

Tracheal Intubation without the Use of Neuromuscular Blocking Agents in Adult Patients: A Prospective Study

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Abstract: ***Introduction:** Neuromuscular blocking agents (NMBAs) make tracheal intubation easier but can cause adverse effects. Propofol suppresses airway reflexes, and an opioid adds to this effect, so the combination may allow intubation without NMBAs. We evaluated intubating conditions and the haemodynamic response with a propofol–fentanyl technique in adults. **Methods:** In this prospective study at a tertiary teaching hospital, 100 adults (18–65 years, ASA physical status I–III, Mallampati I–II) having elective or emergency surgery under general anaesthesia induced with propofol 3 mg/kg, without NMBA. A single anaesthesiologist graded intubating conditions using Steyn's modification of the Helbo-Hansen score. Secondary outcomes were modified Cormack–Lehane grade, apnoea, laryngoscopy duration, and vitals. **Results:** Intubating conditions were clinically acceptable in 91 patients (91%) and not acceptable in 9 (9%). Apnea was achieved in all patients. No bradycardia, hypoxia, laryngospasm or bronchospasm occurred. **Conclusion:** In selected adults with Mallampati I–II airways, propofol 3 mg/kg after fentanyl 2 µg/kg gave clinically acceptable intubating conditions in 91% of patients without NMBAs. Haemodynamic changes were modest and no airway or cardiovascular complications were recorded. The technique may be useful when NMBAs are contraindicated or best avoided.*

Keywords: Intubation, General Anaesthesia, Propofol, Muscle Relaxant

1. Introduction

Before the early 20th century tracheal intubation was done for condition like oral tumor or any lesion of larynx, crudely with finger without any drugs. In 1909, ether introduced for intubation and anesthesia with large bore catheter. Tracheal intubation for general anaesthesia is advanced as inhalational agent, IV induction agents and neuromuscular blocking agents were introduced in anaesthesia. Use of succinylcholine - a depolarising neuromuscular blocking agent has disadvantage in patients with hyperkalemia, plasma cholinesterase deficiency, increased intracranial pressure, malignant hyperthermia, penetrating eye injury, burns, recent spinal cord injury and known allergic reactions. Though some of these adverse effects caused by succinylcholine could be avoided with the use of non - depolarizing muscle relaxants, still non depolarizing muscle relaxants could also be associated with adverse effects like prolonged paralysis or when there is an impossibility of reversing the neuromuscular blockade during CVCI (can't ventilate can't intubate) where the airway couldn't be managed with mask ventilation or tracheal intubation. Some neuromuscular disorders for example myasthenia gravis alter the clinical pharmacology of muscle relaxants and can cause alterations in the dosage, choice and reversal of the muscle relaxant.

Tracheal intubation with deep inhalational induction is done in children and in special conditions where neuromuscular blockers cannot be use⁽²⁾. This technique is also useful where neuromuscular blockade is not needed to facilitate surgical requirement like spine surgery, plastic or thyroid surgery where neuromuscular monitoring is needed. Previously intubation was tried with propofol alone but it give

cardiovascular response which can be dangerous in patients with cardiovascular disease, neurosurgery or eye surgery where increase in intracranial or ocular pressure is to be avoided.^{[3][4]} Pairing propofol with fentanyl or any opioid as premedication can help to blunt this response to aid intubation.^[5]

Upper airway reflexes were more depressed with propofol compared with thiopentone while performing laryngoscopy when given in an equipotent dose which is the reason for its use for facilitating laryngeal mask airway placement. Propofol was found to have better intubating conditions compared to thiopentone when combined with remifentanyl^{[5][6]}.

2. Aims

The primary aim of the study is to evaluate the intubating conditions and hemodynamic stability during intubation in patients not receiving the neuromuscular blocking agents in various elective and emergency surgeries conducted in Civil Hospital, Ahmedabad.

3. Material and Methodology

After obtaining institutional ethical committee clearance, a prospective single blinded study conducted in 100 ASA I-III patients after taking written informed consent in anaesthesia department, civil hospital Ahmedabad scheduled for elective or emergency surgery under general anaesthesia.

