated, and the circuit connected. Correct tube placement was confirmed by the occurrence of square waves in the capnography trace and the presence of bilateral breath sounds on chest auscultation. If successful intubation was not confirmed, a second trial was performed. On failure of the second trial, the patient was excluded from the study. The air Q was deflated and removed using the designated stabilizing rod to maintain the tube in place, which was reconnected to the breathing circuit. The time from end of mask ventilation to endotracheal tube connection was calculated in each group, in case of failure of attempt alternative method of securing the airway using direct laryngoscopy was used.

3. Sample Size

The primary outcome in our study was the incidence of successful intubation. a previous study reported the incidence of successful intubation in neutral position to be 75% [7]. We calculated the sample size to detect a difference of 23% in the rate of successful intubation. A minimum number of 84 patients were needed for a study power of 80% and alpha error of 0.05. The number will be increased to 90 patients (45 per group) to compensate for possible dropouts.

4. Statistical Analysis

Data were coded and entered using the statistical package SPSS version 20. Data were summarized using number and percent for qualitative variables, Main and standard deviation for quantitative normally distributed variables and medium and interquartile range for variables which are not normally distributed. Comparisons between groups were done using chi square test for qualitative data, independent sample to test for quantitative data which are normally distributed and nonparametric mannwhitney test for quantitative data which are not normally distributed. *P* values less than or equal to 0.05 is considered as statistically insignificant.

5. Results

This study included 90 patients scheduled for surgery under general anesthesia with muscle relaxant. Patients were randomly divided into 2 equal groups—45 each:

- Group (N): blind intubation was done through an Air Q in neutral position.
- Group (S): blind intubation was done through an Air Q in sniffing position.

There was no statistical difference between the two groups regarding the age, BMI as shown in Table 1, Gender as shown in Table 2, ASA classification and type of surgery as shown in Table 3, Ganzouri score as shown in Table 4.

In this study, the intubation in group (N) was successful from the first time in 20 cases (44.4%), and from the second time in 14 cases (31.1%). In group (S), the intubation was successful from the first time in 26 cases (57.8%) and from the second time in 9 cases (20%). The overall success number from the first time for both head positions was 46 cases (51.1%) and from the second time was 23 cases (25.5%). Although the intubation in sniffing position has a higher success rate

Table 1. Age and BMI difference between group (N) and group (S).

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Age (years)	38.27	10.33	19.00	60.00	36.84	8.81	21.00	58.00	0.484
BMI	43.98	3.02	40.00	51.00	43.60	2.63	40.00	51.00	0.529

Data are presented as Mean ± SD, min and max. There was no significant difference between both groups in demographic data and BMI ($P < 0.05$).

Table 2. Gender difference between group (N) and group (S).

		Neutral position		Sniffing position		*P* value
		Count	%	Count	%	
Sex	Male	20	44.4%	18	40.0%	0.670
	Female	25	55.6%	27	60.0%	

Data are presented as Number & (%). No significant difference between both groups ($P < 0.05$).

Table 3. ASA classification and types of operations between group (N) and group (S).

		Group				*P* value
		Neutral position		Sniffing position		
		Count	%	Count	%	
ASA	1.00	33	73.3%	34	75.6%	0.809
	2.00	12	26.7%	11	24.4%	
Operation	Sleeve	20	44.4%	14	31.1%	0.428
	Rupture globe	0	0.0%	1	2.2%	
	Pott's fract	1	2.2%	0	0.0%	
	PNCL	6	13.3%	5	11.1%	
	Keratoplasty	0	0.0%	1	2.2%	
	Inguinal hernia	1	2.2%	3	6.7%	
	Hernia	0	0.0%	1	2.2%	
	Gastric placation	4	8.9%	1	2.2%	
	Gastric bypass	7	15.6%	6	13.3%	
	Cut tendon	1	2.2%	2	4.4%	
	Crushed hand	1	2.2%	0	0.0%	
	Cholecyctectomy	2	4.4%	7	15.6%	
	Back lipoma	0	0.0%	1	2.2%	
	Appendicectomy	2	4.4%	3	6.7%	

Data are presented as number & (%). There was no significant difference between both groups in ASA classification and type of operation ($P < 0.05$).

