Original article

Comparison of two techniques of airway anaesthesia for awake fibreoptic nasotracheal intubation in patients with anticipated difficult airway

Rakesh Rai B, U Kailasnath Shenoy*

Email: kailasnathshenoy@yahoo.co.in

Abstract

Introduction: The success of awake fibreoptic assisted intubation often depends on the adequacy of anaesthesia of the airway and patient comfort for the procedure. **Aim:** To compare the standard technique (nerve block) of airway anaesthesia with simple aspiration of lignocaine. **Methods:** Thirty patients in whom difficult airway was anticipated were randomly allocated into either Group A (Aspiration) and Group B (Nerve block). In Group A, 0.2 mL/kg of 1.5% lignocaine was trickled on to the dorsum of the tongue while the patient was encouraged to breathe through the mouth. In Group B, superior laryngeal nerve block and intratracheal injection of lignocaine was used. Fibreoptic bronchoscopy was then carried out by a consultant anaesthesiologist, who was blinded to the local anaesthetic technique used. The patient responses to instrumentation of pharynx, glottis and trachea, and tolerance of the endotracheal tube were noted. **Results:** Two cases were excluded from the study because of bleeding resulting in subsequent loss of visualisation of glottis through bronchoscope. There was no statistical or clinical difference in the patient responses between the two groups ($P > 0.05$) due to fibreoptic bronchoscope in the pharynx, larynx and endotracheal tube in the trachea or with regard to the use of rescue medications. **Conclusions:** Aspiration of 1.5% lignocaine (0.2 mL/kg) provides clinically comparable conditions for intubation as the nerve block technique for awake fibreoptic nasotracheal intubation in patients with anticipated difficult airway.

Keywords: Airway, anaesthesia, difficult airway, fibreoptic intubation.

Introduction

One of the most serious challenges faced by the anaesthesiologist during the care of a patient is that presented by the difficult airway. Whether the difficult airway is recognised preoperatively or not, failure to properly manage the situation is catastrophic and is paralleled by few other clinical events. The consequences of such failure include hypoxaemia, hypercapnoea, resultant metabolic alterations, neurological sequelae and death.

Rakesh Rai B, MD FCICM FANZCA
Intensive Care Specialist, Sydney, New South Wales, Australia

U Kailasnath Shenoy, DA, MD
Professor and Head of Anaesthesiology, Kasturba Medical College, Manipal

A difficult airway is defined as a clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with mask ventilation, difficulty with tracheal intubation or both.[1] The incidence of difficult airway is estimated to be < 10% of all cases of airway management and it is apparent that the lack of anticipation of airway difficulty is most often the cause of compromised clinical outcomes. Hence, recognition of a potentially difficult airway is the first step in its management.[2] A careful evaluation of the airway is an essential requirement for all patients presenting for intubation. If there is a possibility that intubation following induction of anaesthesia will be difficult, then the airway must be secured in the conscious state. The use of fibreoptic bronchoscope

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has largely replaced direct laryngoscopy during awake intubation.

In addition to skills, the success of fibreoptic assisted intubation often depends on the adequacy of anaesthesia of the airway and patient comfort for the procedure.

Many methods have been used to anaesthetise the airway. They may be relatively invasive such as the nerve blocks (which have been described as the standard technique for airway anaesthesia) or noninvasive methods such as lignocaine nebulisation and 'spray as you go' technique. The present study was done to compare the standard technique (nerve block) of anaesthetising the airway with simple aspiration of lignocaine.

Methods

The study was conducted after obtaining institutional approval. Thirty patients of either gender participated in the study. The procedure was explained and an informed consent was obtained from each of the patients to be included in the study.

Patients between 18 and 75 years of age, ASA physical status 1 or 2, weighing 50 – 100 kg, scheduled for elective procedures under general anaesthesia and in whom difficult airway was anticipated (restricted mouth opening with an interincisor distance < 30 mm) were enrolled. Patients with respiratory disease including hyper-reactive airway, gastro-oesophageal reflux disease, history of epistaxis, coagulation disorders, renal or hepatic disease, pregnancy or any contra-indication for nasotracheal intubation were excluded from the study.

A single anaesthesiology resident evaluated all the patients suspected of having difficult airway and enrolled eligible patients who were willing to participate in the study. The patients were kept nil per oral as per standard guidelines. All patients were premedicated with oral diazepam 10 mg, oral ranitidine 150 mg and oral metoclopramide 10 mg, the night before surgery and 90 min prior to the surgery. Glycopyrrolate 0.2 mg was given intramuscularly 90 min before surgery. Two nasal drops of 0.05% oxymetazoline were instilled in each nostril night and before shifting to operating room (OR).

