Original Article

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Anaesthesia Section

Comparison between Standard Technique versus Reverse Manoeuvre of Airtraq Insertion for Tracheal Intubation in Lean versus Obese Patients undergoing Surgery under General Anaesthesia: A Randomised Clinical Study

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ABSTRACT

Introduction: Obese patients pose challenge to anaesthesiologist in terms of securing airway due to large tongue and anatomical variations, need a novel tracheal intubation technique to quickly secure airway in obese individuals. The airtraq laryngoscope with reverse technique of insertion is used to secure airway without classical sniffing position.

Aim: To compare the two techniques of airtraq insertion, standard and reverse manoeuvre, in lean versus obese patients undergoing surgery under general anaesthesia.

Materials and Methods: This randomised clinical study was conducted from July 2012 to January 2014 at Seth GS Medical College and KEM Hospital, Mumbai, Maharasthra, India in a total of 200 American Society of Anaesthesiologists (ASA) physical status I to III undergoing surgery under general anaesthesia. Both lean and obese patients were randomly allocated to each technique. After induction of anaesthesia intubation was performed by an expert anaesthesiologist with each technique (three attempts) were used to intubate trachea. If there was a failure, switch over technique was applied. All the groups were analysed for intubation time, number of attempts, ease of intubation assessed by Visual Analogue Scale (VAS), haemodynamics, and complications. Data entry was done on a Microsoft Excel sheet and data analysis was done using Statistical Package for the Social Sciences (SPSS) software version 15.0.

Results: Both lean and obese groups were comparable in the airway and demographic characteristics. In lean patients there was no significant difference between intubation time with both standard and reverse manoeuvre. While in obese patients reverse manoeuvre (11.84±1.99 seconds) significantly reduced exposure time by 13 seconds as compared to standard technique (24.02±6.94 seconds), thereby reducing total duration of intubation (26.08±1.16 seconds) as compared to total duration of intubation with standard technique (39.62±8.95 seconds). Lean group was comparable in number of attempts with standard technique (47 patients in 1st attempt/3 patients in 2nd attempt) and reverse manoeuvre (49 patients in 1st attempt/1 patient in 2nd attempt). Obese group with reverse manoeuvre all were intubated with first attempt (50 patients) with standard technique (46 patients in 1st attempt/1 patient in 2nd attempt) and there was switch over from standard to reverse technique in three patients. Both lean and obese groups were comparable in complications with both technique.

Conclusion: Reverse manoeuvre proved beneficial in obese patients as it reduced intubation time as compared to standard technique, while lean patients showed no difference.

Keywords: Exposure time, Intubation time, Visual Analogue Score

INTRODUCTION

The airtraq, relatively a newer optical laryngoscope improved intubation difficulty score and ease of intubation when used in normal airway [1], clinically difficult airway and simulated difficult airway scenarios in mannequin [2,3]. This optical laryngoscope is used as rescue device for failed conventional laryngoscopy [4,5]. Airtraq provides direct view of glottis without the optimal position like alignment of airway axes for classic sniffing position [6]. Main factor determining how quick the airway is secured with airtraq is the placement of airtraq in pharynx to get the view of glottis.

Ndoko SK et al., found that in some of the obese patients insertion of airtraq for intubation appeared difficult with standard technique. Hence, they tried to change the technique to reverse manoeuvre to facilitate intubation by airtraq. In reverse manoeuvre airtraq was inserted 180° opposite to standard technique like Guedels airway, once the tip of the blade reached the pharyngeal space then airtraq was rotated conventional position to get the glottic view for intubation [7,8]. Obesity is associated with clinical features and anatomical variations in airway that may increase difficulty in airway management. Obese patients tend to desaturate faster so it can be prevented by preoxygenation with pressurised oxygen along with quick and rapid method to secure airway with airtraq.

