Original Article

A Comparative Study of Ketamine Gargle and Lidocaine Jelly Application for the Prevention of Postoperative Throat Pain Following General Anaesthesia With Endotracheal Intubation

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Abstract

Background: Postoperative throat pain is an established complication of general anaesthesia with endotracheal intubation. We thus sought to determine the incidence of postoperative throat pain and the efficacy of lidocaine jelly and ketamine gargle in the prevention of postoperative throat pain. **Materials and Method:** One hundred and fifty ASA I or II, male: female ratio of 1:2 patients, aged18 -64 year, scheduled for elective general surgery requiring general anaesthesia with endotracheal intubation were randomly recruited into two groups, ketamine (K group) and lidocaine (L group). Group K received ketamine gargle (40 mg in 30 ml normal saline) for 30 sec, five minutes before induction of anaesthesia, while Group L received 2% lidocaine jelly applied to the ETT cuff and 30 ml normal saline was gargled for 30 sec, five minutes before induction of anaesthesia. **Results:** Postoperative throat pain was defined as pain present with swallowing and it was assessed using verbal rating scale. Time from extubation to onset of postoperative throat pain was significantly longer for patients in K group compared to the lidocaine group, P<0.01. Group L patients recorded a higher occurrence of moderate to severe pain (44.1% vs. 23.5%) as against group K with 58.3% no pain and 36.5% mild pain, P< 0.01. The overall incidence of postoperative throat pain for the study was 55.4%. **Conclusion:** The study demonstrated that ketamine gargle has more protection against moderate to severe postoperative pain as compared to topical lidocaine jelly. Patients undergoing surgery under general anaesthesia with endotracheal intubation will benefit from ketamine gargle five minutes before induction of anaesthesia as prophylaxis against postoperative throat pain.

Keywords: *Postoperative throat pain, ketamine gargle, lidocaine, general anesthesia*

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Introduction

Postoperative throat pain is one of the most common complications following anesthesia with endotracheal intubation. Endotracheal intubation is often associated with varying degrees of trauma to the airway mucosa which may result in irritation and inflammation.[1] The incidence of post-operative throat pain following endotracheal intubation ranges from 21-65%.[2] Lubrication of the endotracheal tube with lidocaine jelly, steroids such as betamethasone, K-Y jelly are possible methods of reducing the occurrence of throat pain after endotracheal intubation.[1] Moreover, the use of ketamine gargle in prevention of postoperative sore throat has not being conclusively researched. Furthermore, Edomwonyi *et al.*[3] did not report any significant difference in the incidence of postoperative throat pain between those who had their endotracheal tubes lubricated with lidocaine jelly and those who had theirs lubricated with water.

The incidence of postoperative throat pain can be associated with different sizes of endotracheal tubes and cuff pressure. Cuff pressures of low pressure high

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volume cuffs less than or equal to 25 cmH_20 have been demonstrated to successfully reduce the incidence of postoperative throat pain after endotracheal intubation.[4] This makes an average cuff pressure of 25 cmH_20 or less ideal for most patients.[4,5] Inappropriate tube size and cuff pressure increases the pressure effect on the tracheal mucosa with consequent ischemia and inflammatory changes that increase the risk of developing postoperative throat pain.

Ketamine hydrochloride, an intravenous anaesthetic has recently been found to attenuate the occurrence of postoperative throat pain. This has been attributed to its antinociceptive and probable anti-inflammatory effects. It has been administered for this effect as mouth gargle[2], mouth wash[6] and intravenously,[7] but none has been shown to be superior to the other. Nonetheless, these various routes continue to be used in the prevention and reduction of the incidence of postoperative throat pain. Although contraindicated in severe ischemic heart disease and hypertension, ketamine at a dose of 40 mg[2,8] administered as mouth gargle has very little systemic absorption.

The application of lidocaine jelly to the endotracheal tube has been one of the most common ways of preventing postoperative throat pain.[9] It has been shown to reduce the incidence of postoperative throat pain by 40-91%.[3,10] This implies that optimal measure for attenuation of post-operative throat pain is yet to be determined. This study was therefore designed to compare the efficacy of the two methods described in attenuating postoperative throat pain.

Methodology

Setting: The study population was drawn from general surgical patients scheduled for elective surgery under general anaesthesia with endotracheal intubation at the University of Benin Teaching Hospital, Benin City, Nigeria. Approval was obtained from the hospital research and ethics committee.

