Nebulisation Versus Spray-as-You-Go Airway Topical Anaesthesia in Patients with Temporomandibular Joint Ankylosis using 2 % Lignocaine

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Abstract

Study Design This randomized, comparative clinical study was designed to compare 2 % lignocaine nebulization and 2 % lignocaine via spray-as-you-go technique for topical airway anaesthesia during or awake flexible fiberoptic intubation (AFOI) in temporomandibular joint (TMJ) ankylosis patients.

Methods Sixty adult patients with TMJ ankylosis were randomly assigned to the following study groups using a computer generated random number table 2 % lignocaine nebulised (group A) and 2 % lignocaine via spray-as-you-go technique (group B). After airway anaesthesia, awake flexible fiberoptic nasotracheal intubation was performed. An independent investigator who did not participate in the study scored patients' comfort during airway topical anaesthesia and patients' reaction during awake FOI. Changes in haemodynamics during the airway manipulation were also observed.

Results There were no statistically significant differences in the observed variables between the two groups.

Conclusions Both 2 % lignocaine nebulization and 2 % lignocaine spray-as-you-go technique provided acceptable conditions for AFOI in TMJ patients.

Keywords Nebulisation · Spray-as-you-go · Airway topical anaesthesia · Awake fiberoptic intubation (AFOI)

Introduction

Temporomandibular joint interpositional gap arthroplasty is done under general anaesthesia with nasotracheal intubation. General anaesthesia and nasotracheal intubation are the main problems of surgery in TMJ ankylosis because it is difficult to intubate the patient of TMJ ankylosis as the laryngeal inlet is not visible [1, 2]. Awake intubation is the technique most commonly chosen in patients with a difficult airway [3] but gag reflex, cough, and laryngospasm can be upsetting during the process [4]. Awake patients never permit airway instrumentation without airway anaesthesia. Therefore, effective airway anaesthesia is required for airway instrumentation and patient comfort [5]. Topical airway anaesthesia can be provided in two ways. Number one by nebulizing the patient with 2 % lignocaine via ultrasonic nebuliser for about 10–15 min and number two by using fiberoptic bronchoscope (FOB) to apply local anaesthetics to the airway by a “spray-as-you-go” technique. Both of these methods can aptly anaesthetise the airway, and are suitable for awake intubation. Adequate topical airway anaesthesia generally governs the easiness and comfort of awake fiberoptic intubation [5, 6]. Two and 4 % solutions of lignocaine are commonly selected for the airway topical anaesthesia during nebulisation and spray-as-you-go technique for awake fiberoptic intubation [7–10].

This randomized, double-blind, comparative clinical study was designed to determine whether there were clinically relevant differences in the efficacy of airway topical anaesthesia between 2 % lignocaine via nebulization and 2 % lignocaine via spray-as-you-go technique in patients with TMJ ankylosis.

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Methods

An informed consent was taken from all the patients. Only cooperative patients from 18 to 40 years of age belonging to ASA class I–II of either sex undergoing TMJ ankylosis surgery were chosen for the study.

Obstinate patients, patients with any cardiac and/or respiratory disease, reactive airway disease, hepatic or renal disorders, a history of drug abuse and patients allergic to local anaesthetic agents were excluded from the study. Patients were also excluded if they refused for the consent.

Patient demographic characteristics such as age, gender, weight, and height were noted. All patients underwent a full pre anaesthetic evaluation. Patients were randomly assigned to the following study groups using a computer generated random number table, 2 % lignocaine nebulised group (group A) and 2 % lignocaine via spray-as-you-go technique group (group B).

All patients were deliberated about the nature of their difficult airway and management thereof. Patients were advised regarding the procedure during the preoperative evaluation and an informed consent was taken.

All subjects were fasted for 10 h and no sedative pre-medication was given a night before the surgery. In the operating room preparations were made for emergency access to the airway. Intravenous line established and lactated ringer infusion started. Standard monitoring with non-invasive blood pressure (NIBP), electrocardiography and pulse oximetry was done. All subjects received injection glycopyrrolate 0.004 mg/kg body weight and injection ondansetron 0.08 mg/kg body weight intravenously before starting the study. Nasal mucosa of both nostrils of all patients was prepared with a vasoconstrictor (0.1 % xylo-metazoline) two drops through each nostril 15 min before start of the study.

