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Comparative evaluation of Bailey manoeuvre of deep extubation with conventional awake extubation technique - A randomized clinical study

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ABSTRACT

Background: Extubation is a critical procedure in anesthesia and critical care, often accompanied by complications, such as bucking, coughing, and hemodynamic instability, particularly after major surgeries. The Bailey manoeuvre, involving deep extubation with the i-gel laryngeal mask airway (LMA), may mitigate these issues. The study was planned to compare the hemodynamic effects and side effect profiles of conventional awake endotracheal extubation and exchange extubation with the i-gel LMA. **Aims and Objectives:** The study was designed to compare hemodynamic stress response and respiratory complication between the conventional extubation group and the following exchange extubation group. **Materials and Methods:** In a prospective, randomized, single-blinded controlled study, 60 patients undergoing surgery under general anesthesia were divided into two groups: Group T (awake extubation) and Group L (exchange extubation with the i-gel LMA). Hemodynamic parameters and side effects were recorded and analyzed. **Results:** Group L exhibited significantly lower heart rates, systolic and diastolic blood pressures, and mean arterial pressures at various time points post-extubation compared to Group T. The incidence of hypertension was significantly higher in Group T (90%) versus Group L (50%). Bucking and coughing less in the i-gel LMA exchange group compared to the standard endotracheal tube extubation group. **Conclusion:** Exchange extubation with the i-gel LMA offers better hemodynamic stability and a lower incidence of hypertension compared to conventional awake extubation. This technique may be particularly beneficial for high-risk patients and those undergoing complex surgeries.

Key words: Bailey manoeuvre; Hemodynamic stability; Laryngeal mask airway; Awake extubation; Deep extubation; and Anesthesia emergence

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INTRODUCTION

Extubation, the removal of an endotracheal tube (ETT), is a crucial procedure in general anesthesia and critical care medicine. While generally considered a safe process, extubation can sometimes present significant challenges and lead to unexpected, severe complications. Study has been shown that respiratory complications occur 3 times more frequently during endotracheal extubation compared to tracheal intubation or anesthesia induction, with reported rates of 12.6% versus 4.6%, respectively.[1] These potential complications can result in substantial morbidity and, in some cases, even mortality.[1]

Traditionally, following surgical procedures performed under general anesthesia, patients are extubated once they have fully regained consciousness. However, this conventional approach often leads to adverse events such as bucking, coughing, and sudden fluctuations in hemodynamic parameters. These responses can have

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serious consequences, particularly in the context of major head and neck surgeries and in cardiac patients. The bucking and coughing associated with extubation can cause a substantial increase in intrathoracic pressure, leading to venous congestion and an elevated risk of complications, such as hematoma formation or excessive bleeding.[2] In addition, the extubation process itself can generate aerosols, which heightens the potential for the transmission of infectious agents to healthcare personnel.[3]

Furthermore, performing an awake extubation with an ETT in place is associated with various potential complications, including bucking, coughing, bronchospasm, hypertension, tachycardia, myocardial ischemia, arrhythmias, and increased intracranial pressure.[4]

The process of emerging from general anesthesia and undergoing tracheal tube removal can subject patients to significant physiological and metabolic stress. These stress-induced changes can be detrimental, potentially exacerbating existing conditions or contributing to the development of post-operative complications. To mitigate these risks, it is crucial to employ strategies that minimize stress-related alterations during the emergence from anesthesia, especially for high-risk patients and those undergoing procedures with the potential for severe complications.[4]

Tracheal extubation has been linked to a temporary surge in both arterial pressure and heart rate (HR), typically ranging from 10 to 30%. This increase typically persists for 5–15 min, which can be a matter of significant concern, particularly for patients with cardiac issues or those undergoing neurosurgery.[4]