3.1 Inclusion Criteria

Age: 18 years to 65 years, ASA-PS grade I – III, Elective and emergency surgery undergoing general anaesthesia, Mallampati scores: I & II, Written informed consent by patient and patient's relative

3.2 Exclusion Criteria

Age < 18 years, Patient's refusal to give consent, Patients with difficult airway, Neuromuscular disorders, Cervical cord injuries, Severe cardiovascular, central nervous system, hepatic and renal disease, Patients with other co morbidities like hypertension, diabetes, ischemic heart disease, Patients with increased risk of regurgitation, Anticipated difficult airway, Reactive airway disease (COPD, Asthma), History of drug allergy to the study drugs

3.3 Materials

3.3.1 Drugs Used: Propofol, Fentanyl, Glycopyrrolate, Xylocard, Atropine, Ephedrine, Succinylcholine and Other Emergency Drugs

3.3.2 Monitors: ECG, NIBP, SPO₂, ETCO₂ 18G and 20G intravenous cannula, Disposable syringes, McIntosh laryngoscope, Endotracheal tubes of varying sizes, difficult intubation strategies like gum elastic bougie, guedel's oropharyngeal airway, etc.

3.3.3 Pre Operative Preparation:

All the patients were admitted and they underwent relevant investigations. Preoperatively informed, written consent was obtained from the Patients.

3.3.4 Anaesthesia Protocol

A thorough preanaesthetic evaluation was done and fitness was given for anaesthesia. All patients were made to fast as per norms and maintenance fluid was given during that period. In preoperative area consent was taken, baseline vitals was noted before taking patient inside Operation Theater.

3.3.5 Intraoperative Monitoring Used

Temperature, Non-invasive BP, Electrocardiogram, Pulse oximetry, ETCO₂

3.3.6 Premedication

Patients was premedicated with inj. glycopyrrolate 0.004 mg/kg iv, inj. ondansetron 0.15 mg/kg iv and inj. fentanyl 2 mcg/kg iv over 30 seconds, 5 mins before intubation. Baseline pulse rate and blood pressure were taken at 1 min after injection of glycopyrrolate.

3.3.7 Induction of Anaesthesia

Pre-oxygenation was done with 100% oxygen for 5 minutes via Bain's circuit. All patients received Inj. Propofol 3 mg/kg iv as induction agent Airways were managed by single Anaesthesiologist to avoid observer's variability. Ventilation was controlled by positive pressure mask ventilation after achieving apnea. Ventilation was made as uniform as possible with the help of capnography (35-45cm of H₂O).

3.3.8 Conduct of Study

Laryngoscopy was done 40 seconds after giving propofol and vocal cord appearance was classified by modified Cormack-lehane method. Ease of intubation was assessed by standard 1-4 Helbo-Hansen scoring system. If patients with clinically unacceptable score intubation was performed using muscle relaxant.

Oxygen saturation, HR and NIBP was measured 1 minute, 2 minutes and 5 minutes after intubation. The incidence of bradycardia (<30% of baseline), hypoxia (oxygen saturation of <80%), bronchospasm, laryngospasm, coughing and limb movements will be noted.

Table 1: Helbo-Hansen scoring system

Points	1	2	3	4
Laryngoscopy	Easy	Fair	Difficult	Impossible
Vocal cords	Open	Moving	Closing	Closed
Coughing	None	Slight	Moderate	Severe
Jaw relaxation	Complete	Slight	Stiff	Rigid
Limb movement	None Moderate (jerky)	Slight		Sever

Interpretation–

Total score <10 clinically acceptable intubation score

>10 Unacceptable/poor intubation condition

PRIMARY OUTCOME MEASURES: Intubating conditions

SECONDARY OUTCOME MEASURES: Cormack Lehane grading, Apnea after induction, Duration of laryngoscopy, Heart rate, Systolic blood pressure, Diastolic blood pressure, Mean arterial pressure

All these parameters were measured at Pre induction, Post induction, Post intubation, 1 minute, 2 minute and 5 minute after intubation

4. Observation and Result

Total 100 patients were selected. Intubation was done without neuromuscular blocking agents and different parameters like intubating conditions, Cormack-lehane grading, duration of laryngoscopy and hemodynamic stability were observed.

Table 2: Demographic Details

Age (yrs) (Mean ± SD)	35.75 ± 12.80
Sex (Male/Female)	71/29
Weight (kg) (Mean ± SD)	68.2 ± 8.7
Height (cm) (Mean ± SD)	166.47 ± 5.51
BMI (kg/m ²) (Mean ± SD)	24.59 ± 2.86

Table 3: List of surgical procedure

S. No	Surgery	Numbers
1	Neurosurgical procedures	14
2	Plastic surgeries	23
3	Orthopaedic surgery	30
4	Exploratory laparotomy	7
5	Laparoscopic cholecystectomy	9
6	Feeding jejunostomy	1
7	UL or LL debridement	6
8	Other surgery cases	10

Duration of Laryngoscopy (Seconds)

