ORIGINAL ARTICLE

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A Comparative Study on Evaluation of "No Touch" Extubation and Standard Extubation Technique on Hemodynamic Parameters and Airway Complications During Emergence from General Anesthesia

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Abstract

Background: Extubation is a critical phase in general anesthesia that can provoke hemodynamic instability and airway-related complications. The "no touch" extubation technique aims to minimize stimulation during emergence, potentially reducing adverse events such as coughing, laryngospasm, and hypertension. This study compares the hemodynamic and airway outcomes of "no touch" extubation with standard awake extubation.

Methods: A prospective, randomized study was conducted on 60 ASA I-II patients undergoing elective surgery under general anesthesia. Patients were randomly allocated into two groups: Group A (standard awake extubation) and Group B (no touch extubation). Hemodynamic parameters (heart rate, systolic blood pressure, diastolic blood pressure) were recorded at baseline and at intervals post-extubation. Airway complications, including coughing, laryngospasm, and hoarseness, were also assessed. Statistical analysis was performed using SPSS 21, with significance set at $P<0.05$.

Results: The mean duration from surgery completion to spontaneous eye opening was 13.50 ± 2.66 minutes in Group A and 12.73 ± 3.00 minutes in Group B ($p = 0.30$). Hemodynamic responses showed a significant reduction in systolic blood pressure (SBP) in Group B compared to Group A ($p < 0.05$), while no significant differences were observed in heart rate or diastolic blood pressure. Airway complications were significantly lower in the "no touch" group, with fewer cases of coughing (24% in Group B vs. 37% in Group A), and no instances of laryngospasm in Group B. Hoarseness was also less frequent in Group B (7% vs. 17%).

Conclusions: The "no touch" extubation technique results in a more stable hemodynamic profile and fewer airway-related complications than standard awake extubation, making it a safer alternative, particularly for patients at risk of hemodynamic instability and airway reactivity.

Keywords: *Extubation; General anesthesia; No touch extubation; Standard Awake.*

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INTRODUCTION

Removal of endotracheal tube refers to as extubation, is one of the most frequently performed procedures in anesthesiology. Endotracheal extubation is translaryngeal removal of tube from trachea via mouth or nose. Extubation can be awake or deep.[1] To prevent stress response deeper extubation are done. During emergence, coughing and straining is major issue in presence of tracheal tube.[2] This often leads to complications like agitation, laryngospasm, hypertension, tachycardia and negative pressure pulmonary oedema. There is also increase in intracranial and intraocular pressure.[3,4]

To avoid such hemodynamic alterations no touch extubation is done without any direct stimulations to minimize airway reflex activation and complications. In addition, patient also should have adequate pain management during extubation.[5,6]Given the clinical significance of extubation techniques, it is important to determine their effectiveness in minimizing complications.

This study aimed to determine hemodynamic alteration and airway related complications while extubation using the no-touch technique and standard technique of extubation.

METHODS

This randomized prospective study was carried out in the Department of Anesthesia of Manipal College of Medical Sciences from April 02, 2023 to October 02,2023 after obtaining clearance from the institutional research committee (reference number: MCOMS/IRC/554). Written informed consent was taken from all the patients. Patients with ASA I and II patients, aged 18-65 scheduled for elective general anesthesia with endotracheal intubation were enrolled in the study. Patients with airway reactive disease, severe cardio-pulmonary disease, morbidly obese, medications like sedatives, antitussives, ACE inhibitors, anticipated difficult intubation, pregnant females, emergency cases were excluded from the study.

The sample size was calculated by using following formula.[7]

$$n=\frac{2(Z\alpha + Z\beta)^2 \times \sigma^2}{d^2}$$

This study was considered at 95% confidence interval and 80% power to estimate the sample size. For this purpose, we considered Group A mean heart rate (μ_1) =85.425, standard deviation (SD_1) =6.18 and Group B mean heart rate (μ_2) =81.50, standard deviation (SD_2) =3.63.[8]

Where, n=number of samples

$Z\alpha$=1.96 (type 1 error 0.05)

$Z\beta$=0.842 (Power of 80%)

$\sigma = \frac{SD1+SD2}{2}$ = 4.9

d=difference in mean as 3.9

n = 2 $(1.96+0.84)^2 \times 24.01/15.21$

= 24.75

So, the sample size was >24.75 in each group. However, we increased sample size to 30 patients in each group primarily to account for potential dropouts, non-compliance, or data loss

during the course of the study, so total sample size for our study was 60.

