

## A Comparative Evaluation of Nifedipine and Nitroglycerine in Attenuating the Haemodynamic Response to Laryngoscopy and Intubation

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### Abstract

**Background:** Laryngoscopy and tracheal intubation might cause sympathetic response such as hypertension which may be associated with deleterious effects. Thus, prevention and control of these hemodynamic responses are of utmost importance. Nifedipine and Nitroglycerine helps in reducing hypertension. **Objective:** To study and compare the protective effects of sublingual nifedipine and topical Nitroglycerine on pressor responses to laryngoscopy and endotracheal intubation. **Materials & Method:** After ethical clearance certification was obtained, 75 female patients with ASA grade I & II, age range between 22 and 55 years enrolled for elective major gynaecological study were selected. Patients were randomly divided into three groups of 25 each, group I: Control group, group II: Nifedipine 10 mg, sublingually 10 minutes before induction and group III: Nitroglycerine 2%, 2.5 cm topically applied over forehead, 10 minutes prior to induction. Heart rate and blood pressure were recorded just before laryngoscopy and intubation, just after laryngoscopy and intubation at 1, 2, 3, 5, 10, and 15 minutes on a specially made proforma and electrocardiogram was displayed for any arrhythmias. **Results:** The rise in pulse rate after laryngoscopy and intubation was maximum in 40.38% in control group compared to 34.27% and 34.1% in Nifedipine and Nitroglycerine groups respectively. The systolic blood pressure, diastolic blood pressure and rate pressure product increased significantly after laryngoscopy and intubation in all the three groups, maximum in Control group. **Conclusion:** We found that Sublingual Nifedipine was found to be superior to topical Nitroglycerine in controlling hypertensive responses to both systolic blood pressure and diastolic blood pressure.

**Keywords:** Laryngoscopy, Tracheal Intubation, Hypertension, Nifedipine, Nitroglycerine.

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### Introduction

Laryngoscopy and tracheal intubation are noxious stimuli that provoke a transient but marked sympathetic response such as hypertension and tachycardia in anaesthetized patients[1]. In order to decrease the laryngoscopic response topical or intravenous (IV) lidocaine, opioids, inhaled anesthetics, vasodilators, calcium channel blockers or adrenergic blockers have been used successfully[2-6].

Hypertension during intubation in patients may be associated with deleterious effects which may increase the morbidity in such patients and prolonged hospital stay[7]. Thus, prevention and control of these hemodynamic responses are of utmost importance.

Nifedipine is a calcium channel blocker, which reduces blood pressure by dilating peripheral arterioles. Nitroglycerine causes generalized vasodilatation including coronary artery dilatation and the end result is suppression of pressor response.

### Objectives

To study the protective effects of sublingual nifedipine and topical Nitroglycerine on pressor responses to laryngoscopy and endotracheal intubation.

A comparison of the two different methods having different mechanism of actions with control group.

### Materials & Methods

The present study was conducted at SMS Medical College and Hospitals, Jaipur, Rajasthan. The ethical clearance certification was obtained and seventy-five female patients with ASA grade I & II, age range between 22 and 55 years enrolled for elective major gynaecological study were selected for the study. The patients were assessed pre-operatively and informed consent was obtained. Patients with hypertension, ischaemic heart disease, bronchial asthma, ASA III & IV and those with history of cerebrovascular accident, beta blocker drugs were excluded from the study. In operation theatre, intravenous line was started with 5% Dextrose and patients were premedicated with midazolam 0.07 mg Kg<sup>-1</sup> was given at the time of induction. Pre-induction pulse rate, blood pressure and electrocardiogram were recorded as basal values.

Patients were divided at randomly into three groups of twenty-five each.

Group I: Control group

Group II: Nifedipine 10 mg, sublingually 10 minutes before induction

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Group III: Nitroglycerine 0.2%, 2.5 cm topically applied over forehead, 10 minutes prior to induction.

After pre-oxygenation for 5 minutes, induction of anaesthesia was done with 2.5% thiopentone sodium, 5 mg Kg<sup>-1</sup> body weight and endotracheal intubation was facilitated with suxamethonium 2 mg kg<sup>-1</sup> body weight. Anaesthesia was maintained with standard technique. Any patient who required second attempt or took longer time at intubation, was excluded from the study.

Heart rate and blood pressure were recorded just before laryngoscopy and intubation, just after laryngoscopy and intubation at 1, 2, 3, 5, 10, and 15 minutes after laryngoscopy and intubation especially made proforma and electrocardiogram was displayed for any arrhythmias.

On completion of surgery patients were reversed with neostigmine and atropine. Statistical analysis was done by using Student's 't' test and significance was considered at p<0.05.

**Results**

A total of 75 patients were enrolled for the study and the following results were obtained. All three groups were comparable with regards to age and weight and the difference among them is statistically insignificant. Pulse rate was found to be statistically insignificant increased in all the three groups after laryngoscopy and intubation compared to basal value. In all three groups highly significant in pulse rate were seen after laryngoscopy and intubation.