One alternative approach to traditional awake extubation involves performing deep extubation, in which an ETT is replaced with a laryngeal mask airway (LMA) while the patient is in a deep state of anesthesia. Subsequently, an awake extubation of the LMA is conducted. This technique has been demonstrated to reduce respiratory and hemodynamic complications associated with extubation. However, it is considered an advanced method that requires specialized training and expertise.[5]

The Bailey manoeuvre, also known as the Bailey technique or deep extubation, addresses these complications by performing extubation while patients are in a deep plane of anesthesia, allowing them to wake up comfortably with an LMA in place. This technique involves substituting an oral ETT with an LMA for extubation during deep anesthesia. By extubating under deep anesthesia, various adverse physiological responses, including hypertension, tachycardia, dysrhythmias, coughing, laryngospasm, bucking, myocardial ischemia, and elevated intraocular and intracranial pressure, can be effectively prevented.[6,7] The Bailey manoeuvre entails switching the tracheal tube to the i-gel LMA while the patient is in a deeper state of anesthesia and muscle relaxation. Later on, muscle relaxation is reversed, and the LMA is removed once the patient starts spontaneous breathing and responds to commands.[5,8-10] The Bailey technique offers a more favorable emergence profile compared to both awake and deep extubation methods. It proves especially beneficial in cases where there is a risk of surgical repair disruption due to hemodynamic instability caused by the presence of the tracheal tube.

Aims and objectives

To compare hemodynamic stress response and respiratory complication between bailey manoeuvre and conventional extubation technique.

MATERIALS AND METHODS

After obtaining approval from the ethical committee of the institute prospective, randomized, single-blinded controlled study conducted in the Department of Anesthesiology at G.R. Medical College and J.A. Group of Hospitals in Gwalior, India. The study duration was from April 2023 to April 2024.

Sample size estimation was done, considering hemodynamic parameters and the total sample size was 60, eligible patients were randomly allocated into two groups of 30 patients each using the sealed envelope method. Group T underwent conventional awake endotracheal extubation, while Group L underwent exchange extubation with the i-gel LMA.

Inclusion criteria

The study population included patients aged 18–60 years, weighing 30–80 kg, with ASA grade I or II, scheduled for surgery under general anesthesia.

Exclusion criteria

Patients with predicted difficult airway, acute respiratory tract infection, risk of aspiration (morbid obesity, diabetes mellitus, and gastroesophageal disease), known cases of chronic obstructive pulmonary disease, or undergoing oral cavity or throat surgery were excluded from the study. Pregnant and lactating women were also excluded.

A thorough pre-anesthetic checkup was done before surgery. Informed and written consent were taken. All patients were kept nil orally for at least 6 h before the procedure. Upon the arrival of the patient in the operation theatre, intravenous access with an 18 G cannula was inserted into the patient's forearm. On the day of surgery, routine monitors of pulse oximeter (SpO_2), non-invasive blood pressure capnography ($EtCO_2$) and electrocardiogram were attached, and patients received pre-medication with intravenous ranitidine (150 mg), metoclopramide (10–20 mg), glycopyrrolate. (005–0.01 mg/kg), midazolam (0.03 mg/kg), and pentazocine (0.5 mg/kg), following standard practice. After pre-oxygenation, anesthesia was induced with propofol (1.5–2 mg/kg) and succinylcholine (2 mg/kg), followed by tracheal intubation and check with 5-point auscultation and capnography was carried out. Mechanical ventilation was initiated with oxygen, nitrous oxide in a ratio of 33:67%, and isoflurane (MAC 0.6-1). Atracurium (0.1 mg/kg) was administered intermittently as a muscle relaxant.

In Group T, at the end of the surgery, neuromuscular blockade was reversed with neostigmine (0.05 mg/kg) and glycopyrrolate (0.008 mg/kg), and awake extubation was performed when the patient met specific criteria, as per standard protocols.