The aim of the study was to assess the effectiveness of reverse technique in obese patients over standard technique as compared to lean patients. It was hypothesised that reverse manoeuvre significantly reduced total intubation time in obese group versus standard technique while lean group showed no difference.The primary outcome measure was total duration of intubation (exposure time+modulation time) and secondary outcomes studied were number of attempts, complications, and ease of intubation assessed by VAS score.

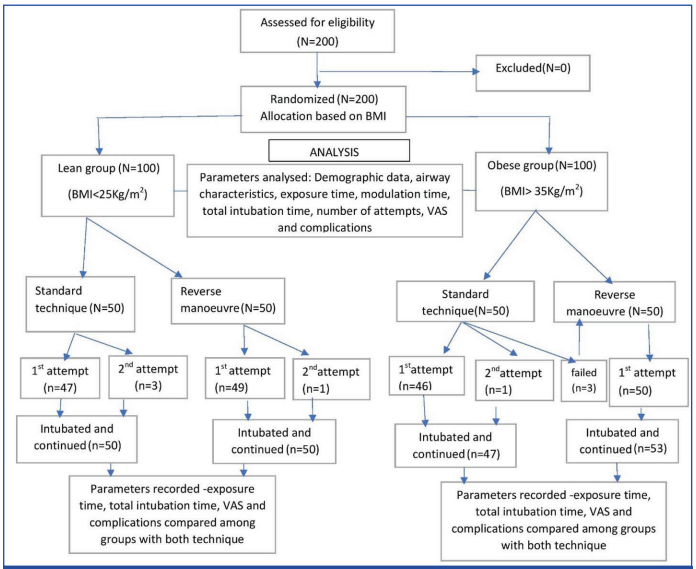
MATERIALS AND METHODS

This randomised clinical study was conducted from July 2012 to January 2014 at Seth GS Medical College and KEM Hospital, Parel Mumbai, Maharashtra, India, after an Institutional Ethics Committee (IEC) approval (EC/94/2012).

Inclusion criteria: A total 200 patients of ASA physical status I to III, aged between 18-65 years, lean patients having BMI<25kg/m^2, and obese patients having BMI>35kg/m^2 undergoing elective surgery under general anaesthesia were included after obtaining written informed consent for the study.

Exclusion criteria: Patient's refusal, patients with limited mouth opening i.e., less than 3 cms, having symptomatic gastric reflex disease, patients with hiatus hernia were excluded from the study.

Sample size calculation: A pilot study was conducted in 20 patients over one month. The primary outcome observed was exposure time which was difference of 13 seconds between two techniques (reverse technique reduced exposure time by 13 seconds). So, at an alpha level of 0.05% and power of study 80%, the calculated sample size by n master 1.0' software was 100 for each group. Hence, a total of 200 patients were studied with 100 for each lean and obese group on basis of Body Mass Index (BMI). In each group patients were randomly allocated for standard and reverse technique [Table/Fig-1].



[Table/Fig-1]: Study plan.

Study Procedure

Both obese and lean patients were allocated to each technique, using the toss method. After thorough preanaesthetic evaluation and informed consent, patients were premedicated with inj. ranitidine 150 mg Intravenous (i.v.) slow and inj. ramosetron 0.3 mg an hour before surgery. Once on the Operation Theatre (OT) table standard monitors attached and baseline parameters recorded. Intravenous cannula was inserted of appropriate size and intravenous fluid started. After preoxygenation for 3 minutes inj. midazolam 0.03 mg/kg, inj. fentanyl 2 mcg/kg, induced with inj. propofol 2 mg/kg and inj. vecuronium 0.08 mg/kg was given after confirmation of mask ventilation, then once there was adequate relaxation and depth of anaesthesia after 3 minutes patients were intubated with airtraq optical laryngoscope either by standard technique or reverse manoeuvre intubation. The intubation was done by the anaesthesiologist who had performed 50 intubations with Macintosh laryngoscope, 50 intubations with airtraq in mannequins and 20 intubation in human patients prior to study.