Table 4. Ganzouri score of both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Ganzouri score	2.71	0.46	2.00	3.00	2.75	0.44	2.00	3.00	0.684

Data are presented as Mean ± SD, min and max. There was no significant difference between both groups in Ganzouri sore ($P < 0.05$).

from the first time than the neutral position, the results were statistically insignificant (first attempt success *P* value = 0.2, second attempt success *P* value = 0.57).

Failure of intubation occurred in group (N) patients and group (S) patients and it was also statistically insignificant (*P* value = 0.8) as shown in Table 5.

The mean duration of blind intubation trials through the Air Q supraglottic device was 80.31 ± 46.71 seconds in group (N) and 65.04 ± 41.68 seconds in group (S). There was no statistical difference between the two groups (*P* value = 0.1) as shown in Table 6.

There was statistical insignificance regarding all hemodynamic variables and

oxygen saturation between both groups as shown in Tables 7-11 and Figures 1-5.

Table 5. Percentage of success and failure of blind intubation trials in both groups.

		Group				*P* value
		Neutral position		Sniffing position		
		Count	%	Count	%	
First attempt success	Yes	20	44.4%	26	57.8%	0.206
	No	25	55.6%	19	42.2%	
Second attempt success	Yes	14	56.0%	9	47.4%	0.570
	No	11	44.0%	10	52.6%	
Failure of intubation	Yes	11	24.4%	10	22.2%	0.803
	No	34	75.6%	35	77.8%	

Data are presented as Number & (%). There was no significant difference between both groups in success rate of intubation ($P < 0.05$).

Table 6. Duration of blind intubation trials in both groups.

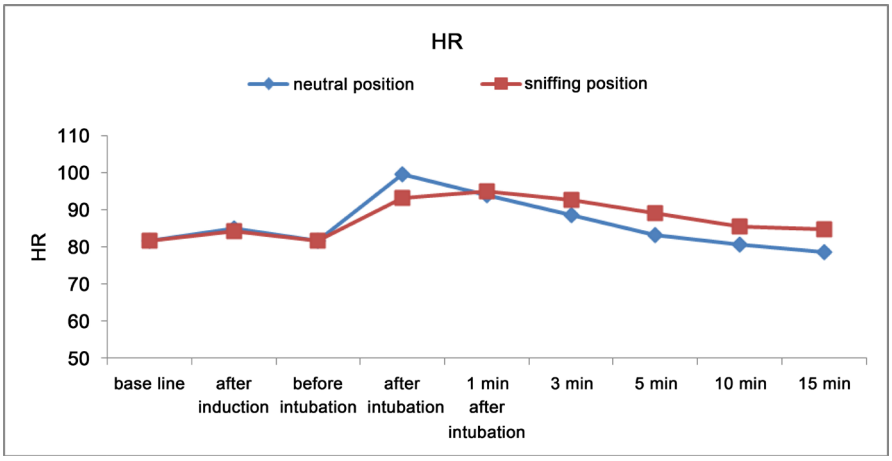
	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Time (sec)	80.31	46.71	26.00	190.00	65.04	41.68	20.00	180.00	0.105

Data are presented as Mean ± SD, min and max. There was no significant difference in time of intubation between both groups ($P < 0.05$).

Table 7. Heart rate (beat/min) difference between both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Base line HR	81.65	13.22	61.00	110.00	81.83	10.60	65.00	110.00	0.950
After induction HR	85.12	15.73	63.00	124.00	84.23	11.69	67.00	107.00	0.790
Before intubation HR	81.79	16.72	60.00	130.00	81.80	12.26	62.00	105.00	0.999
After intubation HR	99.65	17.20	70.00	130.00	93.20	18.54	15.00	122.00	0.139
1 min after intubation HR	94.12	15.43	70.00	125.00	95.06	12.76	74.00	120.00	0.783
3 min HR	88.79	14.66	65.00	118.00	92.83	13.20	68.00	120.00	0.234
5 min HR	83.32	13.71	63.00	115.00	89.26	12.15	66.00	112.00	0.061
10 min HR	80.76	13.93	60.00	116.00	85.63	11.44	65.00	110.00	0.117
15 min HR	78.56	12.53	60.00	112.00	84.83	11.81	60.00	108.00	0.036

Data are presented as Mean ± SD, min and max. There was no significant difference in heart rate between both groups ($P < 0.05$).



