The Egyptian Journal of Hospital Medicine (October 2023) Vol. 93, Page 7181- 7189

Comparison between Airway Block versus Ketofol during Awake Fibroptic Nasotracheal Intubation in Predicted Difficult Airways

Osama Helal Ahmed, Kareem Abd Elaal Hamed, Randa Asaad Omar Mohammadain
Department of Anesthesia, Intensive Care and Pain Management,
Faculty of Medicine, Al-Azhar University, Assiut, Egypt.
Corresponding author: Randa Asaad Omar Mohammadain, **Mobile:** 01121498004;
Email: randaasaed94@gmail.com

ABSTRACT

Background: A skilled practitioner of localized anesthetic of the airway can facilitate intubation of awake individuals suspected of having difficult intubation due to anatomical variations or airway disease that make direct laryngoscopy of the glottis difficult or impossible. **Aim:** Comparing between the influence of ketofol versus the effect of airway block on intubation conditions during awake fiberoptic nasotracheal intubation regarding; intubation scores, patient tolerance, intubation time, hemodynamic stability, and satisfaction score.

Patients and Methods: Eighty-four individuals were assigned randomly to double groups: as Ketofol group contained 42 diseased persons received intravenous ketofol inwhich the individuals received a loading infusion dose of ketofol 100 mcg/kg/min over ten min until achieving sedation score.

Airway block group contained 42 diseased persons inwhich superior laryngeal nerve block was done followed by awake fibroptic intubation without any sedation.

Results: A notable rise was seen statistically in mean arterial blood pressure (MAP) of patients of AB group at intubation, at 1 minute (min) and at 5 min post-intubation when compared to baseline level. While in the ketofol group, MAP was more stable at intubation, at 1 min and at 5 min post intubation comparing to baseline.

Conclusion: Administration of ketofol combined with topical anesthesia (Spray-As-You-Go technique lidocaine 2%) offered better intubation scores, patient tolerance, lesser intubation time, more hemodynamic stability and greater patient satisfaction than effect of airway block combined with topical anesthesia (Spray-As-You-Go technique lignocaine 2%) on patients during performing awake nasotracheal fiberoptic intubation technique.

Keywords: Ketofol, Airway block, Propofol.

INTRODUCTION

In cases of projected difficulty intubating, compromised airway, lower airway pathology and in cases where neck extension must be avoided, fiberoptic intubation is an invaluable approach for securing the airway [(1)]. Patients receiving intravenous sedative for awake fiberoptic intubation should be cooperative throughout the procedure, nodding off if not yet dispersed, and responsive to verbal directions [(2)].

Desirable outcomes of a successful sedation procedure include patient comfort, cooperation, amnesia, hemodynamic stability, blunt airway reflexes, and patent airway with spontaneous breathing [(3)].

Propofol is an antagonist at N-methyl-D-aspartate receptors in addition to its sedative, hypnotic, and anesthetic properties [(4)].

Ketamine is a neuroleptic anesthetic that acts on NMDA receptors in the thalamus, the cortex, and the limbic system [(5)]. Ketamine and propofol, at varying quantities, form the drug ketofol. It's a go-to for a variety of medical treatments [(4)].

Propofol and ketamine together have several advantages, including hemodynamic stability, freedom from rapid recovery, respiratory depression and effective after procedural analgesia. Both the dose and the combination ratio affect the safety and effectiveness of ketofol as an analgesic agent. Ketofol is a combination medication, and as such, it should be ideally suited for procedural sedation [(6)].

Anesthesia during awake fiberoptic intubation is often provided by nerve blocks. Consequently, anesthetizing the upper airway necessitates the use of three distinct blocks: the glossopharyngeal (oropharynx), the superior laryngeal (larynx above voice cords), and the translaryngeal (larynx and trachea below vocal cords) [(7)].

While a nerve block can be used to anesthetize a patient for awake intubation, it is more technically difficult to do. However, they need blocking more than one nerve, which increases the likelihood of problems such intravascular injection and nerve injury [(7)].

