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Original research article

Ketamine versus fentanyl with propofol induction for classic laryngeal mask airway insertion in paediatric patients:Hemodynamic changes

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Abstract

Paediatric LMA is scaled down version of adult LMA and it was not anatomically designed for children. Despite the differences between the adult and the paediatric upper airway anatomy, the LMA has been successfully used in paediatric airway management. A total number of 60 patients of either sex aged 3-11 years belonging to ASA status I-II scheduled for elective surgery under general anaesthesia and satisfying the inclusion criteria was enrolled in the study after taking parental informed, written and valid consent. Patients were randomized into two groups. Group KP (n=30): patients receiving ketamine and propofol for induction. Group FP (n=30): patients receiving fentanyl and propofol for induction. The mean baseline systolic blood pressure (SBP) in Group FP was 112 ± 6.4 mmHg and in Group KP was 111.9 ± 7 mmHg. The readings of subsequent SBP at different time points between two groups were clinically and statistically significant (p value<0.05). The mean SBP measurement was statistically more in ketamine-propofol group compared to fentanyl-propofol group when used for insertion of laryngeal mask airway in children.

Keywords: Ketamine, fentanyl, propofol

Introduction

The LMA is the most widely used SGA and the archetype of the perilaryngeal sealer. It was conceived and designed by Archie Brain, physician and honorary consultant anesthetist of the Royal Berkshire Hospital, England in 1981. It was introduced into clinical practice commercially in 1988[1].

In the first paper on the LMA, Brain described the device as "an alternative to either the endotracheal tube (ETT) or the face-mask with either spontaneous or positive- pressure ventilation (PPV)".At an early stage in the development of LMA the inventor realized its potential in the management of the difficult airway.

In 1981, a prototype of LMA was used in a male patient who underwent inguinal herniorraphy. In 1983, it was used for the first time as an airway rescue for failed intubation in a 112 kg patient with large bowel obstruction[2].

Paediatric LMA is scaled down version of adult LMA and it was not anatomically designed for children. Despite the differences between the adult and the paediatric upper airway anatomy, the LMA has been successfully used in paediatric airway management[3].

There after many changes made in the design and availability of suitable sizes together with favourable clinical experiences have led to the increasing use of LMA in children.Suboptimal positioning of the LMA may be more frequent in children as it is not designed anatomically[4].

Propofol is introduced in 1970 and initial solution of propofol, as released in 1977 in Cremophor EL2. It was withdrawn because of anaphylactic reactions and replaced and reformulated as an emulsion of soya oil. Propofol mixture in water and relaunched in 1986. Today it has become most widely used intravenous hypnotic.

It belongs to group of alkyl-phenols. The alkyl-phenols are highly lipid soluble and are insoluble in an aqueous solution[5].

Most commonly used preparation is 1% propofol, 10% soybean oil and 1.2% purified egg phospholipid added as emulsifier, with 2.25% of glycerol as a tonicity-adjusting agent, and sodium hydroxide to

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change the pH. EDTA was added for its bacteriostatic property.
Propofol has a pH of 7 and appears as a slightly viscous, milky white substance, a result of small lipid droplets in solution. All formulations commercially available are stable at room temperature, are not light sensitive, and may be diluted with 5% dextrose in water[6].
Fentanyl is weak base like all other opioids. When dissolved in solution it dissociates into protonated and free-base fractions, with the relative proportions depending on the pH and pKa. The free-base fraction is more lipid-soluble than the protonated fraction. Fentanyl is highly lipid soluble and has rapid onset of action[7].
Ketamine was synthesized in 1962 by Stevens and was first used in humans in 1965 by Corssen and Domino[8]. Ketamine was released for clinical use in 1970. It produces dissociative anaesthesia rather than generalized depression of the CNS.

Methodology
Approval for this prospective, randomized double blind comparative study was obtained from the institute ethical committee. A total number of 60 patients of either sex aged 3-11 years belonging to ASA status I-II scheduled for elective surgery under general anaesthesia and satisfying the inclusion criteria was enrolled in the study after taking parental informed, written and valid consent. Patients were randomized into two groups.

Group KP (n=30): Patients receiving ketamine and propofol for induction. Group FP (n=30): patients receiving fentanyl and propofol for induction.

Inclusion criteria
- Age 3-11 years.
- American society of anaesthesia (ASA) physical status: 1 and 2.
- Undergoing elective surgeries.
- Informed, written and valid consent by parents or guardians of patients.