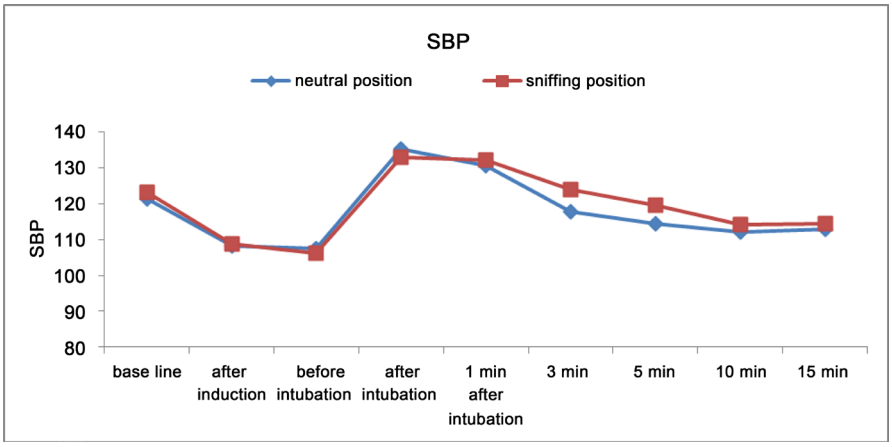
Data are presented as diagram showing difference between two groups in HR. There was no significant difference in heart rate between both groups ($P < 0.05$).

Figure 1. Heart rate (beat/min) difference between both groups.

Table 8. Systolic blood pressure (mmHg) difference between both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Base line SBP	121.44	13.86	95.00	150.00	123.20	14.48	100.00	160.00	0.608
After induction SBP	108.32	10.71	90.00	135.00	108.71	20.91	10.00	140.00	0.923
Before intubation SBP	107.53	14.93	80.00	140.00	106.23	13.29	90.00	140.00	0.703
After intubation SBP	135.29	18.83	90.00	170.00	133.00	17.12	90.00	180.00	0.598
1 min SBP	130.59	19.95	100.00	170.00	132.14	15.64	110.00	180.00	0.719
3 min SBP	117.76	13.83	90.00	140.00	124.00	15.23	100.00	170.00	0.080
5 min SBP	114.44	11.96	80.00	140.00	119.71	12.60	110.00	160.00	0.079
10 min SBP	112.26	12.53	90.00	150.00	114.29	21.60	10.00	150.00	0.637
15 min SBP	112.85	10.65	90.00	135.00	114.43	12.88	100.00	150.00	0.582

Data are presented as Mean ± SD, min and max. There was no significant difference in SBP between both groups ($P < 0.05$).



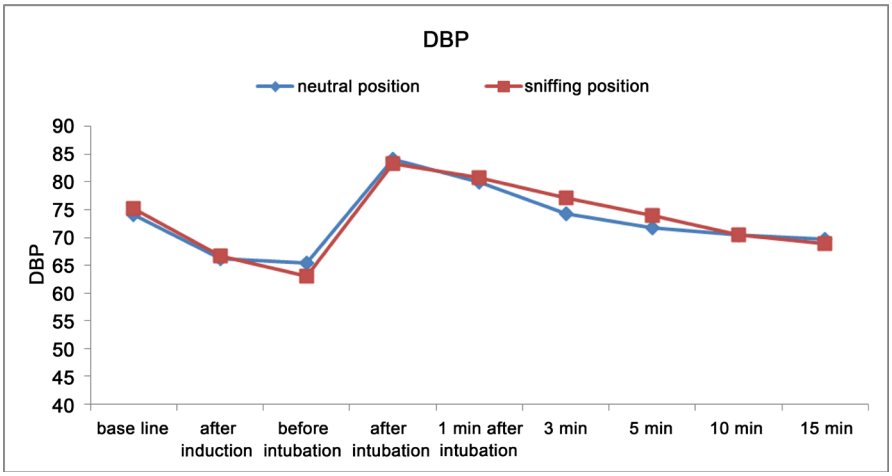
Data are presented as diagram showing difference between two groups in SBP. There was no significant difference in SBP between both groups ($P < 0.05$).