Design: This study was a prospective randomized comparative double blind study.

Inclusion Criteria: ASA I or II patients aged between 18-64 years scheduled for elective general surgery procedures under general anaesthesia with endotracheal intubation.

Exclusion criteria: Patients that were excluded from the study included those that voluntarily refused consent, or had known allergies to study drugs, suffered from pre-operative throat pain or had a history of asthma. Others were those with Mallampati grades > 2, recent NSAID usage, use of throat (pharyngeal) packs and nasogastric tube passage.

Study Protocol

The day prior to the conduct of anesthesia while in surgery, a detailed preoperative history, physical examination and investigations were done for each eligible patient. Routine investigations were done which included, full blood count, serum electrolyte, urea and creatinine levels as well as urinalysis. Other laboratory investigations were done as necessary for each case. The study procedure with risks and benefits were explained to the understanding of these patients. Informed written consent was obtained thereafter during the pre-operative review. Patients were instructed on the four point grades of postoperative throat pain 2, where grade 0 was no pain, grade 1, mild pain, grade 2, moderate pain and grade 3, severe pain. All patients fasted overnight and were premedicated with 10 mg of oral diazepam two hours prior to surgery. The patients were randomly allocated to each study group (Grp K and L) by lucky dip via letters which were kept in opaque envelopes.

On arrival in the operative theatre, pre-operative check of all equipment and anesthetics were carried out. A multi-parameter monitor (Dash 4000 by General Electric Corporation of America) was attached to each patient and baseline vital signs were recorded. Intravenous access was established with a 16G cannula for patients with intravenous fluid, normal saline was connected to keep the line patent for those with anticipated blood loss, while 18G cannula for those procedures with anticipated reduced blood loss. An appropriate sized cuffed endotracheal tube, with sizes ranging from 7.0-7.5 mm internal diameter, high volume low pressure cuff tube for females and sizes 8.0 mm, 8.5 mm or 9.0 mm tube for males was prepared. The anesthetist who administered study drugs and performed laryngoscopy and intubation were blinded to the study groups. Study drugs were prepared and coded by the investigator and these codes were only revealed at the end of the study.

Groups K and L were: K- Ketamine 40 mg (ketalad(R) by Emzor pharm) in 30 ml normal saline with K-Y jelly applied to ETT cuff. L- 2% lidocaine jelly(R) (Emzor pharm) applied to the ETT cuff and gargling of 30 ml of normal saline. The normal saline and K-Y jelly were used as placebo in each group. Normal saline was mixed with ketamine in group K to make it indistinguishable in taste from the normal saline placebo of the group L and thus, patient blinding was maintained. Every patient in the K-group was made to gargle 40 mg of ketamine in 30 ml normal saline, for 30secs, with K-Y jelly applied to the endotracheal tube cuff while patients in the L-group were made to gargle 30 ml of normal saline and 2% lidocaine jelly applied to the endotracheal tube cuff five minutes before conduct of anesthesia. The application of

seemingly colourless K-Y jelly and lidocaine jelly to the K and L groups, respectively thus further contributed to the reduction of bias. Each patient was pre-oxygenated with 100% oxygen for 5 minutes to increase the oxygen reserve and denitrogenate the lungs. Anesthesia was induced with sodium thiopentone at 3-5 mg/kg while tracheal intubation was facilitated with 1-2mg/kg of suxamethonium. Laryngoscopy and tracheal intubation was performed by an anesthetist with a minimum of three years training experience or equivalent of a senior registrar. This is to reduce trauma to oropharyngeal structures and minimize the risk of occurrence of postoperative, sore throat pain.

Immediately after intubation, correct placement of endotracheal tube was confirmed by serial auscultation and thereafter, endotracheal tube cuff was inflated with air to 25 cm H_2O using VBM (Medizintechnik GmbH, Germany) hand-held manometer for low pressure high volume cuff. Intracuff pressure was maintained at a seal of 25cm H_2O throughout the procedure. All patients had a Guedel oropharyngeal airway inserted after intubation to prevent biting on the endotracheal tube. The endotracheal tube was connected to the anesthetic machine via the close circuit breathing system and the patient mechanically ventilated with intermittent positive pressure ventilation mode using the inbuilt Drager Fabius Tiro anaesthetic machine ventilator at a tidal volume of 10 ml/kg. Anesthesia was maintained using a balanced technique with Isoflurane titrated to effect. Muscle relaxation was achieved with 0.05-0.1 mg/kg pancuronium bromide. Intra-operative analgesia was achieved with intravenous pethidine 50mg and IV paracetamol at 15mg/kg for all patients.