The continuous data (age, heart rate systolic, diastolic, mean arterial pressure) were presented as mean and standard deviation and were analyzed by unpaired student t test. Category data were analyzed by using the chi-square test. Data were described as frequency (percentage) distribution as well as in mean ± SD. The value of $p<0.05$ was considered statistically significant. Data analysis was done in SPSS 21.

After preanesthetic checkup and on arrival to the operative room all patients were cannulated with 18G intravenous (IV) catheter. Baseline blood pressure (BP) and heart rate (HR) was recorded. Monitoring was done with ASA standard which included Non-invasive blood pressure (NIBP), Mean Arterial Pressure (MAP), continuous electrocardiography (ECG), heart rate (HR) and pulse oximetry (SpO2).HR, NIBP, and MAP was recorded every five minutes during the procedure. The participants were allocated on two groups i.e., Group A (control group, Standard awake Extubation) and Group B (No touch, awake Extubation).

Patient was induced with intravenous midazolam 0.01mg/kg, fentanyl 1.5-2mcg/kg, propofol 2-2.5mg/kg and 0.1mg/kg vecuronium to facilitate tracheal intubation. The tracheal tube size was 7.5-8mm for male and 6.5 to 7mm for female and the cuff was inflated with air.

Anesthesia was maintained with 1.5-2% Isoflurane in 30-40% oxygen. Monitoring consisted of NIBP, HR, ECG, Spo2, MAP and EtCO2. Esmolol was given at 0.5mg/kg when HR was greater than 120 beats per minutes. Patients received intravenous paracetamol 1g 30 minutes before the end of surgery for post operative analgesia. Also, before end of surgery intravenous ondansetron 4mg and ketorolac 30 mg was given for pain management. Reversal was done by using intravenous neostigmine 50mcg/kg plus glycopyrrolate 10mcg/kg based on clinical assessment after patient just started to have spontaneous breathing. At the end of surgery, patients were randomly allocated into one of the following two groups according to methods of extubation.

Patients were randomly allocated into two groups using flipping a coin method of randomization.

In group A (Control group; Standard awake extubation) after completion of procedure with discontinuation of isoflurane and fresh gas flow was increased. Patient was suctioned for any secretions in pharynx. If patient did not breathe spontaneously, positive pressure ventilation was continued with 100% oxygen until spontaneous ventilation returned. Patient was extubated after all extubation criteria were met.

In Group B (No touch awake extubation), at the end of the procedure when the patient was deeply anesthetized any secretions in the pharynx was suctioned under direct visualization in order to confirm that secretion clearance was complete. Isoflurane was discontinued after the end of the surgery and fresh gas flow was increased.

Positive pressure ventilation was continued with 100% oxygen until spontaneous ventilation returned. Then, tracheal tube cuff was deflated once spontaneous ventilation was present. Tracheal extubation was done when patient regained consciousness, have adequate tidal volume, purposeful movement and spontaneous eye opening. This was done on absolutely no touch technique until patients spontaneously wake up and was able to open their eyes. The anesthetist was only allowed to call their name or give a simple verbal command to open their eyes without physically stimulating the patient.

After extubation in both groups, patient was transported to the post anesthesia care unit (PACU) with 5L/min oxygen via face mask. Pulse oximetry was monitored throughout recovery period.

Measurement was done at the time from the end of surgery till patients spontaneously opened their eyes in both groups. HR, SBP and DBP were measured at the end of surgery which served as baseline values. Subsequent measurements were taken at 5min,10min,15min, and 20min after extubation and also duration of end of surgery to spontaneous eye opening was noted.

The incidence and severity of laryngospasm was recorded according to four-point scale (0= no laryngospasm,1=stridor on inspiration,2=total occlusion of the vocal cords (silence with no air movements) or 3=cyanosis). Severity of coughing was defined as absent if no cough occurred and present if cough was present.

Hoarseness was assessed based on changes in speech quality, with no complaints if there was no change in speech quality at the end of surgery.

