ORIGINAL ARTICLE

A prospective, randomized, controlled trial study of comparison of two techniques for laryngeal mask airway insertion

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ABSTRACT

Introduction: In this study we compared the use of an intravenous propofol/propofol auto-co-induction technique to propofol/midazolam for laryngeal mask insertion. We also studied the incidence of undesirable effects in relation to LMA insertion.

Methodology: In this prospective, randomized, controlled trial study, 60 adults belonging to ASA class 1 and 2 were randomly divided in three groups; Group1- Saline-propofol; Group 2- Propofol-midazolam; Group 3- Propofol-propofol. The induction characteristics reviewing various parameters like the induction dose required, hemodynamic changes and the cost of induction were observed**.** Hemodynamic variables including heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) were recorded at 2, 4 and 6 minutes post induction.

Results: We noticed a decrease in HR, SBP, and DBP & MAP in all 3 groups which was not statistically significant. The total induction dose of propofol in Group 2 (106.3± 21.26 mg) and Group 3 (136.50 ±20.29 mg) was significantly lower than Group 1(159.75 ±31.39 mg) but not statistically different between group 2 and 3. The total cost of induction was significantly reduced in the midazolam co-induction group i.e. Group 2. The number of patients suffering from apnea differed significantly between 3 groups i.e. 12 patients in Group 1, 6 patients in Group 2 and 1 patient in Group 3. No significant difference was seen in 3 groups in incidence of hiccups, excitatory phenomenon or laryngospasm.

Conclusion: Propofol co-induction (Group 2) and propofol auto co-induction is safe alternative to propofol induction and is more cost effective as they decrease the cost of induction. Midazolam co-induction is more economical than propofol **a**uto co-induction.

Key words: Propofol; Midazolam; Co-induction; Laryngeal mask airway; Hemodynamics

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INTRODUCTION

Many drugs e.g. sodium thiopentone, midazolam, and propofol have been evaluated for anesthetic induction and LMA insertion. Evidence suggests that propofol use has shown the best results. However, it also offers certain disadvantages like cardiovascular depression, involuntary movements, and pain during injection. Hence we conducted a thorough research to assess various methods which could help reduce propofol dose and the side effects. These methods included propofol auto induction and propofol co-induction with midazolam. The term 'co-induction' has been used to describe the practice of administering a small dose of a sedative or other anaesthetic agent, either just before or mixed with the

primary agent to reduce the total dose of induction agent[1,2]. Co induction with propofol and midazolam has shown to decrease the total amount of propofol needed for induction along with pain on injection. Addition of midazolam has also been shown to blunt hypertensive response to laryngoscopy[3]. Auto induction or priming principle is the administration of a small dose of induction agent followed by large dose of the same drug. Auto induction of propofol decreases the total dose, pain on injection and side effects and cost of the propofol[4]. Our investigation compares the characteristics of propofol as a sole induction agent with midazolam or propofol as co-induction agents.

METHODOLOGY

After obtaining approval from the ethical committee of the institution, the study was conducted in Department of Anesthesiology and Intensive Care, Govt. Medical College, Jammu (Jammu & Kashmir). Informed consent was obtained from all patients.

Inclusion criteria was adult patients of 20-60 years of age, undergoing elective outpatient surgery under LMA insertion.

Patients currently or recently ingesting benzodiazepines, anti-convulsant, anti-depressant medication, hypersensitive to any of the drugs used, with a known allergy to eggs, with known significant cardiovascular disease were excluded from the study. Pregnant/lactating women were also not included.

On the day of the surgery, the patients were evaluated by an anesthesiologist, a detailed history was taken and a thorough physical examination was made and relevant investigations were checked. The patients were randomized into the following three groups;

Group 1: Saline-propofol group (control): Normal saline 3ml IV was given followed by propofol 0.5mg/kg, repeated every 30 seconds till intubating condition was obtained.

Group 2: Midazolam-propofol group (co-induction): Inj. midazolam 0.03mg/kg was given IV, followed by propofol 0.5mg/kg, which was repeated every 30 seconds, till intubating condition was obtained.

Group 3: Propofol-propofol group (auto induction): Propofol 0.5mg/kg was given IV followed by propofol 0.5mg/kg every 30 seconds till intubating condition was obtained.