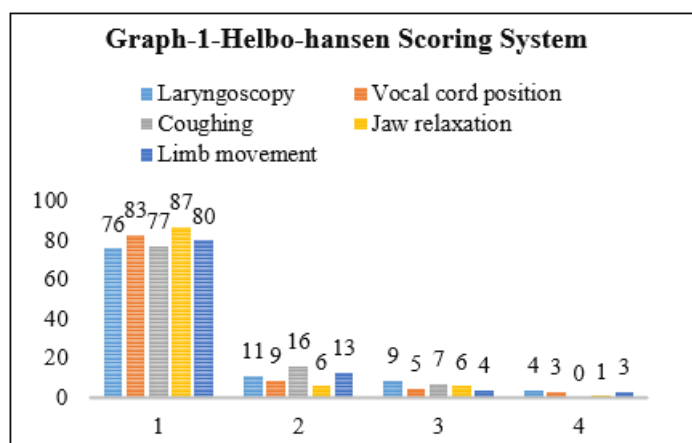
Duration of laryngoscopy is defined as time from start of laryngoscopy to successful tracheal intubation and removal of

laryngoscopy blade from mouth.

Minimum duration-11, Maximum Duration- 22

All 100 patients achieved apnea after giving propofol.

Mean $\pm$ Standard deviation-14.43 $\pm$ 2.15



Overall Intubating Condition

Clinically acceptable- 91%

Clinically not acceptable-09%

Modified Cormack Lehane Grading

Grade1-81%, Grade2-15%, Grade3-4%

Table 4: Hemodynamic parameters

Time	Heart Rate (per minute)	Systolic BP (mmHg)	Diastolic BP (mmHg)	Mean Arterial BP
Pre induction	84.76 $\pm$ 8.94	123.31 $\pm$.03	77.23 $\pm$ 7.92	92.59 $\pm$ 7.74
Post induction	82.58 $\pm$ 8.78	109.05 $\pm$ 8.27	69.96 $\pm$ 6.45	82.99 $\pm$ 6.42
After intubation	88.47 $\pm$ 7.87	116.09 $\pm$ 8.50	73.44 $\pm$ 6.51	87.66 $\pm$ 6.75
1 min after intubation	87.09 $\pm$ 8.42	115.28 $\pm$ 8.27	72.62 $\pm$ 6.31	86.84 $\pm$ 6.26
2 min after intubation	86.03 $\pm$ 8.87	114.73 $\pm$ 7.44	72.03 $\pm$ 5.69	86.26 $\pm$ 5.77
5 min after intubation	83.40 $\pm$ 8.75	112.26 $\pm$ 7.85	69.69 $\pm$ 4.66	83.88 $\pm$ 5.00

5. Discussion

100 patients aged 18-65 year posted for elective and emergency surgeries were taken for study in which we have performed endotracheal intubation without use of neuromuscular blocking agents in both expected and unanticipated difficult intubation where muscle relaxants are either contraindicated or not required.

DEMOGRAPHIC PROFILE -The mean and standard deviation of age, weight, height and BMI are derived as 35.75 $\pm$ 12.80, 68.2 $\pm$ 8.7, 166.47 $\pm$ 5.51 and 24.59 $\pm$ 2.86.

MODIFIED CORMACK LEHANE LARYNGOSCOPY GRADING -81% has CL grade 1, 15% has CL grade 2 and 4% had CL grade 3.

Maximum laryngoscopy duration was 22 seconds and minimum 11 seconds. Mean duration was 14.22 seconds. Laryngoscopy was easy in 76% of patients, 9% difficult and 4% had impossible laryngoscopy. *Prakash et al.* [17] study showed laryngoscopy was easy in all patients in the M group but difficult in 2 out of 40 patients in L group. *Lewis et al.* [1] (1948) also showed in his study that there was difficulty in performing laryngoscopy in 6 patients. He used thiopental sodium as the induction agent and did tracheal intubation without using neuromuscular blocking agents.

Vocal cords are opened in 83% of patients and closed in 3% of the patients. *Prakash et al.* [17] study showed 5 patients in L group had closed vocal cords and so these patients required non- depolarising muscle relaxants for intubation.

In our study, 7% of patients had sustained coughing (>10 sec) on intubation. *Davidson et al.* [18] (1993) studied tracheal intubation with propofol, alfentanil and with or without intravenous lignocaine. His study showed better cough suppressant effect in lignocaine. *Poulton et al.* [19] (1979) study showed equal cough suppressant effect in lidocaine compared to bronchodilators. Jaw relaxation was complete in 87% of patients, rigid in 1% of patients requiring non-depolarising muscle relaxants or advanced intubating techniques. In our study, 3% of patients had severe limb movements which are clinically not acceptable. *Barker et al.* [29] (1992) study showed lower incidence of laryngospasm and vocal cord movements following propofol induction compared to thiopentone induction, and is due to greater depression of laryngeal reflexes by propofol.