RESULTS

There was a total of 60 patients enrolled in this study with aged 18-65 years. They were comparable with respect to ASA status, gender, number of smokers and type of surgery (P>0.05). (Table 1)

Table 1: Patients demographic data (n=60)

Variables	Group A(n=30)	Group B (n=30)	P value
Age (years)	52.50 ±14.65	46.13±12.42	0.07
Gender (M/F)	13/17	15/15	0.79
Weight (kg)	67.47±7.16	62.47±8.81	0.01
ASA (I/II)	9/21	16/14	0.11

The mean duration of surgery (minutes) was 67.50±34.98 and 57.50±24.38 in group A and group B respectively. There was no statistically significant difference in two groups as their p-value was 0.20. The mean duration to end of surgery to eye opening (minutes) was 13.50±2.66 in group A and 12.73±3.00 in group B which was not statistically different as their p value was 0.30.(Figure 1)

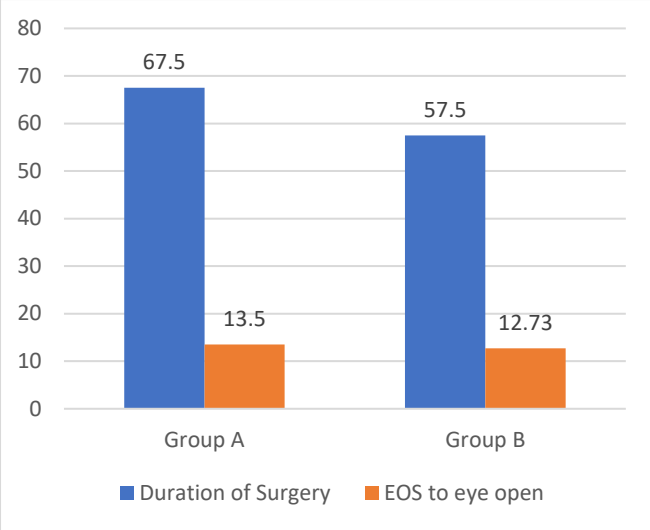

Figure 1: Mean duration

Hemodynamic response (HR, SBP, DBP) was compared between awake standard extubation and no touch extubation. There was no statistically significant difference in heart rate between these groups. SBP and DBP were significantly less ($p<0.05$) in "no touch" technique group in comparison to control group.

Table 2: Basline Hemodynamics (n=60)

Variables	Group A(n=30)	Group B (n=30)	P value
HR baseline	75.13±11.83	76.97±17.40	0.63
SBP baseline	129.53±17.84	118.87±15.90	0.01
DBP baseline	80.57±11.75	75.57±11.48	0.10