The co-induction agent was prepared by a separate anesthesiologist, who did not take part in the study, in a 5 ml syringe. The total volume was made to 3 ml and was covered by paper wraps.

An independent blinded investigator, not directly associated with the study, performed the randomization. It was performed with the generation of table of random numbers. Patients were prepared by overnight fasting.

Patients were taken to the operating room and connected to base line monitors, And the pre induction data for pulse rate, blood pressure, respiration & SpO^2 were noted. Premedication with Inj. Glycopyrrolate 4 μg/kg IV was given 5 minutes prior to the induction in all patients.

The end point of adequate intubating conditions were assessed by jaw relaxation. This and other parameters were assessed by another trained anesthesiologist, who was blinded towards the drug/s being used. A maximum of 3 attempts were made to insert LMA. The position of LMA was checked by observing chest movements and auscultation during gentle IPPV.

Anaesthesia technique: Patients were prepared by overnight fasting; tab. alprazolam 0.25mg was given at bed time to allay anxiety. In the pre-operative suit, patients were given inj. diclofenac 75mg and inj. glycopyrrolate 0.2mg im 45 minutes prior to induction. IV line was established with 18G Teflon venous cannula in a vein on dorsum of the hand or anti-cubital fossa after application of EMLA cream at insertion site ½ hour prior to insertion.

In the operation theater, patients were preloaded with 10ml/kg crystalloids. Patients were pre-oxygenated for 3 min. Anaesthesia was induced in each group as described above. A pre-deflated and well-lubricated LMA was placed by pushing it along the hard palate upto the point of maximum resistance and its position checked as described.

Parameters:

1. HR, SBP, DBP, MAP were recorded at just before induction, then after LMA insertion at 2, 4 and 6 minutes depending upon duration of surgery.
2. Patients' response to LMA insertion was also recorded as follows
   a) Apnea - (absence of respiration for > 30 seconds/ manual ventilation to maintain SpO2 ≥95%)
   b) Hiccups
   c) Laryngospasm
   d) Any excitatory phenomenon i.e. head/limb movements/muscle twitching, was noted.

The patient's response to LMA was graded as follows:

Mild: Settled within 30 seconds without intervention
Moderate: Required incremental doses of induction agent (mouth opening inadequate)

Severe: Succinylcholine was needed for adequate ventilation and oxygenation. Patients who could not beprimary agent to reduce the total dose of induction

agent[1,2]. Co induction with propofol and midazolam has shown to decrease the total amount of propofol needed for induction along with pain on injection. Addition of midazolam has also been shown to blunt hypertensive response to laryngoscopy[3]. Auto induction or priming principle is the administration of a small dose of induction agent followed by large dose of the same drug. Auto induction of propofol decreases the total dose, pain on injection and side effects and cost of the propofol[4]. Our investigation compares the characteristics of propofol as a sole induction agent with midazolam or propofol as co-induction agents.

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Table 1: Demographic characteristics of patients

Parameter	Group 1		Group2		Group3	
	Mean± SD	Range	Mean± SD	Range	Mean± SD	Range
Age (years)	43.40±8.0	30-60	46.95±6.14	32-60	44.60±9.44	29-60
Weight (kgs)	57.45±9.91	40-90	57.55±7.33	50-80	54.05±8.06	40-70
Sex Male:Female	1:19		1:19		1:9	
ASA Grade Grade 1 Grade 2	 19 1		 20 0		 19 1	

Table 2: Pre-operative haemodynamic variables

Parameter	Group1		Group2		Group3	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Heart rate	84.95±9-28	60-100	79.90±7.62	68-94	78±6.22	68-88
Systolic BP	135.65±13.07	118-160	132.45±11.38	109-15	133.85±9.74	108-150
Diastolic BP	80.15±5.44	70-94	81.75±7.36	64.93	80.15±5.44	70-94
MAP	99.95±6.62	87-116	97.21±7.33	82-113	96.95±5.85	84-106
Respiratory rate	15.20±0.95	14-17	14.65±1.29	12-16	14.60±1.09	12-16

p= not statistically significant

given 5 minutes prior to the induction in all patients.