Blood loss was assessed and replaced with normal saline or Ringer's lactate in a ratio of 1:3. In some cases, blood loss was replaced with colloid or whole blood in a ratio of 1:1. Intra-operative vital signs were monitored using DASH 4000 multi-parameter monitor by General Electric Corporation of America. Pulse rate and oxygen saturation were measured every five minutes until the end of surgery, anesthesia and even more often if the need arose. Also, a capnograph was used to monitor end-tidal carbon dioxide concentration. Patients whose procedures were expected to last longer than one hour were catheterized to monitor urine output.

At the end of surgery, patients oropharynx was gently suctioned with as minimal instrumentation as possible. Residual neuromuscular blockade was antagonized using neostigmine 2.5 mg and atropine 1.2 mg. Each patient's trachea was extubated on return of spontaneous respiration and the following ability to obey verbal command or have a sustained head lift for 5 second. The durations of surgery and endotracheal intubation were noted respectively. The duration of tracheal intubation was taken from time of tube placement to extubation.

After extubation, each patient was transported to the Post Anaesthetic Care Unit (PACU) for further observation and monitoring of vital signs. Patients were asked for the presence of pain on swallowing as a symptom of postoperative throat pain when fully awake, prior to discharge to their respective wards. This was after being certified stable by the PACU staff and meeting Aldrete score[11] of 9 and above according to our departmental protocol.

Following initial assessment for the presence of throat pain by the investigator on arrival at the PACU, this was thereafter repeated every 6 hours within the first 24 hours and subsequently, at 12 hour intervals until 72 hours post operatively and entered into the data sheet. To manage pain from operation site, all patients had operation site wound infiltrated with 20 mls of 0.125% plain bupivacaine. They also had intravenous paracetamol at 15 mg/kg at 8 hour intervals and 1 mg/kg of tramadol intravenously every 6 hours until they were able to tolerate oral intake. Moreover, patients who developed mild postoperative throat pain were reassured on the prompt resolution of the symptoms, however, if symptoms persisted beyond 36 hours they were treated accordingly. Moreover, those who had moderate to severe postoperative throat pain were treated with oral diclofenac 50 mg at eight hour intervals for forty eight hours, a non-steroidal anti-inflammatory agent and Strepsil lozenges, every 2 eight hours for forty eight hours by the investigator.

Measurement of Outcomes

Primary outcome: Incidence and severity of postoperative throat pain following application of lidocaine jelly to the ETT and following Ketamine gargle. Secondary outcome: Time of onset of postoperative throat pain following ketamine gargle as well as application of lidocaine jelly to ETT and correlation of duration of intubation with the occurrence of postoperative throat pain.

Statistical Analysis

Data analysis was done with the SPSS version 18.0. Continuous data were summarized as means and standard deviations and categorical data as counts and frequencies. Parametric data were compared using student t-test, chi square and Fisher exact test. A p-value of < 0.05 was considered significant.

Results

One hundred and fifty (150) adult male and female patients scheduled for general anaesthesia with endotracheal intubation of the American Soceity of Anesthesiologists (ASA) physical status class I and II were enrolled into the study. Ten patients were excluded from the study for protocol violations. A total of one hundred and forty patients completed the study and as such, data from these patients were analyzed.

Patient socio-demographic characteristics and duration of surgery were comparable between the groups. Male: female ratio in lidocaine group was 1:3 while in the ketamine gargle group was approximately 1: 2 [Table 1]. The mean ages for the ketamine gargle and lidocaine groups were 40.57 ± 10.45 years and 37.2 ± 12.29 years respectively. Most of the patients had a minimum of secondary education. The mean weight and height for the lidocaine group were 71.66 ± 11.02 kg and 1.60 ± 0.07 m respectively while the mean weight and height for the ketamine gargle group was 64.11± 9.07 kg and 1.57 ± 0.07 m respectively. However, the body mass index (BMI) for the groups was 27.9 kg/m2 for the lidocaine group and 26.05 kg/m2 for the ketamine group [Table 2].