In Group L, after discontinuing nitrous oxide and suctioning the oropharyngeal cavity, the i-gel LMA was inserted with the ETT *in situ*, following the deep extubation technique. The ETT was then removed, and the i-gel was adjusted and connected to the breathing circuit. After confirming the position of the i-gel, isoflurane was discontinued, and the patient was ventilated with 100% oxygen until regaining consciousness. Neuromuscular blockade was then reversed, and the patient was monitored at various time intervals.

Hemodynamic parameters, including HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and SpO_2, were recorded at baseline, at the end of surgery, and at specific time points after extubation (E1, E2, E3, E5, E10, E15, and E30 min), as done in previous studies.[5,6]

The data were systematically collected, compiled, and statistically analyzed using IBM SPSS 26 software. Continuous data were presented as mean ± standard deviation, while categorical data were expressed as numbers and percentages, following standard statistical practices.[4] Appropriate statistical tests, such as the Chi-square test and independent sample t-test, were employed for data analysis. P=0.01–0.05 were considered significant, and P<0.001 were considered highly significant, as per standard conventions.[7,8]

RESULTS

The 60 patients included in the study were comparable between the groups with respect to demographic variables (age, sex, height, weight). Group T and Group L both have 30 patient in each group. Group T underwent conventional awake endotracheal extubation, while Group L underwent exchange extubation with the i-gel LMA.

Hemodynamic statistics

No cases of nausea, vomiting, headache, hypotension, bradycardia, or respiratory depression were reported in either group. The incidence of hypertension was significantly higher in Group T (90%) compared to Group L (50%) (P=0.002), indicating that patients undergoing conventional awake extubation were more likely to experience hypertension as a side effect. The incidence of shivering, tachycardia, and sedation did not differ significantly between the two groups.

DISCUSSION

In this prospective randomized study 60 patients, scheduled for elective surgery under general anesthesia, were studied for two extubation techniques: Group T-conventional awake endotracheal extubation and Group L-exchange extubation with the i-gel LMA (BAILEY MANOEUVRE) with respect to hemodynamic changes.

In this study, the demographic parameters (age, weight, and height distribution) were comparable among the study groups (P>0.05). In addition, the gender status in both the groups, were also comparable (P>0.05) (Table 1).

HR, SBP, DBP and mean arterial blood pressure were noted down as baseline before induction, at EOS, at 1, 2, 3, 5, 10, 15, and 30 min after extubation (Table 2).

Overall mean±SD HR, SBP, DBP, and MAP were not having significant difference between Group T and

Table 1: Demographic characteristics

Parameter	Group T (n=30) (Mean±SD)	Group L (n=30) (Mean±SD)	P-value
Age (years)	40.37±13.60	36.20±12.90	0.228
Height (cm)	157.97±6.83	159.43±6.16	0.386
Weight (kg)	60.37±7.05	62.73±10.33	0.304
Duration of anesthesia (min)	115.17±37.52	137.10±55.56	0.078

The above association found to be statistically insignificant (P>0.05)

Table 2: Displays the gender distribution of the study groups

Gender	Group T (n=30) (Mean±SD) (%)	Group L (n=30) (Mean±SD) (%)	P-value
Male	13 (43.3)	9 (30.0)	0.422
Female	17 (56.7)	21 (70.0)	

The above association found to be statistically insignificant (P>0.05)

Group L at baseline points and at the end of surgery (P>0.05) (Table 3).

After extubation, in Group L mean±SD HR was significantly decreased compared to Group T from E1 min to E30 min (P<0.05) such as at E5 mean±SD HR in Group L (83.93±12.583) were significant less than Group T mean±SD HR (93.80±13.947) beat per minute (Table 4).

After extubation, in Group L mean±SD SBP was highly significantly decreased as compared to Group T from E1 min to E30 min (P<0.001) such as at E15 mean±SD SBP in Group L (118.67±8.860) mmHg highly significant less compared to Group T mean±SD (130.60±13.307) mmHg (Tables 5).