AIM OF THE WORK

- **Primary outcome:** Comparing the effect of ketofol versus airway block nerves on patients' acceptance of endotracheal tube placement using a fiberoptic laryngoscope.
- **Secondary outcomes:** Evaluation of hemodynamic stability by measuring change in Heart Rate (HR), Systolic Blood Pressure (SBP),Diastolic Blood Pressure (DBP),Mean Arterial Pressure (MAP) and peripheral capillary oxygen saturation (SPO_2) percent, evaluation the time during which the Endotracheal Tube (ETT) will be placed, and evaluation of complications.

PATIENTS AND METHODS

This was An interventional prospective observational study conducted on 84 patients of both gender at AL-Azhar university hospitals (Assiut) aged

Received: 30/03/2023
Accepted: 28/05/2023

20-60 years, Scheduled for elective surgeries, Necessitating endotracheal intubation under general Anesthesia in a period from July 2021 to August 2022.
Exclusion criteria:
1- ASA physical state ≥ III.
2- Dental abscesses, Patient with sever airway trauma, infectious and toxic conditions of the neck and airway.
3- Nasal pathology like nasal polyps.
4- Cardiac patients: A-V block, heart failure, severe bradycardia.
5- Coagulation disorders: liver cirrhosis, thrombocytopenia.
6- Respiratory disorders (COPD, Asthmatic).
7- Uncooperative patients.
8- Emergency surgery.

Methods

Preoperative assessment:

Medical history: Conditions such as high blood pressure, diabetes, heart disease, etc. Hospitalization or surgical history. History of airway compromise during anesthesia, or intolerance to anesthetic medications, after prior surgery.

Physical examination: General examination and vital signs. Conditions for example high blood pressure, diabetes, heart disease, etc.

Laboratory investigations: CBC, as well as blood sugar. Time of prothrombin as well as time of partial tissue thromboplastin. Liver function tests (ALT and AST). Evaluation of renal function, including measurement of serum creatinine and blood urea nitrogen. Evaluation of the patient's urine, electrocardiogram (ECG), and chest X-ray.

Pre-anesthetic visit:

The method of awake fiberoptic intubation was described to the cases. Cases gave their informed permission, and they were not allowed to eat or drink anything after midnight of the night before surgery. Before medication with ranitidine tablets (Ranitidine, Medical Union pharmaceutical MUP, Egypt), 150 mg given orally to the patient [8].

Operative management:

In the operating room, intravenous line (I.V.) was secured with wide bore cannula (18 G) (IV Cannula, Ultra Med, Egypt) and multichannel monitor (Drager infinity Vista XL, Drager Medical, China) was applied to record heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), oxygen saturation (SpO_2%), and electrocardiogram (ECG).

Ketofol Group: received intravenous ketofol 0.05 ml/kg, and the mixture was prepared by mixing 40 mg ketamine (ketamine, Sigma Tec, Egypt) and 160 mg propofol (Propofol 1%, Fresenius KABI, Egypt) in 20 ml syringe (the ratio 1:4).

Individuals were given a loading infusion of 100 mcg/kg/min of ketofol for ten minutes until achieving sedation score ≥ 2 evaluated by Modified Observer's Assessment of Alertness/Sedation Scale [9].

Modified Observer's Assessment of Alertness/Sedation Scale: [10]

Scale	Responsiveness
5	Responds readily to name spoken in normal tone
4	Lethargic response to name spoken in normal tone
3	Responds after name called loudly or repeatedly or both
2	Responds only after mild prodding or mild shaking
1	Responds only to painful stimulation
0	No response to painful stimulation

Airway block group: Awake fiberoptic intubation was done without any sedation. Superior laryngeal nerve block was done as fol1ows:

Injections into both sides of the greater cornu of the hyoid bone were the gold standard for blocking the superior laryngeal nerve. The patient was laid down supine, with his or her head stretched as far as it would go. Antimicrobial solution (such betadine (Betadine, El-Nile Co, Egypt) was used to clean the patient's skin.

The cornu of the hyoid bone could be palpated by starting at the thyroid notch and proceeding along the upper border of the thyroid cartilage until reaching the bigger cornu immediately superior to its posterolateral boundary, which is notably prominent in men.

Using the nondominant hand, the anesthesiologist applied contralateral pressure to the hyoid bone to displace it and expose the superior laryngeal nerve and cornu. After then, the anesthesiologist saw the carotid artery's pulse had moved down to the tip of his or her palpating finger.