On the day of surgery, patients were shifted to the OR and all patients were monitored continuously using noninvasive blood pressure (NIBP), electrocardiogram (ECG) monitoring lead II and a pulse oximeter (SpO_2). An intravenous infusion was then set up through a cannula inserted into a suitable vein in the upper limb. Two drops of 0.05% oxymetazoline nasal drops were instilled into each nostril. Patients received midazolam hydrochloride in increments of 1 mg up to a maximum of 0.05 mg/kg intravenously before procedure. All patients gargled 3-4 mL of 2% viscous lignocaine for approximately 2-3 min. Nasal pledgets soaked in 4% lignocaine were placed in both nostrils for 5-10 min.

Patients were then randomly allocated into one of the two groups, Group A: Aspiration group and Group B: Nerve block group.

Aspiration group: The procedure was explained to the patient once again. The patient was then asked to extrude his or her tongue as much as possible. It was then grasped with a gauze pad and very gentle traction was applied to it. With the help of a short extension tubing (approximately 5-8 cm long cut 12 F suction catheter) attached to a 30 mL syringe *(Figure 1)*, 0.2 mL/kg of 1.5% lignocaine was trickled on to the dorsum of the tongue while the patient was encouraged to breathe through the mouth *(Figure 2)*.

Nerve block group: The procedure was explained to the patient once again. Under strict asepsis, the neck was cleaned and draped. The superior laryngeal nerve was blocked bilaterally by infiltrating 1.5 – 2 mL of 2% lignocaine at the lateral and inferior aspect of the cornu of the hyoid using a 25 G, 1" long needle. The injection was made after confirmation of absence of blood on aspiration. The patient was then explained about the possibility of an episode of uncontrollable coughing during and immediately after the injection. With the neck extended, the cricothyroid membrane was palpated and a 23 G, 1" needle, attached to a 5 mL syringe was inserted into the trachea through the membrane. Following

aspiration of air and confirmation of correct needle placement, 3 – 4 mL of 2% lignocaine was injected.

Figure 1: Syringe and catheter assembly

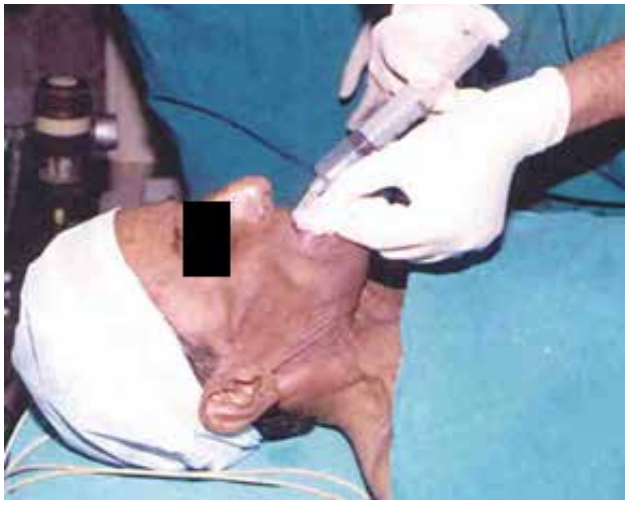

Figure 2: Aspiration of lignocaine following gentle traction on the tongue

Finally, all the patients had their nostrils packed with nasal pledgets soaked in 3% lignocaine (1 – 2 mL) using Killian's nasal speculum and nasal packing forceps (*Figure 3*). They were then preoxygenated for 5 min and were advised to breathe through their mouth as the nose was blocked with nasal pledgets. Airway anaesthesia and sedation was provided by the same anaesthesiologist who did the preoperative assessment (Observer 1). The total dose of lignocaine administered was recorded. The patient's neck was covered with a towel to hide the nerve block injection sites. The fibreoptic bronchoscopy was then carried out by a consultant anaesthesiologist (with more than five years' experience with fibreoptic bronchoscopy – Observer 2), who was blinded to the local anaesthetic technique used. A 4.2 mm Pentax adult intubating fiberscope was used. An appropriate sized endotracheal tube, softened by prior immersion in warm water, was preloaded onto the fibreoptic bronchoscope. Fibreoptic bronchoscopy was done and once the carina was visualised, the endotracheal tube was rail-roaded into the trachea over the bronchoscope. The correct placement of the endotracheal tube was confirmed using capnography.