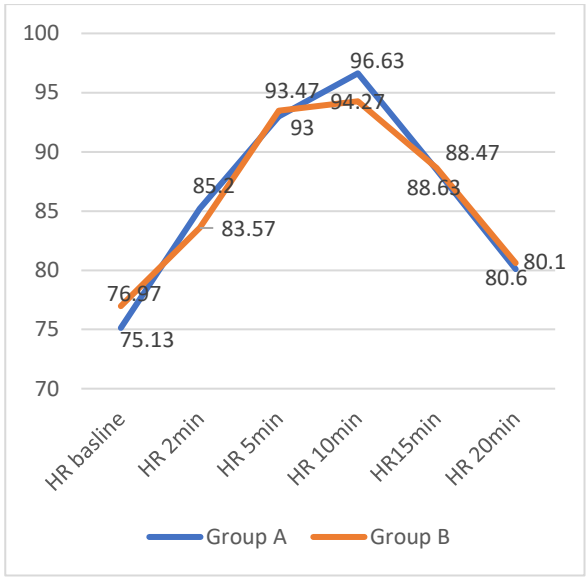

Figure 2: Changes in heart rate

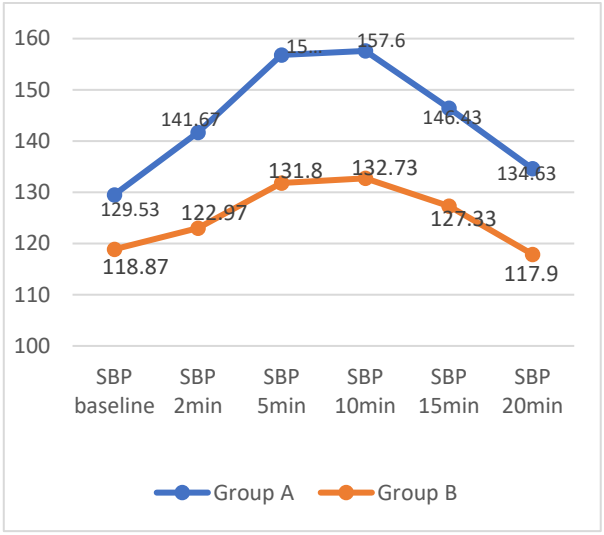

Figure 3: Changes in SBP

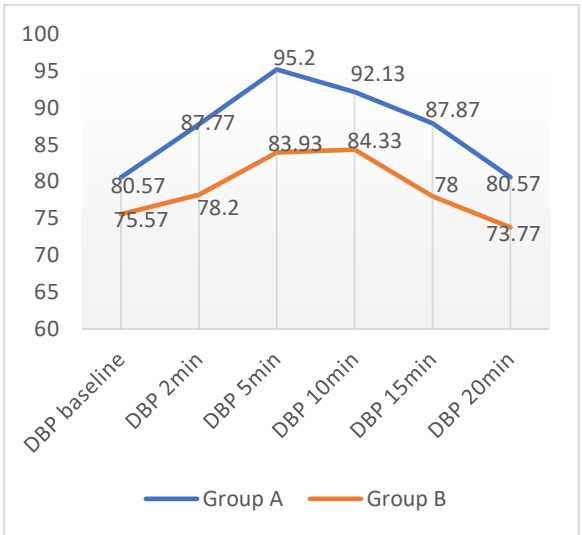

Figure 4: Changes in DBP

Table 3: Airway related Complications (n=60)

	Group A (n=30)	Group B (n=30)	P value
Coughing			0.39
Absent	19	23	
Present	11	7	
Laryngospasm	6	0	0.25
Grade I	5	2	0.06
Hoarseness			

Airway related complications are shown in Table 3. The severity of coughing was significantly lower in the “no touch “group. Among Group A patients,19(63%) had no cough, while 11 (37%) experienced coughing. In contrast, Group B had 23 (76%) patients with no cough and 7 (24%) with coughing. There were no cases of laryngospasm in the “no touch” extubation group, where as the standard awake extubation group had 6 cases (20%) of grade I laryngospasm. All laryngospasm cases were managed successfully with positive pressure ventilation and none required muscle relaxation and reintubation. The prevalence and severity of post-extubation hoarseness were significantly lower in the “no touch” group, with 5 cases (17%) compared to 2 cases (7%) in the standard extubation group. Although, group B had lower rates of airway complications, none of the differences reached statistical significance. ($p>0.05$)

DISCUSSION

Smooth emergence from general anesthesia is a crucial aspect of anesthetic management, as it plays a vital role in preventing hemodynamic fluctuations and airway-related complications. The incidence of coughing during emergence has been widely reported, ranging from 38% to 96% in the presence of a tracheal tube. [8] This significant occurrence of coughing can contribute to various airway related complications.

The cough reflex during emergence is primarily triggered by irritant receptors in the trachea, which respond to the presence of the endotracheal tube and its cuff. These receptors, when stimulated, activate sensory pathways leading to involuntary coughing.[9] One approach to mitigating this response is blocking these receptors, thereby inhibiting the cough reflex during extubation. This aligns with the principle of the "no touch" technique, which focuses on minimizing external stimulation that could provoke airway irritation and sympathetic nervous system activation.

To reduce excessive tracheal irritation, early deflation of the endotracheal tube cuff was performed before extubation. This technique allows for a more gradual withdrawal of the tube, preventing abrupt airway stimulation that could otherwise trigger coughing. Furthermore, unnecessary stimulation, including oropharyngeal suctioning, head turning, pillow removal, and bodily movements, was strictly avoided.[10,11] These measures were carefully

implemented to create a smooth and controlled emergence process, thereby minimizing the risk of adverse airway reactions. By adhering to these principles, the severity of emergence-related coughing was significantly reduced in patients who underwent extubation using the "no touch" technique.