An anterior inferomedial route was used with a 25-gauge, 5/8-inch needle in order to reach the greater cornu's lateral side.

After that, the needle was walked down toward the midline (1-2 mm) from the lower edge of the greater cornu. This would involve puncturing the thyrohyoid membrane and blocking just the internal branch.

When the needle was retracted slightly after contacting the hyoid, both the internal and external branches of the superior laryngeal nerve would be obstructed. The syringe was then sucked to check for air and blood, and if both were absent, 2 ml of local anesthetic (2% lidocaine) (Debocaine 2%, The Arab Co for Gelatin and Pharmaceutical, Egypt) were administered.

For both groups, Step-by-Step method of topical anesthesia (Spray-As You- Go technique) for nasotracheal intubation was done as followed:

Antisialogogue was administered (atropine 0.4-0.6 mg IV) (Atropine, CID Co, Egypt) at least l0-5 minutes before fiberoptic instrumentation.

Lidocaine 10% spray (Lidocaine 10%, The Arab Drug Co, Egypt) was used to anesthetize the nasal cavity, oral cavity and pharynx.

A generous amount of two percent lidocaine ointment (Lidocaine 2%, Alexandria Co for Pharmaceutical, Egypt) was applied in the nose and ask the patient to take deep inspiration. As the lidocaine ointment was dissolved, it was carried deeper into the nasal floor and nasopharynx and swallowed by the cases.

A 5-mL syringe (Syringe, I. Co, Egypt) containing a solution of 1% lidocaine (Debocaine 2%, The Arab Co for Gelatin and Pharmaceutical, Egypt) was attached to the insufflating port of the flexible bronchoscope (FB-18V, PENTAX Medical, India)

The bronchoscope was advanced till the epiglottis and vocal cords were seen and was proceeded as followed:

After injecting two mL of local anesthetic onto the epiglottis and waiting for fifteen seconds, the scope was advanced (resulting in anesthetization of the epiglottis and superior aspect of the cords). When the scope's tip was at the level of the vocal cords, one mL of local anesthetic was given, and then the scope was advanced for fifteen seconds later (numbing the vocal cords). When the scope's tip was positioned behind the vocal cords, 2 mL of local anesthetic was given (resulting in tracheal anesthesia). The scope was zoomed in until the carina was in view. The endotracheal tube (ETT, Ultra Med, Egypt) was advanced over the fiberoptic scope.

Procedure after failed awake fiberoptic intubation:
After induction with standard doses of propofol (Propofol 1%, Fresenius KABI, Egypt), fentanyl, and Atracurium (Atracurium-hameln, hameln pharma bH, Germany), a fiberoptic bronchoscope was utilized to intubate the cases while they were under general anesthesia (GA) due to the cases's prolonged coughing, discomfort and severe resistance during bronchoscopy or trac.

Assessment Parameters:
Demographic data: as regard to age and gender.

Causes of difficulty of intubation and airway condition: As regard Mallampati >II, thyromental distance, obesity (BMI >30 kg/m^2), protruded tongue and prominent upper teeth.

Intubation score[11]: assessed by: Coughing (1 = none, 2 = slight, 3=moderate. 4 = severe). Limb movement (1 = none, 2 = slight, 3=moderate. 4 = severe).

Patient tolerance[11]: measured by:

5-point fiberoptic intubation comfort score: 1 = no reaction. 2 = slight grimacing. 3 = heavy grimacing. 4 = verbal objection. 5 = defensive movement of head or hands.

3-point post intubation score: 1 = cooperative. 2 = restless / minimal resistance. 3 = severe resistance / general anesthesia required immediately.

Intubation time[11]:
Any hypoxic episode (SpO_2 < 90%) was evaluated, as was the time it took to implant the fiberoptic scope and confirm nasotracheal intubation.

Hemodynamic changes:
The two groups were compared with regards to their resting HR, SBP, DBP, and MAP at four different points throughout the (AFOI procedure): before the anesthetic, during intubation, and at one and five minutes post-tracheal intubation.