The following observations were made:

Patient responses to instrumentation of pharynx, glottis, trachea and tolerance of the endotracheal tube were recorded.

Responses were scored as follows:

0 – No response (absence of coughing or gagging)

1 – Mild response (coughing or gagging but this does not affect performance of the procedure)

2 – Marked response (Persistent coughing and gagging requiring supplemental lignocaine - rescue medication) to complete the procedure.

Requirement of rescue medication given at the discretion of the intubating anaesthesiologist (Observer 2): 1.5 mL of 1.5% lignocaine was given through the injection port of the fibreoptic bronchoscope.

Haemodynamic response: The blood pressure and heart rate were recorded at the following times: One minute before and after aspiration / block, and one minute after the endotracheal tube was in place. A 20% increase or decrease of systolic blood pressure/heart rate from baseline was considered significant.

The quantitative data were analysed using Student's t test and qualitative data using Chi square test and Fisher's exact test as appropriate.

Results

Thirty patients were included in this study. Two patients were excluded from the study because of bleeding resulting in subsequent loss of visualisation of glottis through bronchoscope. The demographic data of the patients is given in *Table 1*.

Table 1: Demographic data

	Aspiration group (n = 14)	Block group (n = 14)
Age (years)*	47.64 ± 16.59	49.64 ± 14.66
Gender (M/F) (n)	12 / 2	10 / 4
Weight (kg)*	61.42 ± 9.5	1.14 ± 9.71

*Mean ± SD

The cause of restricted mouth opening included maxillofacial injuries, oral malignancy, old operated

case of malignancy, submental abscess, Ludwig's angina and infected mandibular plate.

Evaluation of patient responses to fibreoptic bronchoscope in the pharynx: Eleven patients in each group had no response to the fibreoptic bronchoscope in the pharynx. Three patients in the aspiration group had mild response whereas none had marked response to the fiberscope in the pharynx. Two patients in Group B had mild response where as one patient had marked response to the fibrescope in the pharynx. There was no statistical or clinical difference between the two groups (P > 0.05) *(Figure 3)*.

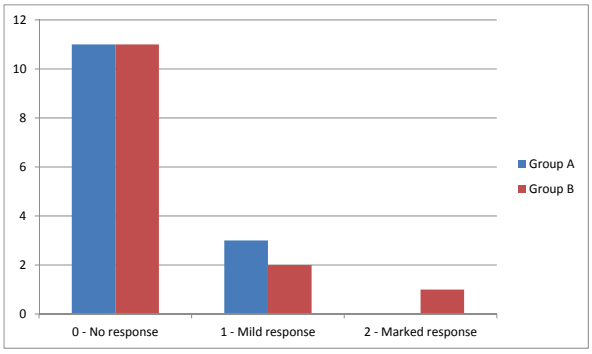

Figure 3: Patient responses to fibreoptic bronchoscope in the pharynx

Evaluation of patient responses to fibreoptic bronchoscope in the glottis: Nine patients in the aspiration group had no response and five had mild response to the fibreoptic bronchoscope in the glottis. Thirteen of fourteen patients in Group B had no response whereas one had a mild response to the fiberscope in the larynx. There was no statistically significant difference between the two groups *(Figure 4)*.

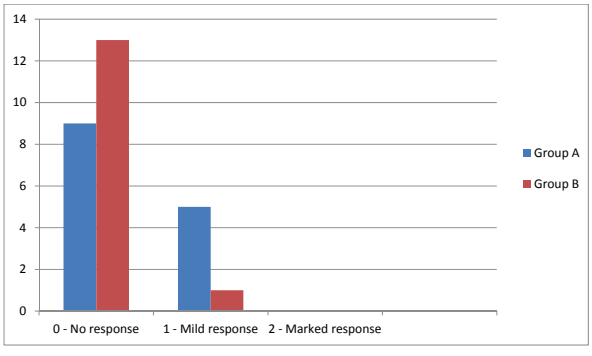

Figure 4: Patient responses to fibreoptic bronchoscope in the glottis

Evaluation of patient responses to fibreoptic bronchoscope in the trachea: Ten of the 14 patients in the aspiration group and seven of the block group had no response to the fibreoptic bronchoscope in the trachea. Two patient in each group had marked response to the fibreoptic scope in the trachea (*Figure 5*). There was no statistical or clinical difference between the two groups.