Figure 2. Systolic blood pressure (mmHg) difference between both groups.

Table 9. Diastolic blood pressure (mmHg) difference between both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Base line DBP	74.12	10.73	50.00	90.00	75.29	13.82	60.00	105.00	0.697
After induction DBP	66.18	9.62	40.00	85.00	66.71	9.39	50.00	90.00	0.815
Before intubation DBP	65.44	11.10	40.00	90.00	62.97	15.19	5.00	90.00	0.445
After intubation DBP	84.09	14.13	50.00	105.00	83.38	12.83	40.00	110.00	0.830
1 min DBP	80.00	13.08	60.00	100.00	80.83	9.98	60.00	100.00	0.768
3 min DBP	74.24	10.94	50.00	95.00	77.09	10.14	60.00	100.00	0.265
5 min DBP	71.74	12.22	40.00	90.00	73.91	7.93	60.00	100.00	0.385
10 mn DBP	70.44	11.70	50.00	90.00	70.43	8.08	50.00	90.00	0.996
15 min DBP	69.76	10.05	50.00	90.00	68.89	8.84	60.00	95.00	0.701

Data are presented as Mean ± SD, min and max. There was no significant difference in DBP between both groups ($P < 0.05$).



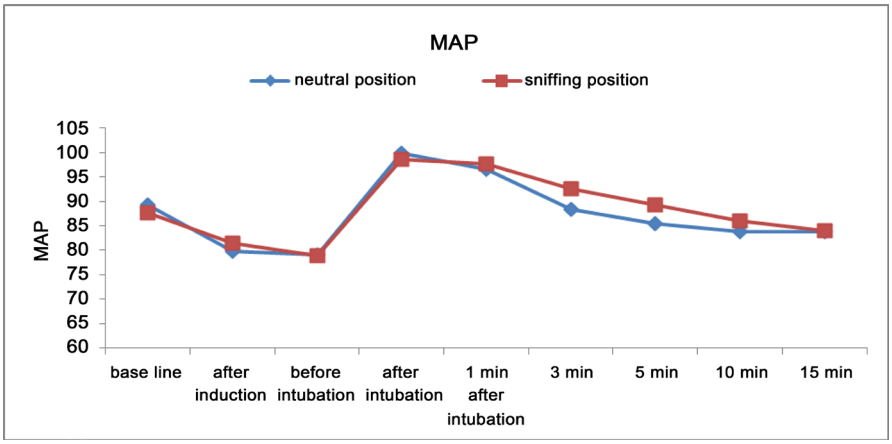
Data are presented as diagram showing difference between two groups in DBP. There was no significant difference in DBP between both groups ($P < 0.05$).

Figure 3. Diastolic blood pressure (mmHg) difference between both groups.

Table 10. Mean blood pressure (mmHg) difference between both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Base line MAP	89.21	9.81	73.00	106.00	87.63	14.74	60.00	120.00	0.604
After induction MAP	79.76	9.20	56.00	96.00	81.49	9.70	65.00	103.00	0.452
Before intubation MAP	79.15	11.60	53.00	106.00	78.83	11.77	56.00	103.00	0.910
After intubation MAP	99.85	15.74	70.00	123.00	98.63	14.64	56.00	130.00	0.739
1 min MAP	96.53	14.85	73.00	121.00	97.60	11.19	80.00	123.00	0.737
3 min MAP	88.47	11.20	66.00	110.00	92.60	11.15	75.00	116.00	0.130
5 min MAP	85.38	11.40	53.00	103.00	89.29	8.70	76.00	116.00	0.114
10 min MAP	83.91	11.50	63.00	110.00	86.00	8.54	70.00	106.00	0.396
15 min MAP	83.85	9.69	63.00	101.00	84.06	9.33	73.00	110.00	0.929

Data are presented as Mean ± SD, min and max. There was no significant difference in MBP between both groups ($P < 0.05$).