Oxygen saturation and arrhythmia:

As regard presence of any hypoxic episodes (SPO_2 % <90%) or any incidence of bradycardia, tachycardia or arrhythmia).

Adverse events: As regard the presence of hoarseness, sore throat.

Satisfaction score:

(1=excellent, 2 = good, 3 = fair, 4 = poor) was evaluated during after surgery checkup which was undertaken the day after operation [11].

Ethical approval:

Approval of research by Ethics Committee of AL-Azhar University (Assiut), Faculty of Medicine was obtained. This study was executed in accordance with the Code of ethics of the World Medical Association (Declaration of Helsinki) for studies on humans. Consent was taken both verbally and in writing from all participants after full explanation of the study.

Statistical Analysis

The following procedures were carried out in relation to the data collection, editing, coding, and entering into IBM SPSS version 23: Numbers and percentages were used to represent qualitative data, whereas mean, and standard deviation were utilized to characterize quantitative data. For continuous variables, independent t-tests will be performing to compare the means of normally distributed data, while Mann–Whitney U tests will be used to compare the median differences of the data that were not normally distributed. Leveen test was used for detection of distribution normality. Ficher exact test and chi-square test were used for categorical data. $P < 0.05$ was considered significant.

RESULTS

Regarding age and gender, no significant difference was found between the 2 studied groups (table 1).

Table 1: Demographic characteristics in both groups

		Airway block group n=42	Ketofol group n = 42	P-Value
Age (years)	**Mean ± SD**	**44.59±7.75**	**45.33±11.60**	**0.779**
Gender	**Male**	**9 (76.9%)**	**15 (69.2%)**	**0.147**
	Female	**33 (23.1%)**	**27 (30.8%)**	

Regrading causes of difficult intubation, there was non-significant deference between the 2 groups (table 2).

Table 2: Diagnosis of cases and causes of difficulty of intubation and airway condition in both groups

	Airway block group n= 42	Ketofol group n = 42	P-Value
Mallampati grading III or IV	**27**	**26**	**0.821**
Thyromental distance < 6.5 cm	**20**	**23**	**0.513**
Obesity, BMI >30 kg/m^2	**29**	**31**	**0.629**
Short neck	**26**	**30**	**0.355**
Protruding tongue	**11**	**11**	**1.000**
Prominent upper teeth	**15**	**14**	**0.818**

There was significant difference between both groups regarding cough severity and limb movement except for the slight limb movement subcategory which showed non-significant difference between the 2 groups. Better results were associated with the Ketofol group (table 3).

Table 3: Intubation scores in both groups

		Airway block group n = 42		Ketofol group n = 42		P-Value
Cough severity	**None**	**0**	**0%**	**22**	**52.4%**	**<0.001***
	Slight	**5**	**11.9%**	**20**	**47.6%**	**0.0007***
	Moderate	**28**	**66.7%**	**0**	**0%**	**<0.001***
	Severe	**9**	**21.4%**	**0**	**0%**	**0.0024***
Limb movement	**None**	**0**	**0%**	**36**	**85.7%**	**<0.001***
	Slight	**9**	**21.4%**	**6**	**14.3%**	**0.57**
	Moderate	**24**	**57.2%**	**0**	**0%**	**<0.001***
	Severe	**9**	**21.4%**	**0**	**0%**	**0.0024***

*: Statistically significant difference

Regrading 5-point score, there was significant difference between the 2groups in the no reaction and heavy grimacing subcategory. Also, there was significant difference between the 2 groups in the 3-point score (table 4).

Table 4: Patient tolerance in both groups

		Airway block group n = 42		Ketofol group n = 42		P-Value
5-point Score	**No reaction**	**0**	**0%**	**27**	**64.3%**	**<0.001***
	Slight grimacing	**10**	**23.8%**	**15**	**35.7%**	**0.34**
	Heavy grimacing	**22**	**52.4%**	**0**	**0%**	**<0.001***
	Verbal objection	**5**	**11.9%**	**0**	**0%**	**0.0551**
	Defensive movement of head or hands	**5**	**11.9%**	**0**	**0%**	**0.0551**
3-point Score	**Cooperative**	**10**	**23.8%**	**42**	**100%**	**<0.001***
	Restless/minimal resistance	**16**	**38.1%**	**0**	**0%**	**<0.001***
	Severe resistance/ general anesthesia required immediately	**16**	**38.1%**	**0**	**0%**	**<0.001***

*: Statistically significant difference

There was significant difference between both groups regarding intubation time (table 5).