The induction with propofol is quick and smooth, with rapid awakening during recovery [40]. With the adjuvant of short acting opioids, their use in combination with propofol for tracheal intubation without neuromuscular blocking agents has been well documented [15] [41]-[43]. Numerous studies have stressed the advantages of propofol, such as a low cumulative

effect which offers fast recovery of consciousness after surgery, an antiemetic effect, a diminished pressor response to laryngoscopy and tracheal intubation, and a lower incidence of airway complications, in adults and pediatric patients.

Various scoring system for assessing intubating conditions have been used in the past. Scoring systems of Alcock et al.^[10], Saarnivaara and Klemola^[15], Scheller et al.^[9] have considered only local factors such as jaw relaxation, cord movement, ease of mask ventilation, coughing, etc. however, we used the scoring system of Helbo-Hansen with Steyn modification^[12], which included both local as well as distal factors, limb movements for better assessment. This scoring system has also been used earlier by Blair et al.^[11] and Robinson et al.^[13] for assessing intubating conditions with propofol and remifentanyl or alfentanil.

In our study, we observed that 91% of patients had clinically acceptable intubating conditions, whereas the remaining 9% had clinically not acceptable intubating conditions. *Prakash et al.*^[17] study showed better intubating conditions in midazolam group compared to lignocaine group. *Keaveny et al.*^[33] (1988) in his study used propofol 3 mg/kg and showed better intubating conditions. *Grant et al.*^[10] (1998) study showed better intubating conditions with propofol 2 mg/kg and pre-treatment with remifentanyl 2 µg/kg. This dose was equal to 4 µg/kg of fentanyl. The most effective time of injection of fentanyl to attenuate the hemodynamic response to laryngoscopy and intubation had been found to be 5 mins after its administration because of its peak effect. Hence we administered fentanyl 5 mins before induction. *Laubie et al.*^[27] demonstrated that the action of fentanyl is on the solitary nuclei and the nuclei of glossopharyngeal and vagus nerve. *Muzi et al.*^[21] suggested that the time of induction was significantly shorter in patients who were premedicated with fentanyl of midazolam administered intravenously 5 minutes before induction shortened the time to achieve optimal intubating condition in adults.

In our study consistent fall in MAP was seen post induction, increased during intubation after which gradual fall was seen. But MAP was maintained above 70mmHg. Post induction HR increased due to pressure response. *Klemola et al.*^[35] found a 12% fall in MAP and 8% fall in HR with a dose combination of 4 mcg/kg remifentanyl and 305 mg/kg propofol, while *de Fathima et al.*^[15] did not find any significant changes in hemodynamics. This fall in BP may not be acceptable in cardiac patients. Decrease in HR and MAP after fentanyl and propofol is due to synergistic action of the two drugs. Fentanyl blunts hemodynamic responses to laryngoscopy and intubation and propofol decreases sympathetic nervous activity^[6] Also baroreceptor reflex control of HR may be depressed by propofol^[21]. Topical laryngeal spraying with lignocaine as suggested by Abouleish et al.^[22] can be used to blunt intubation response.

In our study we have not encountered any complications like bradycardia, hypoxia, masseter spasm, generalised rigidity, laryngospasm or bronchospasm as compare to thiopentone in study by Lewis et al.^[1]

6. Summary

After taking thorough history and pre-operative assessment and informed consent, 100 patients who were satisfying the inclusion criteria were enrolled into the study. All were intubated using propofol – fentanyl combination without the neuromuscular blocking agents and the intubating conditions were assessed using Steyn's modification of Helbo-Hansen scoring system. 91% of patients had better intubating conditions, whereas the remaining 9% had clinically not acceptable intubating conditions. Maximum laryngoscopy duration was 22 sec and minimum laryngoscopy duration was 11 sec. Mean laryngoscopy duration was 14.22 sec. Cormack lehane grading were assessed for all patients. 81% has CL grade 1, 15% has CL grade 2 and 4% had CL grade 3. All the patients had pronounced apnea after induction and hemodynamic parameters like pulse rate, blood pressure and spo2 were stable. No complications and adverse events were noted in any patients.

7. Conclusion

I conclude that the propofol-fentanyl combination provides clinically acceptable conditions for intubation without significant cardiovascular changes without the use of neuromuscular blocking agents. Hence this combination can be a useful alternative technique for tracheal intubation when neuromuscular blocking drugs are contraindicated or need to be avoided.

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