Original Article

Transtracheal lidocaine: An alternative to intraoperative propofol infusion when muscle relaxants are not used

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Abstract

Background: Facial nerve monitoring, often required during total parotidectomy, precludes use of long acting muscle relaxants and propofol infusion is used solely to ensure patient immobility. We aimed to compare intraoperative patient immobility, hemodynamic stability and propofol consumption during total parotidectomy following a transtracheal block.

Material and Methods: Forty patients were allocated to 2 equal groups. Preoperatively, group A patients received transtracheal block with 4 ml of 4% lidocaine, while no block was given to patients in group B. If there was patient movement, tachycardia or hypertension, group A patients received a bolus of propofol 30 mg and propofol infusion was started (100mg/hr). In group B, propofol infusion was started (100mg/hr) soon after intubation.

Result: Both group A and B were comparable with respect to patient immobility and hemodynamic stability. There was no intraoperative propofol requirement in group A.

Conclusion: Transtracheal block is a safe and successful alternative to propofol infusion during surgeries where muscle relaxants are to be avoided.

Key words: Nerve stimulation, parotidectomy, patient immobility, propofol infusion, transtracheal block

Introduction

Parotidectomy with preservation of facial nerve function is the standard treatment for tumors of the parotid gland. Despite efforts by surgeons, postoperative facial nerve paresis and paralysis are the most frequent early complication of parotid gland surgery.[1] Intraoperative identification of facial nerve and its branches using direct nerve stimulation techniques considerably reduces this complication.[2]

Usually, frequent nerve stimulation is required intraoperatively to identify nerve branches and to check their integrity. As muscle relaxants interfere with neuromuscular monitoring,[3] the common practice of general anesthesia (GA) with endotracheal intubation and controlled ventilation with muscle relaxants may not be applicable in patients scheduled for total parotidectomy. Hence, long acting muscle relaxants are generally avoided and intraoperative propofol infusion is administered to ensure patient immobility.

The aim of the present study was to compare the patient immobility, intraoperative hemodynamic stability, and intraoperative propofol consumption during total parotidectomy under GA, without use of nondepolarizing muscle relaxants, following a transtracheal block.

Materials and Methods

This observational study was conducted on 40 consecutive adult patients of American Society of Anesthesiologists (ASA) grade I and II who underwent total parotidectomy under GA between January 2007 and December 2011, after obtaining hospital ethical committee approval and informed consent from patients. As there were no previous similar studies, a pilot study with 20 patients was carried out and mean values of variables determined. From that data, with 95% confidence and 80% power, the minimum sample size was calculated to be 20 in each group.

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GA was induced and maintained in all the patients following a standardized protocol. All patients received glycopyrrolate 0.2 mg, midazolam 2 mg, and morphine 0.2 mg/kg body weight intravenously. Group A patients received a transtracheal injection of 4 ml of 4% lidocaine just before induction of anesthesia, whereas Group B patients did not receive the block. Transtracheal block was performed at the level of the cricothyroid membrane with the neck in extension. Skin over cricothyroid membrane was anesthetized by raising a small skin wheel. A syringe of 10 ml with a 22 gauge needle was advanced till air was aspirated into 4 ml of local anesthetic and the drug was injected rapidly.

Anesthesia was induced with propofol 2.5 mg/kg and intubation of trachea was facilitated with suxamethonium 2 mg/kg intravenously. Endotracheal intubation was performed with 7.5-8 mm internal diameter endotracheal tube. A bite block was inserted to prevent biting of endotracheal tube in case the patient became light intraoperatively.

Anesthesia was maintained with oxygen 33%, nitrous oxide 66%, and an end tidal isoflurane concentration of 1% with mechanical ventilation to maintain end tidal carbon dioxide levels between 30 and 35 mmHg. Intraoperative monitoring using Spacelabs Healthcare Ultraview SL included automatic noninvasive blood pressure monitoring, pulse oximetry, continuous electrocardiogram, respiratory gas monitoring, and temperature monitoring.

The signs considered intraoperatively as indicative of inadequate depth of anesthesia were:

Tachycardia (heart rate (HR) >100/min); hypertension (systolic blood pressure >140 mm of Hg); or patient movements and/or bucking on endotracheal tube.

In group A, if any patient manifested inadequate depth, plane of anesthesia was deepened with a bolus of propofol 30 mg intravenously (IV) and an infusion of propofol was started at a rate of 100 mg/h. In group B an intravenous infusion of propofol was started at a rate of 100 mg/h after intubation, and if there were signs of inadequate depth of anesthesia a bolus of propofol 30 mg IV was given. Propofol bolus of 30 mg IV was repeated in both groups, if required in addition to infusion.

Number of patient's movements, if any, and propofol consumption during surgery were documented. HR and systolic, diastolic, and mean arterial blood pressures were also documented at preinduction, 5, 10, 15, 30, 45, 60, 90, and 120 min after induction of anesthesia.