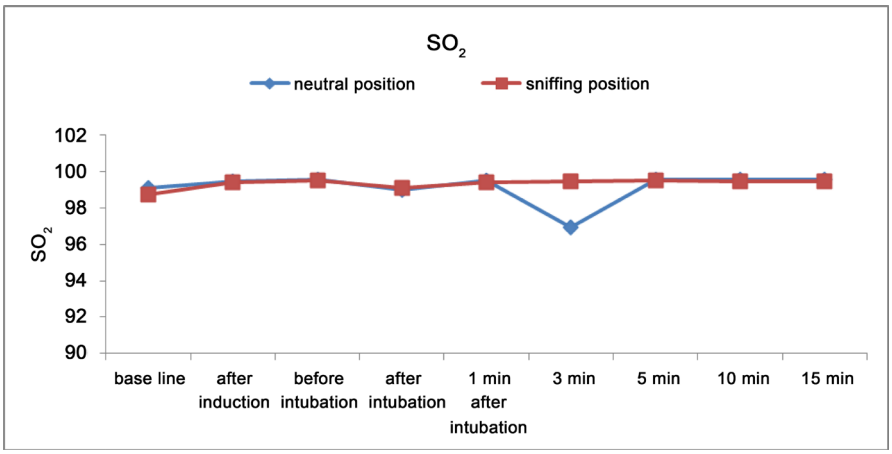
Data are presented as diagram showing difference between two groups in MAP. There was no significant difference in MBP between both groups ($P < 0.05$).

Figure 4. Mean blood pressure (mmHg) difference between both groups.

Table 11. Arterial oxygen saturation difference between both groups.

	Group								*P* value
	Neutral position				Sniffing position				
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	
Base line SO_2	99.12	1.04	96.00	100.00	98.74	3.72	78.00	100.00	0.573
After induction SO_2	99.47	0.66	98.00	100.00	99.43	0.88	97.00	100.00	0.824
Before intubation SO_2	99.56	0.50	99.00	100.00	99.54	0.66	98.00	100.00	0.910
After intubation SO_2	99.00	1.41	95.00	100.00	99.11	1.28	95.00	100.00	0.726
1 min SO_2	99.53	0.56	98.00	100.00	99.40	0.77	97.00	100.00	0.431
3 min SO_2	96.94	15.55	9.00	100.00	99.46	0.70	98.00	100.00	0.342
5 mn SO_2	99.59	0.50	99.00	100.00	99.51	0.66	98.00	100.00	0.602
10 min SO_2	99.56	0.56	98.00	100.00	99.49	0.70	98.00	100.00	0.635
15 min SO_2	99.59	0.50	99.00	100.00	99.49	0.70	98.00	100.00	0.486

Data are presented as Mean ± SD, min and max. There was no significant difference in arterial oxygen saturation between both groups ($P < 0.05$).



Data are presented as diagram showing difference between two groups in SO_2. There was no significant difference in SO_2 between both groups ($P < 0.05$).

Figure 5. Diagram showing difference between two groups in SO_2 (%).

Table 12. Complication incidence in both groups.

		Group				*P* value
		Neutral position		Sniffing position		
		Count	%	Count	%	
Bloody secretions immediately	Yes	9	20.0%	8	17.8%	0.788
	No	36	80.0%	37	82.2%	
Bloody secretions 3 hrs	No	45	100.0%	45	100.0%	---
Bloody secretions 24 hrs	No	45	100.0%	45	100.0%	---
Sore throat immediately	Yes	13	28.9%	14	31.1%	0.818
	No	32	71.1%	31	68.9%	
Sore throat 3 hrs	Yes	11	24.4%	13	28.9%	0.634
	No	34	75.6%	32	71.1%	
Sore throat 24 hrs	Yes	5	11.1%	7	15.6%	0.535
	No	40	88.9%	38	84.4%	
Haorsness voice immediately	Yes	2	4.4%	1	2.2%	1
	No	43	95.6%	44	97.8%	
Haorsness 3 hrs	Yes	1	2.2%	1	2.2%	1
	No	44	97.8%	44	97.8%	
Haorsness 24 hrs	No	45	100.0%	45	100.0%	---

Data are presented as Number & (%). There was no significant difference in post operative complication between both groups ($P < 0.05$).