Table 3: Comparison of baseline vitals between two groups

Baseline vitals	Groups	n	Mean	Standard deviation	P-value
Pulse rate (per minute)	Group T	30	84.50	10.408	0.631
	Group L	30	83.07	12.493	
SBP (mmHg)	Group T	30	125.90	11.532	0.445
	Group L	30	128.10	10.617	
DBP (mmHg)	Group T	30	82.83	9.32	0.710
	Group L	30	78.67	8.16	
MAP (mmHg)	Group T	30	96.80	10.775	0.273
	Group L	30	94.20	7.039	

The mean±SD of baseline vital there is no significant difference in HR SBP, DBP, and MAP baseline parameters (P>0.05). HR: Heart rate; SBP: Systolic blood pressure; DBP: Diastolic blood pressure, MAP: Mean arterial pressure

Table 4: Comparison of (mean±SD) heart rate at various intervals between two groups

Time (min)	Group T		Group L		P-value
	Mean	SD	Mean	SD	
E1	100.90	10.561	91.93	14.948	0.009*
E5	93.80	13.947	83.93	12.583	0.006*
E10	88.57	10.969	80.13	11.461	0.005*
E15	84.53	11.020	77.70	9.86	0.014*
E30	83.40	9.313	77.03	8.771	0.008*

E1: 1 min, E5: 5 min, E10: 10 min, E15: 15 min, E30: 30 min after Extubation; *There is a significant difference in heart rate between the two groups after extubation; 1–30 min (P<0.05), except at the end of surgery

Table 5: Comparison of (Mean±SD) SBP at various interval between two groups

Time (min)	Group T		Group L		P-value
	Mean	SD	Mean	SD	
E1	151.10	18.757	134.23	13.444	<0.0001*
E5	141.40	18.346	122.83	12.603	<0.0001*
E10	135.37	14.838	119.30	9.407	<0.0001*
E15	130.60	13.307	118.67	8.860	<0.0001*
E30	128.00	11.483	115.50	8.464	<0.0001*

E1: 1 min; E5: 5 min, E10: 10 min; E15: 15 min; E30: 30 min after extubation; *There is significant difference in SBP between two groups after extubation; 1–30 min (P<0.05), except at the end of surgery; SBP: Systolic blood pressure

Similarly, after extubation, in Group L mean±SD DBP was significantly decreased as compared to Group T from E1 min to E30 min (P<0.05) such as at E15 mean±SD DBP in Group L (74.87±7.811) mmHg significant less compared to Group T mean±SD (81.97±9.361) mmHg (Table 6).

After extubation, in Group L mean±SD MAP was significantly decreased as compared to Group T from E1 min to E30 min (P<0.05) such as at E5 mean±SD MAP in Group L (94.57±10.569) mmHg significant less compared to Group T mean±SD (104.83±13.084) mmHg (Table 7).

These findings are consistent with previous studies that have reported heightened hemodynamic stress and adverse physiological responses associated with awake extubation, such as hypertension, tachycardia, coughing, laryngospasm, and increased intracranial pressure.[1,4,6] The observed differences in hemodynamic parameters can be attributed to the advantages offered by the Bailey manoeuvre (exchange extubation with the i-gel LMA) (Table 8).

Table 6: Comparison of (Mean±SD) DBP at various interval between two groups

Time (min)	Group T		Group L		P-value
	Mean	SD	Mean	SD	
E1	94.97	13.957	86.3	9.855	0.007*
E5	87.13	12.142	79.03	10.094	0.007*
E10	83.13	12.042	76.53	9.978	0.024*
E15	81.97	9.361	74.87	7.811	0.002*
E30	78.77	8.508	73.03	6.835	0.006*

E1: 1 min; E5: 5 min; E10: 10 min; E15: 15 min; E30: 30 min after extubation; *There is significant difference in DBP between two groups after extubation; 1–30 min (P<0.05), except at the end of surgery; DBP: Diastolic blood pressure