In the reverse manoeuvre airtraq was inserted opposite to the standard technique in the midline of the mouth like Guedels airway. Once the device was in pharyngeal space, it was rotated to get the glottic view, and the endotracheal tube of appropriate size was passed through the vocal cords. Intubation was confirmed by visual chest rise, auscultation for breath sounds and capnography then circuit was attached and patient was put on controlled ventilation with standard ventilation parameters to maintain end tidal carbon dioxide of 35-45 mmHg. Anaesthesia was continued with Oxygen and Nitrous (50:50), Isoflurane (mac1.2) and Vecuronium topups. At the end of the surgery all the patients were reversed and extubated.

Airway management characteristics: Following parameters were recorded throughout the study like exposure time, modulation time, total duration of intubation, number of attempts, complications, and VAS score for ease of intubation. Total intubation time was defined as time from the start of oral insertion of the airtraq optical laryngoscope to the visualisation of superior border of the endotracheal cuff passing through the vocal cords (sum of exposure time and modulation time). Exposure Time (ET) was the time required to achieve a centered view of glottic opening with airtraq. Modulation Time (MT) was the time required to manipulate the tube to pass through the glottic opening. All the anaesthesiologists who intubated were asked to rate the ease of intubation with each technique on VAS (0- very easy to 100-very difficult).

The rescue protocol was that if glottis could not be visualised within 30 seconds after the first attempt, mask ventilation was done for 1 minute and second attempt was tried. In between attempts patients were mask ventilated for 1 minute with 100% oxygen to maintain saturation. A maximum of three attempts were tried to intubate trachea with each technique after which it was switched over to the other technique.

STATISTICAL ANALYSIS

Data entry was done on a Microsoft Excel sheet and data analysis was done with help of Statistical Package for the Social Sciences (SPSS) software version 15.0 and sigma plot version no 11. Quantitative data are presented with the help of mean, standard deviation, comparison among the group was done with the Unpaired t-test. Qualitative data was presented with help of frequency and percentages table, comparison among the study was done with help of Chi-square test, p-value <0.05 was considered statistically significant.

RESULTS

All the patients included in the study were intubated with one of the either technique, and there were no failures in the study. Both lean and obese groups were comparable in their airway and demographic characteristics [Table/Fig-2,3].

Parameters	Lean group		p-value
	Standard technique (n=50) Mean±SD	Reverse technique (n=50) Mean±SD	
Age (years)	33.60±13.33	34.84±12.6	0.634
Male/Female	23/27	23/27	
BMI (kg/m²)**	18.78±1.66	18.88±1.4	0.751
ASA (I/II/III)§	43/7/0	38/12/0	0.202
MPC (I/II/III/IV)*	37/13/0/0	35/15/0/0	0.656
TMD (cms)†	5.50±0.61	5.85±1.55	0.634
IID (cms)‡	3.95±0.49	3.92±0.38	0.733

[Table/Fig-2]: Comparison of demography and airway characteristics in lean groups.
** Body mass index, §American society of anaesthesiology, *Modified Malampatti classification, †Thyromental distance, ‡Interincisor distance

Parameters	Obese group		p-value
	Standard technique (n=50) Mean±SD	Reverse manoeuvre (n=50) Mean±SD	
Age (years)	44.88±11.65	43.64±8.99	0.553
Male/Female	29/21	26/24	
BMI (Kg/m²)** 34-44 (Kg/m²)	35.98±2.43	36.54±1.98	0.56
ASA (I/II/III)§	25/25/0	33/27/0	0.105
MPC (I/II/III/IV)†	43/7/1	40/9/1	0.569
TMD (cms)†	5.57±0.59	5.70±0.47	0.069
IID (cms)‡	4.11±0.41	3.97±0.36	0.733

[Table/Fig-3]: Comparison of demography and airway characteristics in obese groups.
**body mass index, §American society of anaesthesiology, *Modified mallampatticlassification, †Thyromental distance, ‡Interincisor distance

In the lean group ET and total Intubation Time (IT) with both techniques showed no significant difference [Table/Fig-4]. In the obese group exposure time with standard technique was 24.02±6.94 seconds, and with reverse manoeuvre 11.84±1.99 seconds (p-value <0.001); while total intubation time observed was 39.62±8.95 seconds with standard technique, and 26.08±1.16 seconds recorded with reverse manoeuvre (p-value <0.001). So reverse technique reduced total intubation time by 13 seconds by decreasing exposure time [Table/Fig-5].