The end point of adequate intubating conditions were assessed by jaw relaxation. This and other parameters were assessed by another trained anesthesiologist, who was blinded towards the drug/s being used. A maximum of 3 attempts were made to insert LMA. The position of LMA was checked by observing chest movements and auscultation during gentle IPPV.

Anaesthesia technique: Patients were prepared by overnight fasting; tab. alprazolam 0.25mg was given at bed time to allay anxiety. In the pre-operative suit, patients were given inj. diclofenac 75mg and inj. glycopyrrolate 0.2mg im 45 minutes prior to induction. IV line was established with 18G Teflon venous cannula

Table 3: Mean heart rates at various intervals

Time (min)	Group 1 (Mean±SD)	Group 2 (Mean±SD)	Group 3 (Mean±SD)
0	84.95±9.28	79.90±7.62	78.00±6.02
2	79.50±6.73	75.05±7.45	74.10±6.82
6	79.50±6.73	75.00±6.29	75.15±5.60

p=statistically not significant

Table 5: Total dose of propofol used for induction

Propofol used	Group1	Group2	Group3
Range(mg)	110-220	75-150	100-180
Mean± SD(mg)	159.75±31.39	106.31±21.26	136.50±20.59

Inter group comparison (Benferroni't'test)
1 vs. 2 – p 0.0001
1 vs. 3 – p 0.014
2 vs. 3 – p 0.001

Table 4: Mean systolic, diastolic and mean blood pressures at various intervals

Time (min)	Group1			Group 2			Group 3		
	SBP mmHg (Mean±SD)	DBP mmHg (Mean±SD)	MBP mmHg (Mean±SD)	SBP mmHg (Mean±SD)	DBP mmHg (Mean±SD)	MBP mmHg (Mean±SD)	SBP mmHg (Mean±SD)	DBP mmHg (Mean±SD)	MBP mmHg (Mean±SD)
0	134.40±12.90	81.90±8.93	99.55±6.62	132.25±11.29	80.45±7.27	97.21±7.33	132.95±9.21	79.45±4.99	96.95±5.85
2	128.50±12.18	78.10±6.10	94.55±7.01	126.08±12.84	75.55±7.40	92.26±8.75	129.05±8.38	77.10±6.20	93.80±5.89
6	129.95±12.03	77.90±4.61	94.55±5.96	124.50±12.34	75.90±7.18	92.26±7.53	128.60±8.26	76.40±5.56	93.65±5.70

SBP=systolic blood pressure, DBP= diastolic blood pressure, MBP= Mean blood pressure
The SBP did fall from baseline but fall was not statistically significant.

Table 6: Response to LMA insertion

Response	Group 1	Group 2	Group 3	Statistical inference
Apnea	12/8	6/14	1/19	X^2 =10.91 p < 0.001
Hiccups	2/18	1/19	1/19	$X^{2=}$ 0.54 p = 0.76
Head movements	3/17	2/18	2/18	$X^{2=}$ 0.44 P = 0.80
Gag reflex	2/18	1/18	2/18	p > 0.005
Coughing	2/18	3/17	2/18	p > 0.005
Limb movements	3/17	2/18	2/18	$X^{2=}$ 0.32 p= 0.85
Inadequate relaxation	0/20	0/20	2/18	--------

All values in the Group columns expressed in number of patients

DISCUSSION:

The use of combination of drugs for induction has been heavily criticized for a long time, however it is now well known that co-induction with drugs is better able to achieve the desired results, e.g. faster onset, low side effects, and lower costs. Co-induction of midazolam and propofol is proven by many researches to act synergistically. This combination not only produces balance of desired vs. adverse effects but also reduces the dose and cost of propofol by up to 50%[6]. Studies have been done comparing intravenous propofol-propofol co induction as an alternative to midazolam-propofol co-induction and propofol induction alone[5].