Exclusion criteria
- Mouth opening less than 2.5 cm.
- Patients who are at risk of aspiration.
- Patients with reactive airway disease.
- Patients with seizure disorder.
- Patients with anticipated difficult airway.
- Known case of neuromuscular disease.

This study was a prospective, randomized study of individuals satisfying all inclusion criteria. All patients in the inclusion criteria were assessed by an anaesthsiologist a day prior to surgery. Parental informed, valid and written consent was obtained after pre-anaesthetic evaluation. All patients were advised to be nil per oral as per current ASA guidelines 51.
On arrival to the operating room, the patients were allocated into two groups by computer generated random numbers and allocation concealment was done by serially numbered closed envelopes.
1. Group KP (n=30) received ketamine (0.5mg/kg) and propofol (3.5mg/kg).
2. Group FP (n= 30) received fentanyl (2mcg/kg) and propofol (3.5 mg /kg).

Results

Table 1: Comparison of heart rate in bpm at various time intervals between groups

Sl.No.	Heart rate in bpm	Group-1 (N=30)		Group-2 (N=30)		p value*
		Mean	SD	Mean	SD	
1.	T0-preop	108.23	6.4	108.33	7.1	0.95
2.	T1-preinduction	103.73	6.4	115.23	6.8	<0.001*
4.	T2-preinsertion	94.43	6.7	107.43	7	<0.001*
4.	T3-at 1min	95.87	6.8	112.13	7	<0.001*
5.	T4-at 3 min	96.93	6.7	113.50	7.1	<0.001*
6.	T5-at 5min	98.33	6.6	114.03	7.2	<0.001*
7.	T6-at 15 min	93.70	6.1	111.0	7.4	<0.001*
8.	T7-at 30 min	93.37	5.2	109.9	7	<0.001*

Note: # p value based on independent sample t test. * Statistically significant (p<0.05)

The mean heart rate at different time intervals between the two groups. Statistical analysis is done using independent samples t test. The p value is < 0.05 hence there is statistically significant difference

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between theof mean heart rate following preoperative readings between the two group. The mean heart rate was more in ketamine-propofol group than fentanyl-propofol group.

Table 2: Comparison of systolic blood pressure in mm of hg at various time intervals between groups

Sl.No.	Systolicblood pressure	Group-1 (N=30)		Group-2 (N=30)		p value*
		Mean	SD	Mean	SD	
1	T0-preop	112.5	6.4	111.9	7	0.74
2	T1-preinduction	113.8	6.8	121	7.1	<0.001*
3	T2-preinsertion	105.2	7.2	112.8	7.4	<0.001*
4	T3-at 1min	112.9	6.2	118.1	7.9	0.007*
5	T4-at 3min	112.8	5.8	116.8	7.9	0.03*
6	T5-at 5min	112.3	6.2	115.6	7.9	0.08
7	T6-at15min	111.7	6	115.2	6.9	0.04*
8	T7-at 30 min	111.8	6	114.7	7.1	0.09

Note: p value based on independent sample t test. * Statistically significant (p<0.05)

Statistical analysis using independent samples t test shows that there is statistically significant difference between the readings of mean SBP following preoperative readings between the two groups till 5 min and after that it was comparable between two groups(P<0.05). The mean SBP measurement was statistically more in Ketamine-propofol group compared to fentanyl-propofol group when used for insertion of laryngeal mask airway in children.

Table 3: Comparison of diastolic blood pressure in mm of hg at various time intervals between groups

Sl.No.	Diastolic blood pressure	Group-1 (N=30)		Group-2 (N=30)		p value*
		Mean	SD	Mean	SD	
1	T0-Preop	64	4.7	61.2	4.2	0.02*
2	T1-preinductio	59.6	4.6	66.3	4.3	<0.001*
	T2-preinsertion	56.5	4.7	59.4	4.3	0.02*
3	T3-at 1 min	57.8	4.7	62.8	4.2	<0.001*
4	T4-at 3min	56.4	4.8	63.8	4.4	<0.001*
5	T5-at 5min	56.7	4.8	63	4.5	<0.001*
6	T6-at 15min	58.1	4.6	63.3	4.6	<0.001*
7	T7-at 30min	58.6	4.3	62.6	4.4	0.001*

Note: p value based on independent sample t test. * Statistically significant (p<0.05)

The mean DBP at different time intervals between the two groups. Statistical analysis using independent samples t test shows that there is statistically significant difference between the baseline as well as subsequent readings of mean DBP between the two groups (P<0.05). The mean diastolic blood pressure was significantly and consistently higher in ketamine- propofol than fentanyl-propofol group.