Table 7: Comparison of (Mean±SD) MAP at various interval between two groups

Time (min)	Group T		Group L		P-value
	Mean	SD	Mean	SD	
E1	114.13	14.117	102.70	11.167	0.001*
E5	104.83	13.084	94.57	10.569	0.001*
E10	100.27	12.384	90.83	9.274	0.001*
E15	98.47	11.116	89.23	7.505	<0.0001*
E30	95.10	9.386	87.80	6.002	0.001*

E1: 1 min; E5: 5 min; E10: 10 min; E15: 15 min; E30: 30 min after extubation; *There is significant difference in heart rate between two groups after extubation; 1–30 min (P<0.05), except at the end of surgery; MAP: Mean arterial pressure

Table 8: Incidence of side effects

Side effect	Group T n (%)	Group L n (%)	P-value
Hypertension	27 (90)	15 (50)	0.002*
Tachycardia	17 (56.7)	11 (36.7)	0.195
Sedation	4 (13.3)	3 (10)	0.5

There is significant lower incidence of hypertension in Group L as compared to Group T (p value ≤0.05)

The Bailey technique involves extubating the patient while under deep anesthesia, allowing for a smoother transition to spontaneous breathing and minimizing the physiological stress associated with the extubation process.[7,8] By avoiding the stimuli of awake extubation, such as bucking, coughing, and laryngeal irritation, the exchange extubation technique with the i-gel LMA effectively prevents adverse hemodynamic responses.[5,9]

The observed hemodynamic stability with the exchange extubation technique is particularly beneficial in high-risk patients or those undergoing procedures with the potential for severe complications. Hypertension and tachycardia during extubation can be detrimental in patients with cardiac conditions, intracranial pathologies, or those at risk for post-operative bleeding.[1,4] By minimizing these hemodynamic disturbances, the Bailey manoeuvre may reduce the risk of adverse events and facilitate a smoother recovery process.

Regarding side effects, the incidence of hypertension was significantly higher in Group T (90%) compared to Group L (50%), further supporting the notion that conventional awake extubation is associated with a higher risk of hypertension.[5,6] This finding is clinically relevant, as hypertension during extubation can increase the risk of post-operative complications, particularly in patients with underlying cardiovascular or cerebrovascular diseases.[1,6] By maintaining a deeper plane of anesthesia and avoiding the stimuli associated with awake extubation, the Bailey manoeuvre effectively prevents the associated hypertensive response.[7-9]

It is important to note that the exchange extubation technique with the i-gel LMA is considered an advanced method that requires specialized training and expertise. Proper placement and positioning of the LMA are crucial for successful extubation and prevention of complications, such as airway obstruction or aspiration.[9,10] Therefore, the implementation of the Bailey manoeuvre should be accompanied by appropriate training and protocols to ensure patient safety and optimal outcomes.

Limitations of the study

However, the study was limited to a single center, and the sample size was relatively small. In addition, the study did not include patients with predicted difficult airways or those undergoing specific surgical procedures that may influence the choice of extubation technique.

CONCLUSION

Exchange extubation with the i-gel LMA (Bailey manoeuvre) resulted in better hemodynamic stability and a lower incidence of hypertension compared to conventional awake endotracheal extubation. The exchange extubation technique appears to offer a more favorable emergence profile, minimizing physiological stress and adverse hemodynamic responses. These findings support the use of the Bailey manoeuvre as a valuable alternative to conventional awake extubation, particularly in high-risk patients or those undergoing procedures with the potential for severe complications.

An increase in catecholamine level is a probable cause of hemodynamic response to extubation, which is minimal with LMA removal.[11,12]

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RT- Definition of intellectual content, literature survey, prepared first draft of manuscript, implementation of study protocol, data collection, manuscript preparation, and submission of the article; **SG**- Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **YM**- Literature survey and coordination and manuscript revision.

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