Forty seven (69.2%) patients in the lidocaine group had postoperative throat pain. Out of this number, 63.8% had their trachea intubated with sizes 7.0 and 7.5 mm internal diameter low pressure high volume cuffed endotracheal tubes while 36.2% had sizes 8.0-9.0 mm internal diameter ETT. In the ketamine gargles group, 13.3% of the patients had postoperative throat pain and had their trachea intubated with size 7.0 mm-7.5 mm internal diameter low pressure high volume ETT while 86.7 % had sizes 8.0 mm-9.0 mm internal diameter ETT. In the lidocaine group, endotracheal tube sizes 7.0 mm - 7.5 mm were more commonly used while in the ketamine group ETT sizes 8.0 mm- 9.0 mm were more commonly used (P = 0.01 [Table 3]).

Most of the patients in this study had an average duration of trachea intubation greater than one hour. Duration of intubation was taken as time of endotracheal tube placement to its removal. Fifteen (50%) participants that had postoperative throat pain in the ketamine group had their intubation lasting 1-2 hours, eight participants (26.7%) had intubation lasting 2-3 hours while four participants (13.3%) had intubation lasting more than 3 hours and two participants (6.7%) in this group had intubation lasting an hour or less. However,

Table 1: Effect of socio-demographic characteristics of patients on postoperative throat pain.

Socio-demographic characteristics	Frequency (%)		p-value
	Lidocaine jelly	Ketamine gargle	
Age(years)			
<20	4(5.8)	2(2.7)	0.53***
21-40	37(54.4)	34(47.2)	
41-60	25(36.7)	32(44.4)	
61-70	2(2.9)	4(5.4)	
≤40	41	36	0.22
>40	27	36	
Mean age(years)	37.2(±12.29)	40.57(±10.45)	0.05**
Sex			
Male	17 (25.0)	26 (36.1)	0.15
Female	51 (75.0)	46 (63.9)	
Educational level			
No formal education	0 (0.0)	1 (1.4)	0.55***
Pry and sec education	35(51.9)	37 (51.4)	
Tertiary education	33 (43.5)	34 (47.2)	

Mean (± SD); Lidocaine jelly group = 37.72 ± 12.29 yrs, ketamine gargle group = 40.57± 10.45 yrs **t-test *** Fisher's Exact test

Table 2: Anthropometric parameters of patients in both groups

Anthropometric parameters	Mean ± Standard deviation		p-value*
	Lidocaine jelly	Ketamine gargle	
Weight (Kg)	71.66 ± 11.02	64.11 ± 9.07	0.03
Height (meters)	1.60± 0.072	1.57 ± 0.071	0.14
Body Mass Index (Kg/meters^2)	27.99 ± 4.47	26.05 ± 3.15	0.37

*t-test

in the lidocaine group, most of the participants (59.6%) that had postoperative throat pain had duration of endotracheal intubation lasting 1- 2 hours while few (17%) had endotracheal intubation lasting an hour or less and three (6.4%) had endotracheal intubation lasting more than three hours [Table 4].

Throat pain among patients in the ketamine gargle group was less severe with more incidences of mild and moderate throat pain. There was no postoperative throat pain in 58.3% of the patients in the ketamine group and 30.8% of the lidocaine group, however, this was not significant, P = 0.07. Mild and moderate throat pain accounted for 36.5% and 4.2% in the ketamine group respectively. In the lidocaine group, there were more cases of severe throat pain (23.5%) and moderate throat pain (44.1%), however, this group recorded 1.5% incidence of mild throat pain and 30.8% incidence of no throat pain,(P < 0.01 [Table 5]).

The duration of surgery was similar in both groups. Lidocaine group had mean duration of 97.6(± 38.0 minutes

Table 3: Effect of endotracheal tube sizes on post operative throat pain

Size of ETT (mm I.D)	Frequency (%)		p-value
	Lidocaine jelly (n = 47)	Ketamine gargle (n = 30)	
7.0 - 7.5 (Females)	30 (63.8)	4 (13.3)	0.01
Ratio of patient who dev POST in L-group	0.88		
8.0 - 9.0 (Males)	17 (36.2)	26 (86.7)	
Ratio of patients who dev POST in K-group		0.12	
Total	47(100)	30(100)	