After ETT removal we observed the patients in the recovery room at 0, 3 & 24 hours for possible complications and we compared their incidence in both groups as shown in Table 12. The ETT was inspected for Blood-streaked mucous occurred in only 9 cases (20.0%) in group (N), and in 8 cases (17.8%) in group (S).There was no statistical significant difference between both groups (*P* value = 0.7). Sore throat occurred in 13 cases (28.9%) in group (N), and in 14 cases (31.1%) in group (S) with no statistical significance. Hoarseness of voice occurred in only 2 cases (4.4%) in group (N), and in 1 case (2.2%) in group (S).

6. Discussion

The intubating supraglottic airway device (SGAD) was specifically designed as both a primary airway and a conduit facilitating intubation either blindly or via fiberoptic intubation. It has been incorporated into difficult airway algorithms and guidelines from many anesthetic societies. The air Q reusable laryngeal mask is a relatively new device specifically designed for intubation [8].

Obesity is an independent risk factor for problems with face mask ventilation, and so many morbidly obese patients would have a difficult airway [9] [10] and some reports have claimed that tracheal intubation maybe more difficult in obese patients [11] [12].

This study compared between the neutral head position and the sniffing position on the success rate of blind intubation through air Q using straight silicone wire-reinforced tube in morbidly obese patients.

To the best of our knowledge, we are the first study to address the effect of different head positions on success rate of blind intubation through air Q in obese patients. There is paucity in data to compare the effect of head position on blind intubation through air-Q.

This study included 90 patients scheduled for surgery under general anesthesia with muscle relaxant. Patients were randomly divided into 2 equal groups—45 each.

Group (N): blind intubation was done through an Air Q in neutral position.

Group (S): blind intubation was done through an Air Q in sniffing position.

The Demographic characteristics, BMI and ASA status in our study were compared in both groups and there was no statistically significant difference between the two groups.

This study also compared the time consumed in each position for intubation as the mean duration of blind intubation trials through the Air Q supraglottic device was 80.31 ± 46.71 seconds in group (N) and it was 65.04 ± 41.68 seconds in group (S). The difference between both groups was statistically insignificant.

Regarding all hemodynamic variables including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and oxygen saturation, they were compared in both groups and there was statistical insignificance between them.

By studying the success rate of intubation of the two positions, we found that the success rate in first attempt in sniffing position was 57.8% and in neutral position 44.4% with *P* value of 0.206, which was not statistically different.

In agreement with these results, Rieko Yamada and colleagues [13] whom compared the success rate of blind intubation with Fastrach and Air-Q in different head positions, and found that the success rate of blind intubation was significantly higher in Fastrach group than that of the air-Q in both the pillowless and head-elevated positions. Interestingly, found that the head-elevated position had no effect on the success rate of blind intubation in either Fastrach or Air-Q groups in comparison to pillowless head position.

In the current study, the sniffing position had successfully aligned the tracheal axis and the outlet of the air-Q, which resulted in improvement of glottic opening visualization. It was expected that the alignment of these axes would increase the success rate of blind intubation. However, the success rate in both positions was not statistically significant. The possible explanations for this discrepancy are that the air-Q has not epiglottic elevator, it has a notch-like slope and an elevation ramp on the cuff to make the angle of emergence of the tracheal tube tip steeper. The tip of the tracheal tube might advance significantly anteriorly after it emerges from the cuff. Therefore, the tip of the tracheal tube increasingly deviates from the line of the fiberoptic sight with advancement of the tube, which

might lead to unsuccessful intubation.

Whenever it is available, we believe that fiberoptic-assisted intubation should be the first choice with the air-Q because the success rate of blind intubation remains relatively low, and multiple attempts at blind intubation can cause airway trauma and subsequent airway swelling, which would worsen intubation conditions even with fiberoptic-assisted intubation [14] [15].

In conclusion, although the sniffing position improves glottic visualization, the change of head position had no effect on the success rate of blind intubation through air Q in obese patients.

Limitations

Further studies are expected on other intubating supraglottic devices. Also we didn't use other positions in comparison like ramped position in which the upper body, neck and head are elevated to a point where an imaginary horizontal line can be drawn from the sternal notch to the external ear which may improve the view of the larynx during laryngoscopy. Placing morbidly obese patients in this position could contribute to an increased rate of successful tracheal intubation in these patients [16].

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