Table 5: Mean intubation time (min) in two groups

		Airway block group (n= 36)	Ketofol group (n = 41)	P-Value
Intubation time (min)	**Mean ± SD**	**7.11±2.41**	**5.0±0.66**	**<0.001***

*: Statistically significant difference.

There was significant difference between the 2 groups regarding heart rate during and after intubation however there was non-significant differences regarding the baseline HR (table 6).

Table 6: Heart rate (beat/min) at different times in both groups

Heart Rate (beat/min)		Airway block group (n = 42)	Ketofol group (n = 42)	P-Value
HR (beat/min) at baseline	Mean ± SD	82.11±7.96	80.40±9.12	0.363
HR during intubation	Mean ± SD	113.88±6.22	83.76±7.08	<0.001*
HR at 1 min post-intubation	Mean ± SD	98.33±10.95	72.71±5.36	<0.001*
HR at 5 min post-intubation	Mean ± SD	87.88±10.74	68.35±4.97	<0.001*

*: Statistically significant difference

There was significant difference between the 2 groups regarding SBP, DBP and Mean arterial blood pressure during and after intubation however there was non-significant differences regarding the baseline SBP, and base line mean arterial blood pressure (table 7).

Table 7: Systolic blood pressure (mmHg) at different times in both groups

SBP (mmHg)		Airway block group (n = 42	Ketofol group (n = 42)	P-Value
At baseline	Mean ± SD	123.0±9.48	120.14±7.65	0.132
During intubation	Mean ± SD	156.88±12.38	127.02±9.54	<0.001*
At 1 min post-intubation	Mean ± SD	136.22±19.22	118.28±7.38	<0.001*
At 5 min post-intubation	Mean ± SD	115.88±13.55	108.80±6.40	<0.003*
DBP (mmHg)				
At baseline	Mean ± SD	77.11±9.41	73.00±8.72	0.041*
During intubation	Mean ± SD	101.33±9.31	81.69±10.80	<0.001*
At 1 min post-intubation	Mean ± SD	84.33±16.01	69.76±9.61	<0.001*
At 5 min post-intubation	Mean ± SD	74.88±13.34	60.00±7.32	<0.001*
Mean arterial blood pressure (mmHg)				
At baseline	Mean ± SD	93.33±10.02	88.30±8.28	0.134
During intubation	Mean ± SD	119.88±10.06	96.35±9.69	<0.001*
At 1 min post-intubation	Mean ± SD	99.66±19.19	85.02±8.58	<0.001*
At 5 min post-intubation	Mean ± SD	85.1116.24	75.83±6.57	<0.001*

*: Statistically significant difference

There was significant difference between the 2 groups regarding the incidence of adverse events in including sore throat or hoarseness of voice (table 8).

Table 8: Adverse events among both study groups

Adverse event		Airway block group (n = 42)	Ketofol group (n = 42)		P-Value
Sore throat or hoarseness of voice	+ve	14 (33.3%)	0	0%	<0.001*
	-ve	28 (66.7%)	42	100%	

*: Statistically significant difference

Ther was significant difference between the 2 groups regrading all categories of the patients' satisfaction score (table 9).

Table 9: Patient's satisfaction score among both study groups

patient's satisfaction score	Airway block group (n = 42)		Ketofol group (n = 42		P-Value
Excellent	0	0%	23	54.8%	<0.001*
Good	6	14.3%	19	45.2%	0.0037
Fair	23	54.8%	0	0%	<0.001*
Poor	13	30.9%	0	0%	<0.001*

*: Statistically significant difference

DISCUSSION

Those who are well-versed in localized anesthetic of the airway are able to intubate conscious individuals who are thought to have difficult intubation due to anatomical variations or airway disease that makes it difficult or impossible to see the glottis with direct laryngoscopy. Neurological damage can be prevented by limiting neck mobility in cases of upper airway trauma and cervical spine injury [12].