On induction, we found a significant fall in HR from

Table 7: Ease of LMA insertion

	Ease of insertion		Number of attempts	
	Grade 1 N(%)	Grade 2 N(%)	One N(%)	Two N(%)
Group1	15(75)	5(25)	18(90)	2(10)
Group2	17(85)	3(15)	19(95)	1(5)
Group3	14(70)	6(30)	18(90)	2(10)

Table 8: Total cost of induction drugs (rupees)

	Ease of insertion		Number of attempts	
	Group 1 Mean±SD	Group 2 Mean±SD	Group 3 Mean±SD	Anova
Total cost (Rupees)	127.80±25.11	98.7±18.18	109±16.7	F 10.29

Intergroup Comparison (Bonferroni "t" test)
1 vs. 2--- p .000
2 vs. 3--- p .001
2 vs. 3--- p .340

baseline values in all 3 groups. This is consistent with the work of Cullen who attributed the fall in HR to vagotonic properties of propofol[7]. Cullen showed that lower HR was sustained despite fall in blood pressure, which was probably because of resetting of baroreflex mechanism7. Some other studies also demonstrated a fall in SBP, DBP and MAP when propofol was given; however, other researchers observed no change in HR after propofol induction [8-11]. A fall of 23% in MAP in propofol group and 5% in patients receiving midazolam and propofo[l3,4,12]. This is consistent with our study where we observed a fall in SBP and DBP. This is in contrast to work done by Tzabanr Y (1996) who did not observe any fall in MAP when midazolam was followed by propofo[113].

In our study we found the total mean cost of propofol was Rs 127.80 in Group 1 as against Rs 80.8 in Group 2 and Rs 109.2 in Group 3. Out of 20 patients in Group 1, 12 had apnea as against 6 and 1 in Group 2 and 3 respectively. This is comparable with earlier studies by Wells[14] who reported the incidence to be 14%. Mc Collum[15] reported 11% patients to develop apnea after propofol. In Group 2 lesser number of patients was seen to have excitatory phenomenon as compared to other groups. This is comparable to observation of Kay et al [16] who noted that excitatory phenomenon were more with propofol. Though none of the patients developed laryngospasm which is comparable with the work of Djaiani [4].

Propofol predosing has long been studied by various authors using many different techniques with variable results. It was noted not to reduce the induction dosages for elderly patients[17-18]. The predosing with many other agents has also been studied in an effort to reduce the dose of propofol for hemodynamic stability. Esmolol has also been shown to reduce the propofol required for induction of anaesthesia by 25%, while the addition of ketamine 0.5mg/kg was shown to improve the hemodynamic when compared with fentanyl 1 μg/kg with less prolongation of apnea and is associated with better LMA insertion conditions than placebo[18-20]. In a recent study, Goel S et al concluded that in children, the combination of propofol with ketamine or midazolam produces stable hemodynamic and improved LMA insertion conditions but is associated with delayed recovery[21].

The ease of insertion of LMA and no. of attempts at insertion were comparable in all 3 groups with none of the patients requiring > than 2 attempts. These findings were in accordance with that of Djajanini 4.

Our study, although a very smaller one, also clearly demonstrates the benefit of combining propofol with midazolam. Smaller doses of the same drug before giving the bulk of it reduces the total dose to be used for the desired results.

CONCLUSION

We conclude that midazolam-propofol co-induction and propofol auto- induction, both are safe and better alternatives to propofol induction for LMA insertion.

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History of Resuscitation

The first description of a successful resuscitation is recounted in the Bible, in the Book of Kings. A child of a Shunemite couple complained of a headache and died. The prophet Elisha prayed and then: "…placed himself over the child. He put his mouth on his mouth, his eyes on his eyes, and his hands on his hands, as he bent over him. And the body of the child became warm. He stepped down, walked once up and down the room, then mounted and bent over him. Thereupon the boy sneezed seven times, and the boy opened his eyes".

Hebrew midwife Puah is reported to have "breathed into the baby's mouth to cause the baby to cry...". Exodus 1:15-17

"When necessary, a cannula of gold, silver or another suitable material is advanced down the throat to support inspiration." AVICENNA (Abu Ali Al-Hussein Ibn Abdallah Ibn Sinna) 980-1037

Tossach's feat

"There are some facts, which in themselves are of so great importance to mankind, or which may lead to so useful discoveries, that it would seem to be the duty of everyone under whose notice they fall, to render them as extensively public as it is possible". John Fothegill; 1745.

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