Intraoperative propofol consumption was analyzed using either independent sample *t*-test (normal sample) or Wilcoxon Mann-Whitney test (non-normal sample). Whereas, number of patient movements were analyzed with Pearson chi-square test or Fisher's exact test. Hemodynamic parameters were analyzed using nonparametric test (Mann-Whitney test) to elucidate the *Z*-value and *P*-values, with level of significance being $P < 0.05$.

Results

Observations and statistical analysis

Distribution of patients in both groups was similar with respect to age, sex, weight, ASA physical status, and duration of surgery [Tables 1 and 2].

All patients in both groups remained immobile intraoperatively. No patient in group A required intraoperative bolus or infusion of propofol. All patients in group B had been receiving propofol infusion, but none required additional propofol bolus intraoperatively. The preinduction HR was comparable in both groups. When the difference in mean of the preinduction value of HR to mean values of HR at 5, 10, 15, 30, 45, 60, 90, and 120 min were compared between groups, it was found that there was no statistical difference between the groups ($P > 0.05$) [Table 3, Figure 1].

Similar results were obtained when mean arterial pressure (MAP) was compared between the groups. There was no

Table 1: Comparison of age, weight, and duration of surgery among groups

Variables	Groups	Mean	SD	*P*-value
Age in years	Group A	43.8	14.280	0.207
	Group B	47.93	10.488	
Weight in kg	Group A	63.17	5.826	0.566
	Group B	64.07	6.247	
Duration of surgery in min	Group A	156.8	22.2	0.311
	Group B	163.2	25.2	

SD = Standard deviation

Table 2: Comparison of gender and ASA physical status distribution

Variables	Groups		Number	*P*-value
Gender distribution	Group A	Male	11	1.00
		Female	9	
	Group B	Male	12	
		Female	8	
ASA physical status distribution	Group A	ASA I	8	1.00
		ASA II	12	
	Group B	ASA I	9	
		ASA II	11	

SD = Standard deviation, ASA = American society of anesthesiologists statistical difference between the groups ($P > 0.05$) with respect to MAP at preinduction and 5, 10, 15, 30, 45, 60, 90, and 120 min [Table 4, Figure 2].

Discussion

Maintaining GA without muscle relaxants requires deeper planes of anesthesia in order to ensure patient immobility during surgery. Deeper planes can be achieved either with higher inspired concentration of volatile anesthetics or by additional doses of induction agents like propofol; but this adds to the cost of surgery. When the minimum alveolar concentration (MAC) of various volatile agents are compared, it is evident that MAC for intubation is always higher than MAC for incision for all the volatile anesthetic agents.[4] This implies that stimulus from trachea due to presence of endotracheal tube is more intense than even the surgical stimulus.[5]

The larynx and trachea can be anesthetized by many methods. The transtracheal block produces topical anesthesia secondary to direct contact of local anesthetic with mucosa. As the patient coughs during the injection there occurs an extensive spread of local anesthetic and the sensory input from laryngeal and tracheal

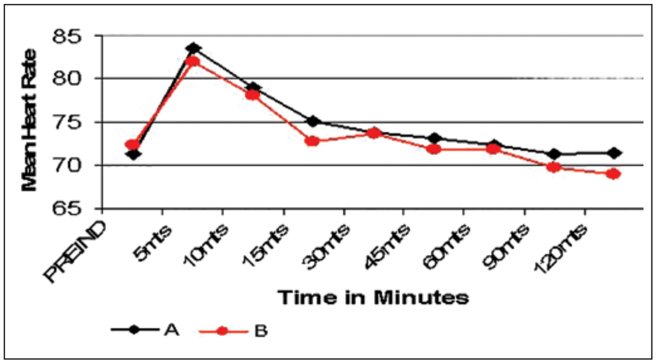

Figure 1: Trends in Mean Heart rate (HR) over time

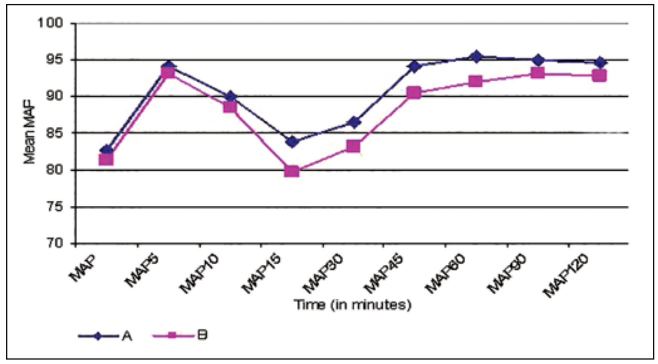

Figure 2: Trends in Mean arterial pressure (MAP) over time

Table 3: Mean and standard deviation (SD) of difference between preinduction heart rate (HR) value and HR values at various time intervals