Then group A patients received topical anaesthesia with 10 ml of 2 % lignocaine via ultrasonic nebuliser for about 10–15 min followed by midazolam 0.05 mg/kg and fentanyl 2 µg/kg intravenously just before the procedure.

With the patient lying in the supine position, the fiberoptic bronchoscope was checked for illumination and the more patent nostril was chosen for intubation, the other nostril was used for oxygen insufflation (2–3 L/min). Nasal fiberoptic intubation was done with suitable sized cuffed flexible spiral tube. After orientation and localization of the laryngoepiglottic region, the fibroscope was introduced through the glottic opening entering the trachea visualising the tracheal rings and the carina and then the endotracheal tube railroaded through the fibroscope into the trachea.

After successful passage of the tube through the vocal cords and after identification of the carina, position of the tube was reconfirmed by mainstream capnograph, then tube was secured and the cuff inflated. Propofol 2 mg/kg IV and

rocuronium bromide 0.9 mg/kg were used to induce general anaesthesia and establish mechanical ventilation.

In all group B patients, the nasal cavity and nasopharynx was anaesthetized with 5 nasal sprays using 10 % lignocaine, each spray delivered 0.1 mL (10 mg) lignocaine, followed by midazolam 0.05 mg/kg and fentanyl 2 µg/kg given intravenously just before the procedure (Table 1).

After the desired level of sedation was achieved, lignocaine gelly lubricated FOB was inserted through the more patent nostril into the nasopharynx and its tip was first positioned at the vallecula and then in the vicinity of the piriform fossa. Three milliliters of the 2 % lignocaine were slowly sprayed in 3 parts of 2 mL onto these supra-glottic areas and the FOB was then removed. After another 10 min waiting period, the FOB was reinserted to expose the glottis and 1 mL of the study drug was sprayed into the laryngeal area. This procedure was repeated at 5 min intervals until adequate anaesthesia of the vocal cords was achieved. The FOB was then taken into the trachea and its tip was positioned below the vocal cords. During inspiration, 3 mL of the study drug was sprayed into the trachea.

Five minutes after endotracheal spray, the fibroscope was reintroduced through the most patent nostril, glottic opening visualised and the the fibroscope was advanced into the trachea. The tracheal rings were identified and then the endotracheal tube railroaded through the fibroscope into the trachea. After successful passage of the tube through the vocal cords and after identification of the carina, position of the tube was reconfirmed by mainstream capnograph, then tube was secured and the cuff inflated. Propofol 2 mg/kg IV and rocuronium bromide 0.9 mg/kg were used to induce general anaesthesia and establish mechanical ventilation.

Patient comfort was assessed by modified Ramsay scale [11] which was used for rating sedation by measuring six component categories, and the total score was assigned. Modified Ramsay scale was determined before start of the study and every 5 min during airway manipulation.

Data were summarized as Mean $\pm$ SD. Groups were compared by one way analysis of variance (ANOVA). A

Table 1 Modified Ramsay scale for rating sedation

Indication	Score
Anxious, agitated, restless	1
Awake, cooperative, oriented, tranquil	2
Semiasleep but responds to commands	3
Asleep but responds briskly to glabellar tap or loud auditory stimulus	4
Asleep with sluggish or decreased response to glabellar tap or loud auditory stimulus	5
No response can be elicited	6

Table 2 Group wise distribution of cases

S. No.	Group	Description	No. of cases (n)	Percentage (%)
1.	A	Nebulised lignocaine	30	50
2.	B	Lignocaine via spray-as-you-go technique.	30	50

Table 3 Patient's demographic characteristics

	Group A (n = 30) (%)	Group B (n = 30) (%)	P value
Age (years)			
Mean $\pm$ SD	28.15 $\pm$ 9.40	27.10 $\pm$ 8.64	>0.05
Sex			
Female	24 (80)	27 (90.0)	>0.05
Male	6 (20)	3 (10)	
BMI (kg/m ²)			
Mean $\pm$ SD	24.7 $\pm$ 2.3	24.3 $\pm$ 2.0	>0.05
ASA class			
I	21 (70)	15 (75.0 %)	>0.05
II	9 (30)	5 (25.0 %)	

Table 4 Midazolam & fentanyl consumption in the two groups

	Group A	Group B	P value
Midazolam(mg)	3.41 $\pm$ 1.11	3.65 $\pm$ 1.78	>0.05
Fentanyl (μ g)	120.40 $\pm$ 86.44	149.40 $\pm$ 112.18	>0.05