*Fisher's Exact test

Table 4: Incidence of postoperative throat pain in relation to the duration of intubation

Duration of Intubation (minutes)	Frequency (Ratio)		p-value
	Lidocaine	Ketamine	
30 – 60	8 (0.17)	3 (0.10)	0.03*
60 – 120	28 (0.59)	15 (0.50)	
121 – 180	8 (0.17)	8 (0.27)	
> 180	3 (0.6)	4 (0.13)	
Total	47(100)	30(100)	

*Fisher's exact test

Table 5: Severity of postoperative throat pain among patients in both study groups

Grade of pain	Frequency (%)		p-value
	Lidocaine jelly	Ketamine gargle	
No pain	21(30.8)	42(58.3)	< 0.07*
Mild pain	1 (1.5)	26 (36.5)	< 0.01
Moderate pain	30 (44.1)	3 (4.2)	< 0.01
Severe pain	16 (23.5)	1 (1.0)	< 0.01
Total	68(100)	72(100)	

*Fisher's exact

Table 6: Effect of duration of surgical procedures on post operative throat pain

Duration of Surgery (minutes)	Frequency (Ratio)		
	Lidocaine jelly	Ketamine gargle	
< 60	4 (0.09)	3 (0.1)	1.02
61 – 120	30 (0.64)	15 (0.5)	0.24
121 – 180	6(0.13)	9 (0.3)	0.08
181 – 240	7 (0.15)	3 (0.3)	0.73
Total	47	30(100)	

*Fisher's Exact test. ***Mean ± SD; Lidocaine jelly = 97.6 ± 38.0 minutes, Ketamine gargle = 93.9 ± 29.6 minutes.

while ketamine gargle group had a mean duration of 93.9 (± 29.6 S.D) minute. Few patients in both the study groups had surgery lasting less than an hour while most patients had their surgery lasting between 1-2 hours (thirty and fifteen patients in the lidocaine and ketamine groups respectively) but this was not significant as shown in Table 6.

With regard to the time of occurrence of throat pain, lidocaine group had throat pain as early as 6 hours and 7-12 hours postoperatively while it was predominantly 19 hours and beyond, post operatively in the ketamine gargle group. This was statistically significant (P < 0.001 [Table 7]).

The overall incidence of postoperative throat pain in the study population was 55.4%(69.1 + 41.7)/2 [Figure 1]. The incidence of postoperative throat pain in the lidocaine group is 69.1% while in the ketamine gargle group is 41.7%. The incidence in the female population was 35.1% while it was 100% in the male participants [Table 8]. Table 1: Effect Of socio-demographic characteristics of Patients on postoperative throat pain.

Mean (± SD); Lidocaine jelly group = 37.72 ± 12.29 yrs, ketamine gargle group = 40.57 ± 10.45 yrs

**t-test

*** Fisher exact test Table 2: Anthropometric parameters of patients in both groups

*t-testTable 3: Effect of endotracheal tube sizes on postoperative throat pain

*Fisher exact test Table 4: Incidence of postoperative throat pain in relation to the duration of intubation

*Fisher exact test Table 5: Severity of postoperative throat pain among patients in both study groups

*Fisher exact test Table 6: Effect of duration of surgical procedures on postoperative throat pain

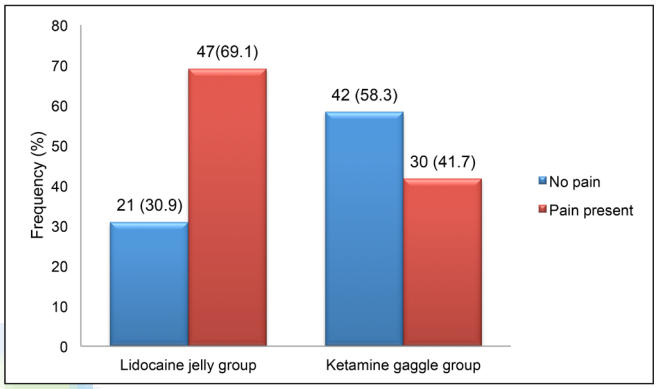

Figure 1: Incidence of postoperative throat pain among patients in both study groups

Table 7: Time of occurrence of post operative throat pain among patients in both study groups