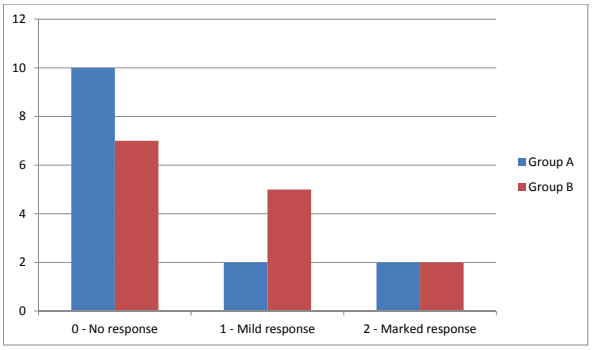

Figure 5: Patient responses to fibreoptic bronchoscope in the trachea

Evaluation of patient responses to endotracheal tube in the trachea: Nine of the fourteen patients in the aspiration group and eight of the fourteen patients in the block group had no response to the endotracheal tube in the trachea. Five patients in the aspiration group and six patients in the block group had mild response but none in either group showed marked response to the endotracheal tune in the trachea (*Figure 6*). There was no statistical or clinical difference between the two groups.

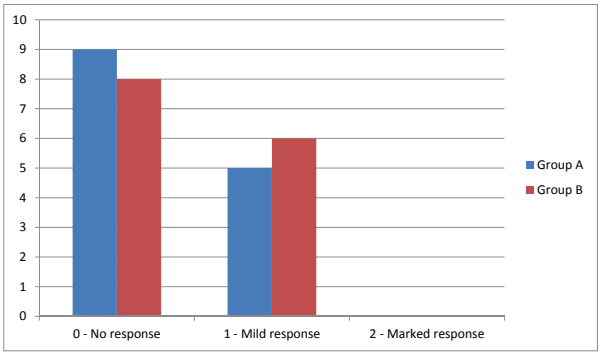

Figure 6: Patient responses to endotracheal tube in the trachea

Requirement of rescue medication: Of the 14 patients in the aspiration group, two patients received rescue medication while three out of 14 patients in the block group required rescue medications

(Table 2). There was no statistical or clinical difference between the two groups (P > 0.05).

Table 2: Requirement of rescue medication and the total amount of lignocaine used in both groups

	Aspiration group (n = 14)	Block group (n = 14)
Requirement of rescue medication (n)	2	3
Total amount of lignocaine used (mg) (Mean ± SD)	292.42 ± 39.56	271 ± 22.12

Total amount of lignocaine used (mg): Comparison of the amount of lignocaine used between the two groups showed no difference between the two groups *(Table 2)*. Individually, the total dose of lignocaine was restricted to a maximum of 5 mg/kg body weight.

Haemodynamic changes: No patient in either group had a significant change in haemodynamics during the procedure.

Discussion

Flexible fibreoptic intubation of the trachea is now the method of choice when difficult direct laryngoscopy is anticipated. The principal advantage of this technique is that it allows the tracheal tube to be placed in a conscious state under adequate anaesthesia of the airway with minimal discomfort to the patient. Technically it is easier to perform fibreoptic intubation in the awake patient. In the anaesthetised patient, the soft palate, tongue and epiglottis fall backwards on to the posterior pharyngeal wall making endoscopy difficult.

The success of any procedure performed on the conscious patient will depend very largely on the degree of discomfort to which the patient is subjected. In our study, we have compared the standard nerve block technique to anaesthetise the airway with simple aspiration technique.

During the act of swallowing, the tongue acts as a piston to propel the bolus of food or liquid from the back of the mouth through the pharynx into the oesophagus. The larynx rises cephalad to create a negative postcricoid pressure to suck the bolus towards the oesophagus.[3] At the same time, a combination of closure of the true and false cords and retroversion of the epiglottis over the laryngeal aditus prevents aspiration.

In the aspiration technique the traction on the tongue prevents it from participating in the normal act of swallowing and thereby preventing the epiglottis from downfolding and retroverting over the glottis.[4] This encourages aspiration. However, despite traction on the tongue, pharyngeal peristalsis can still function normally to propel the bolus down the oesophagus. The stimulus of swallowing reflex is the fluid that is in contact with the pharyngeal mucosa.[5] With time, when the pharyngeal mucosa gets anaesthetised, the reflex to swallow subsides. Then, the instilled lignocaine begins to pool in the pharynx, ready to be aspirated. In order for this to occur, a large volume of solution has to be swallowed before anaesthesia of pharynx occurs. Hence, to decrease the intensity of swallowing and to encourage earlier pharyngeal pooling, all patients were advised to gargle 2% viscous lignocaine before aspiration was done.