Table 5 Baseline haemodynamic parameters

S. No.	Variable	Group A	Group B	P value
1.	Heart rate (bpm)	83.40 $\pm$ 4.08	82.48 $\pm$ 5.54	>0.05
2.	SBP (mmHg)	130.64 $\pm$ 9.51	130.16 $\pm$ 6.94	>0.05
3.	DBP (mmHg)	81.60 $\pm$ 6.34	82.32 $\pm$ 6.13	>0.05
4.	MAP (mmHg)	97.95 $\pm$ 6.33	98.27 $\pm$ 5.59	>0.05

two-sided ($\alpha = 2$) *P* value less than 0.05 ($P < 0.05$) was considered statistically significant. All analyses were performed on STATISTICA software.

Results

Sixty patients were studied (Table 2). The two patient groups were comparable regarding their demographic characteristics (age, sex, body mass index and ASA physical status (Table 3).

The two groups were also comparable with respect to the dosages of midazolam and fentanyl administered for the desired level of sedation (Table 4).

Table 6 Comparison of heart rate at different time intervals between the two groups

S. No.	Time interval	N	Group A	Group B	P value
1.	Pre	30	83.40 $\pm$ 4.08	82.48 $\pm$ 5.54	>0.05
2.	0 min	30	85.36 $\pm$ 4.05	86.04 $\pm$ 5.46	>0.05
3.	5 min	30	80.84 $\pm$ 6.06	78.88 $\pm$ 5.67	>0.05
4.	10 min	30	74.72 $\pm$ 7.09	73.12 $\pm$ 6.05	>0.05
5.	15 min	30	72.28 $\pm$ 7.24	73.04 $\pm$ 7.78	>0.05
6.	20 min	30	81.08 $\pm$ 7.71	81.28 $\pm$ 7.27	>0.05
7.	25 min	30	83.28 $\pm$ 9.15	82.76 $\pm$ 9.17	>0.05
8.	30 min	30	80.80 $\pm$ 9.06	70.16 $\pm$ 4.24	>0.05
9.	35 min	30	78.56 $\pm$ 4.23	68.20 $\pm$ 3.03	>0.05
10.	40 min	30	78.50 $\pm$ 3.54	66.00 $\pm$ 3.03	>0.05
11.	45 min	30	83.40 $\pm$ 4.08	82.48 $\pm$ 5.54	>0.05
12.	50 min	30	80.84 $\pm$ 6.06	76.88 $\pm$ 5.67	>0.05
13.	55 min	30	95.91 $\pm$ 5.99	93.12 $\pm$ 6.36	>0.05
14.	60 min	30	95.00 $\pm$ 7.11	91.51 $\pm$ 6.07	>0.05

Table 7 Comparison of MAP among groups at different time intervals

S. No.	Time interval	N	Group A	Group B	P value
1.	Pre	30	98.21 $\pm$ 6.20	98.27 $\pm$ 5.59	>0.05
2.	0 min	30	98.12 $\pm$ 7.03	95.19 $\pm$ 6.33	>0.05
3.	5 min	30	95.91 $\pm$ 5.99	93.12 $\pm$ 6.36	>0.05
4.	10 min	30	95.00 $\pm$ 7.11	91.51 $\pm$ 6.07	>0.05
5.	15 min	30	95.13 $\pm$ 6.25	91.92 $\pm$ 5.66	>0.05
6.	20 min	30	95.27 $\pm$ 6.77	93.49 $\pm$ 5.03	>0.05
7.	25 min	30	95.64 $\pm$ 5.32	94.35 $\pm$ 4.71	>0.05
8.	30 min	30	97.01 $\pm$ 6.17	98.28 $\pm$ 6.40	>0.05
9.	35 min	30	95.17 $\pm$ 8.82	96.00 $\pm$ 6.33	>0.05
10.	40 min	30	96.67 $\pm$ 3.32	98.27 $\pm$ 5.59	>0.05
11.	45 min	30	98.21 $\pm$ 6.20	98.27 $\pm$ 5.59	>0.05
12.	50 min	30	98.12 $\pm$ 7.03	95.19 $\pm$ 6.33	>0.05
13.	55 min	30	95.91 $\pm$ 5.99	93.12 $\pm$ 6.36	>0.05
14.	60 min	30	95.00 $\pm$ 7.11	92.51 $\pm$ 6.07	>0.05

There was no significant difference between the two groups regarding their baseline hemodynamic parameters (HR, MAP, and SpO₂) (Table 5). Haemodynamic parameters were also comparable at all time interval during the study (Tables 6, 7, 8).