Time of occurrence of pain (hours)	Frequency (%)		
	Lidocaine jelly (n = 47)	Ketamine gargle (n = 30)	p-value*
< 6	2 (4.3)	2 (6.7)	< 0.01
7 – 12	25 (53.1)	4 (13.3)	0.01
13 – 18	10 (21.3)	2 (6.7)	0.11
19 – 24	7 (14.9)	8 (26.7)	0.24
> 24	3 (6.4)	14 (46.7)	0.42

*Fisher's exact

Table 8: Incidence of postoperative throat pain in both sexes

	Frequency (%)		
Incidence of Pain	Lidocaine Jelly (n = 68)		p-value
	Male	Female	
No	0(0.0)	21(100.0)	
Yes	17(36.2)	30(63.8)	< 0.01
Total	17(25.0)	51(75.0)	
	Ketamine Gargle (n = 72)		
No	0(0.0)	42(100.0)	
Yes	26(86.7)	4(13.3)	< 0.01
Total	26(36.1)	46(63.9)	

* Fisher's Exact test Overall incidence of post-operative throat pain in Males = 43 (100%) Overall incidence of post-operative throat pain in Females = 34 (35.1%)

*Fisher exact test.

***Mean ± SD; Lidocaine jelly = 97.6 ± 38.0 minutes, Ketamine gargle = 93.9 ± 29.6 minutes. Table 7: Time of occurrence of postoperative throat pain among Patients in both study groups

*Fisher exact test Table 8: Incidence of postoperative throat pain in both sexes

* Fisher exact test

Overall incidence of postoperative throat pain in Males = 43 (100%)

Overall incidence of postoperative throat pain in Females = 34 (35.1%)

Overall incidence of post-operative throat pain in the study population = 77 (55.4%)

Disussion

This study has shown that gargling of 40 mg of ketamine for five minutes prior to endotracheal intubation has more beneficial effects when compared to the application of lidocaine jelly in the prophylaxis of postoperative throat pain. Not only did ketamine gargle reduce the occurrence of postoperative throat pain attributable to endotracheal intubation, it also reduced the severity when it occurred. In addition, postoperative throat pain occurred much later, about 19 hours post-intubation when ketamine gargle was used by our patients. This is in contrast with the early onset of postoperative throat pain in patients who had their ETT lubricated with lidocaine jelly.

The incidence of postoperative throat pain of 55.4% in this study is in keeping with previous studies.[12-14] This may be attributable to the method of assessment of postoperative throat pain. Direct questioning technique was used in this study with less emphasis on pain from operative site. Also, proper grading of severity of postoperative throat pain may have contributed to the measured outcome in this study. In addition Christensen's[12] results may have been slightly different probably because of the short duration (< 24hrs) for which postoperative throat symptoms were studied. This might have led to fewer detectable incidences of postoperative throat pain as some patients may have developed throat pain beyond 24 hours of endotracheal intubation as seen in this study. Furthermore, the noted fewer incidence of postoperative, sore throat pain found in the ketamine group compared with the lidocaine group may be attributable to the analgesic and probable anti-inflammatory effects of ketamine. Although the incidence of postoperative throat pain in our study was similar to that of Doukomo and colleagues, there are some differences. While we used different endotracheal tube sizes in relation to the patient's sizes, they restricted the sizes of endotracheal tubes to 8.0 mm for males and 7.0 mm for females in their study.

Controversy exists with context to the effect of gender on the occurrence of postoperative throat pain. While Higgins *et al*.[15] and Ahmed and colleagues[16] reported a female predominance in relation to the development of postoperative throat pain, Stout and colleagues[17] found no gender difference in their study. Our study showed that female patients had higher incidence of post-operative throat pain in the lidocaine group while their male counterparts had a higher incidence in the ketamine group. A possible explanation for the findings of Higgins[15] and Ahmed[16] is the fact that females have narrower airways than males. This could predispose them to postoperative throat pain when intubated. It is however not clear why males had higher incidence of post-operative throat pain in the ketamine group in our study.

Furthermore, we found that the contribution of age to the development of postoperative throat pain was not significant, P = 0.53. In the study of Higgins *et al*.,[15] age in 10 year increments was significantly associated with postoperative throat pain, P < 0.05. They implied that older patients have higher incidence of post-operative throat pain and the risk of development of postoperative throat pain increases as one ages. But in this study, it was noted that there is no significant risk associated with development of postoperative throat pain in those less than or more than 40 years of age (P = 0.22).