The standard nerve block technique is the most common technique to anaesthetise the airway. Thus, we considered it appropriate to compare the aspiration technique with the nerve block technique. Our study showed that the simple aspiration technique is as effective as the nerve block technique for anaesthetising the airway. Also, patients were haemodynamically stable during the performance of the technique. There was no significant difference in the haemodynamics (systolic blood pressure and heart rate) of both groups, both after the procedure and also after the endotracheal tube was in place. This was also taken as one of the parameters to check the efficacy of the technique.

In our study of the 14 patients in the aspiration group, 11 (78%) did not react to the insertion of the fibreoptic bronchoscope in the pharynx which was comparable to that seen in the block group *(Figure 4)*. All except one patient in the aspiration group were comfortable during the passage of

fibreoptic bronchoscope through the glottis. However, five out of 14 patients had a mild response to the fibrescope at the glottis in the block group *(Figure 5)*. This seemed clinically significant but this did not reach statistical significance. In addition, a comparable number of patients had tolerated both the endoscope and the endotracheal tube in the trachea *(Figure 6)*.

The results of our study are comparable to the study by Chung *et al* who had documented the efficacy of the aspiration technique for awake fibreoptic intubations.[4] Of the total 39 patients included in the study, 32 (82%) did not react to the insertion of the fibreoptic bronchoscope in the pharynx. 29 (74%) did not react to manipulation of the fibreoptic bronchoscope through the glottis and trachea. It was also noted that nearly 46% did not react to the passage of the tracheal tube into the trachea and the rest reacted with muted cough that did not interfere with the procedure.

We modified our methodology of aspiration technique by premedicating all our patients with anticholinergic (glycopyrrolate) before the procedure thereby reducing the chances of the aspirating fluid being diluted by oral secretions ensuring better contact with the mucosa. We included patients with restricted mouth opening since the only methods available to anaesthetise the oral and oropharyngeal mucosa in these patients are the topical anaesthetic methods. The glossopharyngeal block was not possible in these cases as the access for intraoral approach was limited.

In the study by Sidhu *et al*, a total of 58 patients with cervical spine disease underwent awake fibreoptic intubation.[5] Topical anaesthesia was administered using the 'spray as you go' technique and the severity of cough was observed along with the haemodynamics. In this technique, only 22 (38.6%) of the 58 patients had no response to passage of fiberscope. They also used higher concentration of lignocaine (4%) and each time 2-4 mL was sprayed progressively as the fiberscope was passed. In their study, eight (14.3% patients developed oxygen desaturation (SpO_2 < 90%) during the procedure. All the patients in the present study were preoxygenated for five minutes before the fibreoptic bronchoscopy. None of our patients developed oxygen desaturation during intubation.

In the study by Reasoner *et al*, they compared the standard nerve block technique with lignocaine nebulization technique in 40 patients.[6] There was no significant difference between the two groups at any interval in the haemodynamics. The authors used nearly 20 mL of 4% lignocaine (815 ± 208 mg) for nebulization as compared to 349 ± 44 mg of lignocaine for nerve block group. Such high doses however, did not result in any systemic effects of lignocaine toxicity. They measured the lignocaine concentration of plasma and found it well below 5 µg/mL. The quality of anaesthesia between the two groups was comparable. The nebulisation of lignocaine seemed to involve a larger dose of lignocaine and took time as compared to aspiration technique.

In the study by Graham *et al*, both the patient and the bronchoscopists preferred a simple transtracheal injection to either nebulized lignocaine or the 'spray as you go' technique.[7] However, that study was performed in an unblended fashion and the doses administered was relatively small compared to the study by Reasoner *et al*.[6] Also coughing was frequent during the procedure.

Topical anaesthesia for awake fibreoptic intubation using the aspiration technique offers a safe, easy and comfortable method and can be recommended for patients with difficult airways. The associated cardiovascular stability suggests that awake fibreoptic intubation can be safely performed in patients with cardiovascular disease.

Conclusions

Aspiration of 1.5% lignocaine (0.2 mL/kg) provides clinically comparable conditions for intubation as the nerve block technique for awake fibreoptic nasotracheal intubation in patients with anticipated difficult airway.

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