All patients tolerated insertion of the FOB and airway sprays without severe gagging. No limb movements were observed in either group during AFOI. Patients in group A were more co-operative than group B during the procedure as comfort scores were significantly different between the two groups. Comfort scores were higher in patients who received 2 % lignocaine via nebulisation as compared to those who received lignocaine via spray-as-you-go technique (Table 9).

Table 8 Comparison of SpO₂ between the two groups

S. No.	Time interval	N	Group A SpO ₂ (Mean ± SD)	Group B SpO ₂ (Mean ± SD)	P value
1.	Pre	30	99.14 ± 1.16	98.60 ± 1.03	>0.05
2.	0 min	30	99.20 ± 1.36	99.60 ± 1.04	>0.05
3.	5 min	30	98.23 ± 1.33	98.38 ± 1.62	>0.05
4.	10 min	30	98.60 ± 1.03	98.80 ± 1.08	>0.05
5.	15 min	30	96.83 ± 1.38	96.82 ± 1.28	>0.05
6.	20 min	30	98.80 ± 0.88	98.60 ± 1.80	>0.05
7.	25 min	30	99.90 ± 1.22	99.37 ± 1.58	>0.05
8.	30 min	30	97.33 ± 0.68	98.58 ± 1.58	>0.05
9.	35 min	30	99.00 ± 1.10	97.93 ± 1.51	>0.05
10.	40 min	30	99.13 ± 1.27	99.37 ± 1.52	>0.05
11.	45 min	30	98.30 ± 0.98	98.80 ± 1.24	>0.05
12.	50 min	30	98.38 ± 1.62	97.22 ± 1.22	>0.05
13.	55 min	30	99.60 ± 1.04	98.80 ± 1.58	>0.05
14.	60 min	30	98.60 ± 1.03	98.42 ± 1.28	>0.05

Table 9 Mean modified Ramsay score

	Group I	Group II	'P' value
Ramsay score (Mean ± SD)	2.22 ± 0.0.71	1.60 ± 0.66	<0.05

There were no failed intubations in either group. No incidence of adverse effects was observed with administration of nebulised lignocaine as well as lignocaine via spray-as-you-go technique for AFOI.

Discussion

Numerous combinations of analgesics, amnesics [4, 12] and airway topical anaesthesia have been used for awake nasotracheal intubation. The primary aim of this study was to determine differences in the efficacy of airway topical anaesthesia between 2 % lignocaine nebulisation and 2 % lignocaine via spray-as-you-go technique for AFOI. Our results showed that the two groups were comparable with regard to hemodynamic changes during AFOI. All patients exhibited excellent or acceptable cooperation during AFOI. Therefore, we consider that both 2 % nebulised lignocaine and 2 % lignocaine via spray-as-you-go technique can provide clinically good conditions for AFOI.

In our study, MAP and HR increased gradually with each stage during airway manipulation and intubation. In both groups, however, MAP and HR observed during airway manipulation were comparable. Also, they improved rapidly to basal values after intubation, in consonance with previous studies [4, 9, 10]. These slight cardiovascular

responses may be ascribed to tracheal stimulation caused by the insertion of the FOB and endotracheal tube [4]. There is increasing evidence to suggest that tracheal stimulation is the primary cause of the cardiovascular response [13] and effective airway topical anaesthesia can completely block these adverse responses [4, 7, 14]. The absence of significant differences in the haemodynamic responses between the two groups during AFOI advocates that 2 % lignocaine nebulisation and 2 % lignocaine via spray-as-you-go technique are equally effective for AFOI [4].

Adequate airway topical anaesthesia with minimum dosage of lignocaine is of supreme importance for patient safety, a reasonable waiting period after every airway spray is preferred [4, 7, 9, 15, 16]. A reasonable waiting period after lignocaine nebulisation is also preferred.

In conclusion, both 2 % nebulised lignocaine and 2 % lignocaine via spray-as-you-go technique with the FOB, provided clinically acceptable conditions for AFOI in TMJ ankylosis patients. As compared with 2 % nebulised lignocaine, however, 2 % lignocaine via spray-as-you-go technique required a larger total volume. We therefore, recommend that 2 % lidocaine be used via nebulisation for airway topical anaesthesia during AFOI in TMJ ankylosis patients.

Conflict of interest None.

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