Table 4: Comparison of mean arterial pressure in mm of hg at various time intervals between groups

Sl.No.	Meanarterial pressure	Group-1 (N=30)		Group-2 (N=30)		p value*
		Mean	SD	Mean	SD	
1	T0- preop	80.2	5	78.1	5.1	0.11
2	T1-preinduction	77.6	4.9	84.5	5	<0.001*
3	T2-preinsertion	72.7	5	77.2	5	0.001*
4	T3- at 1min	76.2	4.8	81.2	5.1	<0.001*
5	T4- at 3min	75.2	4.8	81.5	5.0	<0.001*
6	T5- at 5min	75.3	4.9	80.5	5.1	<0.001*
7	T6- at 15 min	75.9	4.6	80.6	5.1	<0.001*
8	T7- at 30 min	76.3	4.3	80	4.9	0.004*

Note: p value based on independent sample t test. *Statistically significant (p<0.05)

Statistical analysis using independent samples t test shows that there is statistically significant difference between the readings of mean MAP following preoperative readings between the two groups (P<0.05). The mean MAP was statistically more in ketamine –propofol group compared to fentanyl-propofol when used in insertion of laryngeal mask airway in children.

Table5: Comparison of spo2at varioustimeintervals between groups

Sl.No.	Feature	Group-1 (N=30)		Group-2 (N=30)		p value*
		Mean	SD	Mean	SD	
1	SpO2	100	0	100	0	NA

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Statistical analysis using independent samples t test shows that there is no statistically significant difference in the readings of SpO2 between the two groups (P>0.05). Both the groups are comparable to each other in terms of comparison of SpO2.

Discussion

Hemodynamic parameters were continuously monitored. Values were recorded at baseline, after induction, at the time of insertion, 1min, 3mins, 5 mins, 15 mins then every 15 minutes till end of surgery and post-operatively. HR, SBP, DBP, RR, SpO2 were monitored.

The mean baseline heart rate was 108.23 ± 6.4 in Group FP and 108.33±7.1 in Group KP. Heart rate was assessed at various time intervals after administration of drugs. The readings at subsequent intervals between two groups were found to be statistically significant (p value <0.05). The mean heart rate was more in ketamine- propofol group than fentanyl-propofol group.

The mean baseline systolic blood pressure (SBP) in Group FP was 112 ± 6.4 mmHg and in Group KP was 111.9 ± 7 mmHg. The readings of subsequent SBP at different time points between two groups were clinically and statistically significant (p value<0.05). The mean SBP measurement was statistically more in ketamine-propofol group compared to fentanyl-propofol group when used for insertion of laryngeal mask airway in children.

The mean baseline diastolic blood pressure (DBP) in Group FP was 64 ±4.7 and in Group KP was 61.2 ± 4.2. Changes in the subsequent readings between two groups found to be statistically significant (p value < 0.05). The mean diastolic blood pressure was significantly and consistently higher in ketamine-propofol than fentanyl- propofol group.

The baseline mean arterial pressure (MAP) in Group FP was 80.2 ± 5 and in Group KP was 78.1 ±5.1. Changes in the subsequent readings between two groups found to be statistically significant. (P value <0.05) The mean MAP was statistically more in ketamine-propofol group compared to fentanyl-propofol when used for insertion of laryngeal mask airway in children.

There was no statistically significant difference in readings of SpO_2 between the two groups. (P value > 0.05).

A randomized double blind study conducted by Ranju Singh, MadhurArora and HomayVajifdar, to compare ketamine-propofol and fentanyl-propofol for insertion of laryngeal mask airway in children undergoing elective surgery shown results in consistent with our study with regards haemodynamic parameters[9].

The heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were consistently higher in ketamine group compared to fentanyl group[1].

A randomized, comparative study conducted by Z. Begec *et al*. to compare ketamine or alfentanyl administration prior to propofol anaesthesia and the effects on proseal laryngeal mask airway insertion conditions and heamodynamic changes in children has shown results similar to our study with regards to hemodynamics.

The heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure were higher with ketamine at all measurement points compared to alfentanil and were statistically significant. As exaggerated fall in HR and BP was noted with alfentanil, this study concluded better heamodynamic stability with ketamine and propofol than alfentanil and propofol[10].

Conclusion

The hemodynamic parameters such as the heart rate, the systolic, diastolic and mean arterial blood pressures was found to be significantly more in ketamine-propofol group compared to fentanyl-propofol group after the insertion of LMA.

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