We also found that although BMI was not a significant factor (P = 0.37) in the causation of postoperative throat pain, weight of the patients had a significant impact on the incidence of postoperative throat pain, P < 0.03. However, there is presently a paucity of literature on the direct relationship between occurrence of postoperative throat pain and weight. But it may be postulated that an adequate patient height may also translate to adequate length of neck with good extension/flexion movement which may transform into easy of intubation with reduced trauma to oropharyngeal structures and development of postoperative throat pain.

Endotracheal tube size has been shown to be an important contributory factor in the causation of postoperative throat pain. In our study we used sizes 7.0 mm and 7.5 mm internal diameter cuffed low pressure high volume ETT for females and sizes 8.0 mm-9.0 mm for males. These were found to be significant in the causation of postoperative throat pain.(P = 0.01). This observation

was in keeping with the findings of Xu[18] and Stout.[17] While Xu compared the incidence of postoperative throat pain in post-thyroidectomy women who had either sizes 6.0 mm and 7.0 mm internal diameter ETT, with their ETT lubricated with either saline or lidocaine jelly, Stout[17] compared the incidence of postoperative throat pain in men who had their trachea intubated with sizes 9.0 mm and 7.0 mm internal diameter ETT against women who had their trachea intubated with sizes 8.5 mm and 6.5 mm. They concluded that sizes of ETT significantly affected the incidence and severity of postoperative throat pain.

It was also observed in this study that the duration of endotracheal intubation contributed significantly to the development of post-operative throat pain (P = 0.03). More than fifty percent of participants who had endotracheal intubation lasting more than one hour had postoperative throat pain as compared to less than ten percent in those who had who had their trachea intubated for an hour or less. This was in keeping with the finding of previous studies.[3,19,20] Aliya *et al*.[19] demonstrated in their work that the duration of intubation appeared to have a direct relationship with the occurrence of postoperative throat pain. Thirty seven percent of their study population, who had procedures lasting more than two hours, had postoperative throat pains whereas fewer than eight percent of patients who underwent procedures lasting less than one hour developed throat pain post operatively. This might be due to the fact that longer duration of intubation meant longer ETT-mucosal contact which will invariably increase the risk of development of postoperative throat pain.

Lidocaine jelly group recorded higher incidence of moderate and severe postoperative throat pain, 44.1% and 23.5% respectively compared to the ketamine gargle group which recorded 4.2 % and 1% moderate and severe throat pain respectively. This is in keeping with the study of Rudra *et al*.[8] and Canbay and colleagues.[2] In both studies, ketamine gargle was compared against placebo and postoperative throat pain assessment done similarly as in our study. Ketamine gargle had no incidence of severe postoperative throat pain with less than 5% incidence of moderate throat pain.[2] Post-operative analgesia was uniform and the method of pain assessment was also uniform in both of these studies. The lower incidence of moderate and severe postoperative throat pain in the ketamine group may be due to its anti-inflammatory effect.

Our study has also shown the efficacy of ketamine in the prevention of early onset postoperative throat pain. This is evident by the onset of postoperative throat pain predominantly 19 hours after tracheal intubation in the ketamine gargle group and within the first few hours in the lidocaine jelly group. The highest incidence of postoperative throat pain in the lidocaine group was recorded between 7-12 hours post-operatively while in the ketamine group this occurred after 24 hours of extubation. This is in keeping with the finding of Canbay and coworkers.[2]

Study Limitations

This study had some limitations. Despite the minimal dose of ketamine used for gargling in this study and the expectation of minimal systemic absorption, this could not be completely eliminated. Therefore, systemic effect of ketamine, such as analgesia, may have contributed to the outcome of the study, and a major limitation of the index study was the absence of facilities for measurement of plasma ketamine levels.

Despite these limitations, the strength of the findings that ketamine had better prophylaxis against moderate to severe postoperative throat pain adds value to the available evidence for the use of ketamine gargles in prevention of postoperative throat pain.

Conclusion

In this prospective randomized comparative study, the result showed that ketamine gargle provides better prophylaxis against the occurrence of moderate to severe postoperative throat pain. Patients undergoing surgery under general anaesthesia with endotracheal intubation will benefit from ketamine gargle five minutes before induction of anesthesia as prophylaxis against postoperative throat pain.

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Conflicts of interest

There are no conflicts of interest.

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