When managing a challenging airway, flexible fiberoptic laryngoscopy intubation is still the gold standard. Fiberoptic intubation in the awake cases retains a high safety margin and causes minimum patient discomfort, although it does need sufficient local anesthetic of the airway. Under local anesthetic and sedation, several authors have indicated that FOT may be accomplished with great hemodynamic stability [13].

Several regimens of sedation were used previously during practice of awake fiberoptic intubation, e.g., fentanyl, remifentanil, midazolam, propofol, dexmedetomidine, etc. Also, awake fiberoptic intubation was done without sedation by using of local anesthetics in topical anesthesia for airway (Spray-As-You-Go technique) or airway block techniques (e.g., glossopharyngeal nerve block, superior laryngeal nerve block translaryngeal block).

The primary purpose of this study was comparing between the effect of ketofol versus effect of airway block, when both combined with topical anesthesia (Spray-As-You-Go technique), on intubation scores and on tolerance of patients to awake fiberoptic intubation technique.

Advantages of ketofol infusion during AFOI include a special kind of sedation in which cases are still tired but may be woken quickly, are cooperative, and have minimal respiratory impairment. Ketofol's potential has been investigated as both a stand-alone sedative and an adjunctive drug for use in AFOI [14].

Regarding demographic characters, there was no statistically significant variance among the two groups regarding age and gender, where average age in the AB group was 44.59±7.75 years and in the ketofol group mean age was 45.33±11.60 years.

Regarding causes of difficulty of intubation and airway conditions There was no statistically significant variance among both groups regarding causes of difficulty of intubation and airway condition

Regarding intubation scores, cases in the ketofol group experienced significantly better score of cough severity and limb movement. In the group of ketofol, 52.4% of patients had no cough, 47.6% had slight cough, 0% had moderate cough, 0% had severe cough, versus 0%, 11.9%, 66.7%, 21.4% in the group of AB respectively.

Regarding limb movement, the group of ketofol showed that 85.7% of patients had no movement, 14.3% had slight movement, 0% had moderate movement, and 0% had severe movement, versus 0%, 21.4%, 57.2%, and 21 4% in the group of AB respectively.

These results may be explained by the effect of ketofol. Ketofol has the benefit of combination of propofol and ketamine that allows sedation, analgesia and hypnosis; all of which are desirable during AFOI [15].

Liu *et al.* [16] studied ninety mature individuals, who were rated as Level I and Level II by the American Society of Anesthesiologists. These individuals were scheduled to have elective surgery that required orotracheal intubation because of expected airway complications. Remifentanil or ketofol was used to sedate the patients undergoing the modified AFOI technique in a double-blind, randomized pilot study. Results of present study are comparable with results of this study in the ketofol group. As regarding cough severity, they found that 42.2% of patients had no cough versus 52,4% in our study and 35.5% had slight cough versus 47.6% in our study. Regarding limb movement, they found that 46.6% of patients had no movement versus 85.7% in our study and 31.l% of patients had slight limb movement versus 14.3% in our study.

To evaluate the relative efficacy of ketofol and target controlled propofol infusion for sedation during fiberoptic intubation, **Tsai *et al***. [11] conducted a randomized controlled trial. Forty individuals were enrolled and randomly assigned to receive either ketofol (100 mcg/kg) over 10 mm (n=20) or propofol target controlled infusion (n=20) prior to tracheal intubation for elective surgery in which problematic airways were predicted. Our findings are consistent with findings of their study in the ketofol group. Regarding cough severity, they found that 40% of patients had no cough and 45% of patients had slight cough. Regarding limb movement, they found that 60% of patients had no movement and 30% of patients had slight movement.

Both studied groups, in our study, had significant differences in patient tolerance to AFOI, as patients in ketofol group showed better tolerance to intubation than those in group of airway block, regarding 5-point fiberoptic intubation comfort score and 3 point after intubation score. In group of ketofol, 64.3% of patients had no reaction, 35.7% had slight grimacing, 0% had heavy grimacing, 0% had verbal objection, 0% had defensive movement of head and hands, in comparison with 23.8%, 52.4%, 11.9%, and 11.9% in group of AB respectively.