Several studies have demonstrated that minimizing airway irritation during extubation can significantly reduce sympathetic stimulation. Our findings align with the study by Minogue et al., which reported that attenuation of airway stimulation resulted in reduced hypertension and tachycardia during extubation.[16] Similarly, the study by Tanaka et al. found that lidocaine application to the trachea before extubation significantly reduced hemodynamic fluctuations, suggesting that limiting tracheal irritation plays a crucial role in emergence stability.[17] Likewise, the “no touch” technique ,by eliminating excessive manipulation and airway stimulation, appears to achieve a similar effect without pharmacological intervention.

The "no touch" extubation technique demonstrated a significant advantage in attenuating hemodynamic responses during emergence. Hemodynamic fluctuations, particularly hypertension and tachycardia, are commonly observed during extubation due to sympathetic-adrenal activation and catecholamine release. These physiological changes can be problematic, especially in patients with cardiovascular comorbidities, as they may increase the risk of myocardial ischemia, arrhythmias, and other cardiovascular events. [13,14] Our findings indicate that the "no touch" technique was effective in maintaining stable heart rate (HR) and blood pressure (BP) during the emergence phase, highlighting its potential benefit in hemodynamic stability.

Postoperative sore throat was not significantly different between the "no touch" technique and the standard awake extubation group. This suggests that postoperative sore throat may not be solely related to the anesthetic technique but could also be influenced by patient factors and the type of surgical procedure. Other potential contributors include localized trauma from surgery, throat packing, and excessive oral suctioning.[12]

While deep extubation has been proposed as an alternative strategy to prevent straining and coughing, it carries inherent risks, including aspiration and airway obstruction. Deep extubation prolongs the time from tracheal extubation to the return of protective airway reflexes, increasing the potential for complications such as aspiration pneumonia. Furthermore, in the absence of intact airway reflexes, there is a heightened risk of soft tissue collapse, leading to airway obstruction and hypoxemia.[15] These concerns underscore the need for careful patient selection and vigilant monitoring when considering deep extubation as an alternative technique.

In contrast, the "no touch" extubation technique provides a safer alternative by achieving similar benefits—minimizing coughing and

hemodynamic instability—without the risks associated with deep extubation. In our study, there were no instances of vomiting, airway obstruction, or laryngospasm in the "no touch" extubation group. This finding further supports the safety and efficacy of this technique in ensuring a smooth and controlled emergence from anesthesia. By minimizing airway stimulation and maintaining physiological stability, the "no touch" approach offers an optimal balance between safety and efficacy in extubation practices.

Regarding recovery time, while the "no touch" technique is typically associated with a longer emergence time due to its more gradual approach to extubation, our study found that recovery durations were longer in standard awake than in “no touch” technique. This might be due to several factors, including the use of shorter-acting anesthetic agents, the nature of the laparoscopic surgeries, and the relatively healthy patient population studied. These factors could have contributed to a more rapid recovery despite the use of the "no touch" technique. In contrast to previous studies where the "no touch" technique led to a longer recovery time, our results suggest that surgical factors and anesthetic management might have played a role in normalizing the recovery times in both groups. Similarly study by sheta et al., found that awake ‘no touch’ technique for tracheal extubation produces less airway related complications as well as minimal hemodynamic response during emergence from general anesthesia which is similar to our study.[18].

Overall, our findings suggest that the "no touch" extubation technique is a valuable alternative to standard awake extubation, particularly in patients who may be at risk of hemodynamic instability or airway complications. This is a randomized study where our sample size is relatively small and findings may lack generalizability to broader patient population. Further studies with larger sample sizes and long-term follow-ups are needed to confirm these benefits and establish standardized protocols for its implementation in clinical anesthesia practice.

CONCLUSIONS

The findings of this study suggest that the awake "no touch" extubation technique leads to fewer airway-related complications and a more stable hemodynamic profile during emergence from general anesthesia. By minimizing airway stimulation, this method effectively reduces adverse responses such as coughing, hypertension, and tachycardia. Given its safety and efficacy, the "no touch" technique may serve as a viable alternative to conventional extubation strategies, particularly in patients at risk for hemodynamic instability or airway irritation.

CONFLICT OF INTEREST
None
SOURCES OF FUNDING
None

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