Modulation time in the lean group with both standard technique and reverse manoeuvre was comparable [Table/Fig-4] while in obese patients with standard technique modulation time was significantly more (15.40±2.77 seconds) than the reverse manoeuvre (14.32±1.46 seconds). But an overall reduction in total intubation was noted with a significant decrease in exposure time [Table/Fig-5].

Intubation parameters	Lean group		p-value
	Standard technique (n=50) Mean±SD	Reverse technique (n=50) Mean±SD	
ET (secs)§	11.02±0.82	11.52±0.94	0.062
MT (secs)†	7.10±1.33	7.06±1.37	0.071
IT (secs)‡	18.14±1.23	18.58±1.26	0.061
Number of attempts (1/2/3)	47/3/0	49/1/0	0.307
Switch over	0	0	
VAS**	21.40±0.49	18.80±8.36	0.081

[Table/Fig-4]: Comparison of intubation time, attempts and VAS among lean groups.
Unpaired t-test and Mann Whitney U test were applied. Duration of intubation (ET, MT and IT) and VAS results given as mean and standard deviation.
§Exposure time. † Modulation time, ‡Intubation time, **visual analogue score

Intubation parameters	Obese group		p-value
	Standard technique (n-50) Mean±SD	Reverse technique (n-50) Mean±SD	
ET (secs)§	24.02±6.94	11.84±1.99*	<0.001
MT (secs)†	15.40±2.77	14.32±1.46	0.017
IT (secs)‡	39.62±8.95	26.08±1.16*	<0.001
Number of attempts (1/2/3)	46/1/3	50/0/0	0.125
Switch over	3	0	
VAS**	28.30±10.53	17.70±0.36*	<0.001

[Table/Fig-5]: Comparison of intubation time, attempts and VAS among obese groups.
p-value <0.05 was considered significant. Unpaired t-test, Mann whitney U test were applied
Duration of intubation (ET, MT and IT) and VAS results are given as mean and standard deviation.
§Exposure time. †Modulation time, ‡Intubation time, **visual analogue score

Number of attempts were comparable in the lean group with both technique. In obese patients with standard technique one patient required second attempt, who could not be intubated after 3rd attempt, was switched over to reverse manoevure. While, with the reverse technique all patients got intubated in a single attempt [Table/Fig-4,5]. Anaesthesiologist involved in the study reported that intubation was easy and comparable in the lean groups for both techniques. However in the obese group, the intubation was significantly easier with the reverse technique [Table/Fig-4,5].

The most common upper airway complications were, soft palate injury, hard palate injury, tonsillar pillar injury and mucosal bleeding. Both groups were comparable in terms of the complications using both the insertion techniques [Table/Fig-6].

Complications	Lean group		p-value
	Standard technique (N=50) n (%)	Reverse technique (N=50) n (%)	
Lip trauma (%)	1 (2)	3 (6)	0.307
Teeth trauma (%)	0	0	
Soft palate injury (%)	0	1 (2)	0.315
Hard palate injury (%)	0	1 (2)	0.315
Tonsillar pillar injury (%)	0	1 (2)	0.315
Mucosal bleeding (%)	2 (4)	0	0.360
Obese group			
Tonsillar pillar injury	2 (4)	2 (4)	1

[Table/Fig-6]: Comparison of complications among the lean groups.