100% of patients of ketofol group were cooperative, 0% were restless (had minimal resistance), 0% had severe resistance, in comparison with 23.8%, 38.1%, 38.1% in AB group respectively.

These findings can be explained by the fact that ketofol induces a cooperative form of sedation in which the patient can be roused from sleep to wakefulness with relative ease, at which point they can perform tasks and communicate and cooperate effectively while being intubated and ventilated, and then fall back to sleep without further stimulation.

Our findings are consistent with findings of **Mondal *et al.*** [17] who compared ketofol 0.06 ml/kg

(Group A) with fentanyl 2 mcg/kg (Group B) and discovered that the ketofol group had improved intubation circumstances and intubation tolerance. The majority of the individuals (28 out of 30) in the ketofol group had a cough score (≤ 2), and only six patients in the ketofol group had a poor post-intubation score (≥ 2).

Our findings are also consistent with those of **Avitsian *et al.*** [14], who reported on a series of clinical cases involving the use of ketofol to induce sleep during awake fiberoptic endotracheal intubation (AFOI). The individuals were quite cooperative during the neurologic assessment that followed intubation. They came to the conclusion that proper sedation, in conjunction with airway topicalization, might be the key to reducing cases discomfort as well as facilitating intubation.

In addition, the results of the current study are comparable to those of **Chu *et al.*** [18], who observed an improved tolerance to intubation without respiratory depression and tipper airway obstruction in the ketofol group (0.05 ml/kg). Ketofol has also been demonstrated to be an efficacious agent for AFOI in certain challenging airway situations [19].

Similarly, **Bergese *et al.*** [20] found that ketofol at 0.05 ml/kg bolus was safe and helpful for patients having AFOI without airway block or topical anesthetic, which is consistent with our findings.

Regarding intubation time, our study showed that mean intubation time was significantly higher in the airway block group than in the ketofol group, where average intubation time was 7.1±2.41 min in the AB group while was 5.00±0.66 min in the ketofol group.

Our results are comparable with **Tsai *et al.*** [11] who found that mean intubation time was 3.8±1.1 min in group of patients receiving ketofol for sedation during awake fiberoptic intubation.

In a study involving fifty adults with cervical spine injuries, **Gupta *et al.*** [21] split the patients evenly between two groups. Group L got ultrasonic nebulization of 10 ml of 4% lignocaine to anesthetize the airway, whereas Group NB received airway blocks (bilateral superior laryngeal and trans tracheal recurrent laryngeal) with 2 ml of 2% lignocaine and thick lignocaine gargles. Orotracheal intubation under fiberoptic bronchoscope (FOB) guidance followed. Their study showed that the time taken to perform FOB guided intubation was less in Group NB (2.05±0.78 min) as compared with Group L (3.34±1.21 min) and this was statistically significant. These results were slightly different from our results where their average intubation time in group of NB was 2.05±0.78 min, our average intubation time in group of AB was 7.11±241 min. That difference may be due to the fact of counting intubation time only for successful attempts of intubation, not all attempts of intubation in their study.

Hemodynamic stability, in our study, was more observed in the ketofol group than the group of airway block. There was no statistically significant variance in HR among both groups at baseline, but there was statistically significant variance in HR between both groups at intubation, at 1 min and 5 min post intubation. In the group of ketofol, average HR was at baseline 80.40±9.12, at intubation 83.76±7.08, at 1 min post-intubation 72.71±5.36, and at 5 min 68.35±4.97, in comparison with 82.11±796, 13.88±6.22, 98.33±10.9, and 87.88± 10.74 in the group of AB respectively.

Also, there was no statistically significant variance in SBP, MAP among both groups at baseline, but there was significant Difference in DBP at baseline and there was statistically significant variance in SBP, DBP, MAP among both groups at intubation, at 1 mm and 5 mm post-intubation.

The results in our study indicated that patients of ketofol group were more hemodynamically stable than patients of AB group, at intubation, at one min and five mm after intubation.

The explanation of these results may be because of synergism among ketamine and propofol. Ketamine it is an analgesic at subdissociative levels, and it has been shown to reduce propofol consumption and preserve hemodynamic stability when administered in combination with propofol [22].