Time (min)	Group A		Group B		*Z*-value	*P*-value
Preinduction HR	71.3 (mean)	7.3 (SD)	72.4 (mean)	10.0 (SD)	–0.068	0.946
Time (min)	Difference of mean HR from preinduction value	SD	Difference of mean HR from preinduction value	SD		
5	–12.4	4.5	–9.7	5.0	–1.955	0.051
10	–7.8	7.1	–5.7	9.9	–0.434	0.664
15	–3.8	11.7	–0.4	12.0	–0.961	0.336
30	–2.5	11.4	–1.3	10.6	–0.651	0.515
45	–1.8	7.3	0.6	14.3	–0.041	0.968
60	–1.1	8.8	0.5	9.7	–0.380	0.704
90	0.0	0.0	2.6	10.8	–0.292	0.770
120	–0.2	8.1	3.4	15.1	–0.555	0.579

Table 4: Mean and SD of difference between preinduction MAP value and MAP values at various time intervals

Time (min)	Group A		Group B		*Z*-value	*P*-value
Preinduction MAP	82.8 (mean)	6.9 (SD)	81.3 (mean)	7.4 (SD)	–0.636	0.525
Time (min)	Difference of mean MAP from preinduction value	SD	Difference of mean MAP from preinduction value	SD		
5	–11.5	7.7	–11.9	8.7	–0.041	0.968
10	–7.2	4.6	–7.2	5.2	–0.108	0.914
15	–1.1	10.8	1.6	12.4	–0.582	0.561
30	–3.7	9.5	–1.9	11.9	–0.447	0.655
45	–11.4	7.2	–9.3	7.2	–1.069	0.285
60	–12.7	7.9	–10.7	7.7	–1.111	0.267
90	–12.3	7.6	–11.9	7.1	–0.149	0.882
120	–12.0	6.3	–11.6	7.4	–0.054	0.957

mucosa, due to presence of endotracheal tube, is blocked. Hence, it presumably should lead to a reduction in requirement of anesthesia to maintain adequate depth during the intraoperative period, as MAC incision is always less than MAC intubation.[4]

A transtracheal block, which anesthetizes the trachea below the area of the vocal cords, is commonly practiced and has many applications. It aids awake intubations[6] and is frequently used during bronchoscopy in awake patients.[7-11] If performed immediately prior to induction of GA, a transtracheal block reduces stress response during laryngoscopy and intubation.[12]

Various other techniques have also been used to block the recurrent laryngeal nerve. Local anesthetic sprayed into vocal cords and larynx following direct laryngoscopy in an awake patient after topical oropharyngeal anesthesia is another option. But gagging and inability to deposit drug into larynx and trachea makes this a less satisfactory alternative. Spraying cords and larynx after induction of GA is not effective, as cough reflex is abolished and spread of the drug will be impaired. The density of anesthesia achieved is highly variable throughout the airway, following nebulization of lidocaine 2-4% for 15-30 min. Most effective alternative to transtracheal block is spraying local anesthetic through injection port of a fiberoptic bronchoscope.[13]

Major drawback of transtracheal block is coughing and patient discomfort as it is an invasive technique and has to be given before induction of anesthesia.[6] A rapid injection reduces risk of needle induced trauma while coughing. Another disadvantage is that airway reflexes will take time to return. Early extubation following a short surgical procedure in a patient who has received transtracheal block carries the risk of aspiration in the event of regurgitation. But this can be easily overcome by delaying extubation till protective airway reflexes return. There is no need for postoperative ventilation as such; since oxygen supplementation with a T piece with the patient breathing spontaneously will be more than sufficient, as the patient will tolerate the endotracheal tube due to absence of airway reflexes. The transtracheal block cannot be performed in patients with swelling in front of neck , local infection and is technically difficult in post burn contracture of neck.

In the present study a bolus of propofol was used to deepen the plane of anesthesia, as it has a quicker onset of action which helped in quick control of any patient movement during microsurgery. Increasing concentration of inhalation agent would take time to attain a deeper plane as compared to IV injection.

Transtracheal injection of lidocaine was found to be an effective alternative to propofol infusion in our study, especially when long acting muscle relaxants needed to be avoided. This technique can also be extrapolated to other surgeries where neuromuscular monitoring is needed, like in post brachial plexus injury patients undergoing nerve anastomosis. One of the weaknesses of this study is that there is a possibility that the study may be underpowered to elicit a significant difference between the two techniques.

It is concluded that patient immobility and intraoperative hemodynamic stability during total parotidectomy under GA, with transtracheal block or intraoperative propofol infusion, are comparable. Hence, we recommend transtracheal block as a less expensive, safe, and successful alternative to propofol infusion during surgeries where muscle relaxants are to be avoided.

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