DISCUSSION

In this study, the reverse manoeuvre of insertion of airtraq was found to facilitate a tracheal intubation in obese patients compared to the standard technique. In lean individuals, both techniques were comparable for tracheal intubation time.

Obese patients were found to have airway abnormalities and variation in anatomical airway due to fat deposition. This makes alignment of airway axes difficult for intubation making intubation challenging for anaesthesiologists. Insertion of airtraq by standard technique requires crawling movements to push the tongue and soft tissue in obese patients. Considerable force is required to place tip of airtraq in pharynx with abrupt loss of resistance to the scope to visualise glottis, therefore standard technique prolonged intubation time in the present study. In the reverse technique, airtraq was inserted at 180° to the standard technique to the midline. Once it reached, it was rotated to the conventional pharyngeal position to visualise glottis. Quick passage of airtraq by reverse technique was because the whole blade can be rapidly placed in pharynx. Reverse manoeuvre brings the vocal cords nearer to the device allowing quick passage of endotracheal tube in addition to reducing the insertion time. Reverse manoeuvre reduced overall intubation time in obese group. Lean patients were found to have wide oral cavity due to less soft tissue, so insertion of airtraq by standard technique requires less force and dorsal curve of airtraq easily follows the anatomical contour of the hard palate. Even by reverse technique airtraq can be easily placed in lean groups, so both techniques were comparable in terms of intubation time.

Dhonneur G et al., evaluated standard and reverse technique in 80 patients (40 lean and 40 obese). They observed that reverse manoeuvre did not influence tracheal intubation in characteristics in lean groups and in obese patients standard technique of insertion found to be non significant in 20% of cases while reverse manoeuvre facilitated and expedited the tracheal intubation time by 12 seconds [9].

Attempts were comparable in lean groups with both techniques. Because lean group had wide oral cavity, placement of airtraq with both techniques required less force and resistance. In the obese group, all patients could be intubated with airtraq by standard technique except one patient who required second attempt and three patients who require could not be intubated with third attempt were switch over to reverse technique for intubation. However with reverse manoeuvre all obese patients could get their trachea intubated in single attempt. It was possible because present study selected patients with mouth opening of more than 3 cms.

Gupta N et al., also found intubation with a airtraq does not require multiple attempts because the contour of the blade-shaped to anatomical airway and less manoeuvre of the airway [10]. In the study conducted by Ranieri Jr D et al., all the anaesthesiologists participated in the study opted for reverse manoeuvre in the obese and required single attempt to secure trachea with airtraq. As anaesthesiologist are acquainted with Guedels airway so insertion by reverse manoeuvre was easy as it is similar to Guedels airway [11]. In the current study also intubation in lean patients was easier with both techniques, while intubation with reverse technique was significantly easier in obese group as compared to standard technique.

Minor upper airway injuries were noted in all the groups, overall complications observed in the present study was less. In the lean group few had mucosal bleeding with standard technique and tonsillar pillar injury with reverse manoeuvre;while in obese patients tonsillar pillar injury was noted with both technique. This was probably because the standard technique of placement of tip of airtraq requires considerable pressure. In the reverse manoeuvre, rotation of the blade may lead to tonsillar pillar injury. End results of this study were comparable with study done by Dhonneur G et al., [9], where both group patients had less injury with both techniques.As explained previously because of narrow oral cavity in obese patients due to large tongue and soft tissue, placement of airtraq with both technique requires considerable practice in obese patients and has to be done cautiously. Overall complications were less compared to Macintosh in previous studies [9,10].

Limitation(s)

Airtraq cannot be used in all patients as its thickness is 1.8 mm and width is 2.8 cm, requires mouth opening to be atleast 3 cm. So, patients with mouth opening of less than 3 cms were excluded. As airtraq is a new device it needs expertisation and skill to reduce complications.

CONCLUSION(S)

Insertion of airtraq by reverse manoeuvre was found to be superior to standard technique in terms of intubation time, number of attempts, and ease of insertion in obese patients as compared to lean patients.

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