Consistent with the findings of **Kolli** [9], we found that the ketofol group's HR decreased significantly from the baseline value 5 minutes after the I.V. bolus infusion (68.60 ± 7.28). The heart rate of the ketofol group was not significantly different from its pre-intubation value (71.08 b 8.33) during the procedure. The ketofol group consistently had a decreased HR compared to the baseline value.

Baseline value of MAP was 100.14 ± 7.80 in the ketofol group. There was decrease in MAP from the baseline value, it was 95.10 + 8.28 in the ketofol group after five min of bolos infusion. There was a significant decrease in MAP in the ketofol group at various points of time after intubation.

Our findings are consistent with those of a randomized double-blind prospective trial by of **Mondal *et al.*** [17], in which 60 patients undergoing elective laparotomies were split into two groups. Over the course of 10 minutes, those in Group A were given 0.1 ml/kg of ketofol, whereas those in Group B were given 2 mcg/kg of fentanyl. Prior to having AFOI, individuals in both groups were given intravenous glycopyrrolate 0.2 mg, nebulized with 4 ml of 2% lidocaine over 20 minutes, and sprayed with 10% lidocaine. Their study showed minimal increase in MAP in group A (group of ketofol) where it was at baseline 94.43 ± 6.668, post intubation 95.03 ± 4.83. But, the post intubation HR (75 ± 6.48) decreased significantly in comparison with baseline value (77.466 + 5.75).

Yildiz *et al.* [23], who analyzed the impact of a single pre induction intravenous dose of ketofol 0.05 ml/kg on the cardiovascular response resulting from laryngoscopy and endotracheal intubation in 50 patients undergoing elective minor surgery, reported results consistent with our own. A single dosage of ketofol

given before to surgery was shown to lessen the need for opioids and anesthetics as well as to dampen the patient's hemodynamic reactions during laryngoscopy. Additionally, ketofol lowered both blood pressure and heart rate, and sped up postoperative recovery.

Peden *et al.* [24] found that young volunteers experienced bradycardia and sinus arrest after receiving a bolus and infusion of ketofol, and they recommended giving glycopyrrolate before starting the infusion.

Regarding oxygen saturation in blood (SpO_2%), patients of both groups showed no hypoxic episode (SpO_2 < 90%). In the ketofol group, that may be explained because ketofol have minimal effects on ventilation. Ketofol has sedative, analgesic, and anxiolytic effects, but it does not cause ventilator depression like other sedatives and it keeps breathing steady **[25].**

Regarding ECG, patients of ketofol group showed no incidence of bradycardia, arrhythmia or sinus arrest (which are side effects of ketofol infusion observed by **Peden *et al.* [24]** as mentioned earlier, that may be explained because we administered atropine as an antisialogogue before laryngoscopy procedure which prevented such side effect.

While patients of AB group showed sinus tachycardia at time of intubation, which may be explained due to stress response and sympathetic stimulation occurring during tracheal intubation.

Regarding patient's satisfaction score, which was taken one day after the day of operation to follow up the patients of both groups, it showed that in the group of ketofol the score was excellent in 54.8% of patients, good in 45.2%, fair in 0%, poor in 0% versus 0%, 14.3%, 54.8%, 30.9% in the group of AB respectively.

In a randomized, double-blind study of forty individuals undergoing awake fiberoptic nasotracheal intubation, **Hu *et al.* [26]** found that ketofol was more effective than remifentanil.

Similarly, to our research, other studies by **Yildiz *et al.* [27]** have found that ketofol improves laryngoscopy scores, decreases intubation recollection, and increases patient satisfaction, all while having little effects on hemodynamics.

CONCLUSION

Administration of ketofol combined with topical anesthesia (Spray-As-You-Go technique lidocaine 2%) offered better intubation scores, patient tolerance, lesser intubation time, more hemodynamic stability and greater patient satisfaction than effect of airway block combined with topical anesthesia (Spray-As-You-Go technique lignocaine 2%) on patients during performing awake nasotracheal fiberoptic intubation technique.

DECLARATIONS:

- **Consent for publication: I attest that all authors have agreed to submit the work.**
- **Availability of data and material: Available**
- **Competing interests: None**
- **Funding: No fund**
- **Conflicts of interest: no conflicts of interest.**

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