Table 4 shows raised mean systolic blood pressure in all the three groups after laryngoscopy and intubation.

The mean changes in systolic blood pressure after laryngoscopy and intubation in different groups which was maximum in control group while minimum in Nitroglycerine group. The significant rise in systolic blood pressure persisted upto 5 minutes after laryngoscopy and intubation in control and nitroglycerine groups. Systolic blood pressure was reached to basal value at 3 minutes after laryngoscopy and intubation in nifedipine group.

The mean diastolic blood pressure increased in all the three groups after laryngoscopy and intubation.

Changes in diastolic blood pressure after laryngoscopy and intubation were highly significant at different time intervals compared to basal values in all the three groups. The rise in diastolic blood pressure was statistically significant till 15 min after laryngoscopy and intubation in control and Nitroglycerine group but in Nifedipine it reached basal value after 10 min.

The mean rate pressure increased in all the three groups after laryngoscopy and intubation.

A highly significant rise in rate pressure product after laryngoscopy and intubation in all three groups as compared to basal value was observed. Rise was maximum in control group after laryngoscopy and intubation.

**Table 1: Demographic Data**

Groups	Age (years)	Weight (Kg)
Control N = 25	40.16 ± 6.68 (23 – 50)	50.56 ± 5.56 (38 – 64)
Nifedipine N = 25	40.72 ± 8.56 (22 – 55)	50.32 ± 8.9 (38 – 70)
Nitroglycerine N = 25	39.68 ± 6.14 (28 – 52)	50.36 ± 6.46 (40 – 64)

**Table 2: Pulse Rate per minute (Mean ± S.D.)**

S.No.	Time	Groups		
		Control	Nifedipine	Nitroglycerine
1	After pre-medication (basal value)	90.52±14.62	97.8±13.98	95.84±13.58
2	Before Laryngoscopy & intubation	105.32±15.58	116.32±17.04	115.72±11.19
3	Immediately after laryngoscopy & intubation	127.08±14.9	131.32±15.38	128.52±15.27
4	After laryngoscopy and intubation at different time intervals			
	a	116±15.5	128.4±16.23	121.32±14.69
	b	110.64±14.86	124.04±17.11	115.88±13.47
	c	108.32±14.8	119.92±16.98	110±15.47
	d	104.9±15.68	116.12±16.27	105.88±16.53
	e	103.08±14.66	113.92±14.47	104.56±14.7
	f	97.88±11.13	110.72±13.48	101.88±13.76

**Table 3: Mean changes in pulse rate**

S.No.	Observation time	Groups					
		Control		Nifedipine		Nitroglycerine	
		Mean Changes	p value	Mean Changes	p value	Mean Changes	p value
1	Before laryngoscopy & intubation	15.12±11.2	<.001	18.5±14.8	<.001	14.36±14.8	<.001
2	Just after laryngoscopy & intubation	36.56±14.41	<.001	33.52±15.4	<.001	19.16±17.1	<.001
3	After Laryngoscopy & intubation						
	a. 1 min	24.6±15.12	<.001	30.6±15.46	<.001	15.68±15.82	<.001
	b. 2 min	20.36±14.87	<.001	26.24±15.6	<.001	17.36±15.16	<.001
	c. 3 min	19.56±11.3	<.001	22.12±17.7	<.001	14.04±15.2	<.001
	d. 5 min	19.36±8.59	<.001	18.3±16.5	<.001	11.8±17.5	<.01
	e. 10 min	17.92±10.4	<.001	16.12±15.9	<.001	9.28±10.8	<.01
	f. 15 min	7.36±10.04	<.05	12.9±14.6	<.001	3.36±14.1	>.05

**Table 4: Mean Systolic Blood Pressure mmHg (Mean ± S.D.)**

S.No.	Time	Groups		
		Control	Nifedipine	Nitroglycerine
1	After pre-medication (basal value)	134.88±12.26	136.72±11.86	135.2±10.4
2	Before Laryngoscopy & intubation	127.84±26.55	133.04±18.37	133±13.35
3	Immediately after laryngoscopy & intubation	181.44±12.7	167.6±24	167.2±16.46
4	After laryngoscopy and intubation at different time			

	intervals			
	a. 1 min	170.16±11.26	156.68±23.6	165.84±17.6
	b. 2 min	156.12±12.02	146±18.62	154.56±20.04
	c. 3 min	150.24±15.4	138.16±16.1	148.48±15.93
	d. 5 min	146.8±13.94	136.64±17.66	143.28±15.93
	e. 10 min	138.88±14.08	130.32±16.3	137.52±14.18
	f. 15 min	133.68±11.23	124.48±16.6	131.2±12.44

**Table 5: Mean Changes and p value of Systolic Blood Pressure (Compared to Basal Value)**

S.No.	Observation time	Groups					
		Control		Nifedipine		Nitroglycerine	
		Mean Changes	p value	Mean Changes	p value	Mean Changes	p value
1	Before laryngoscopy & intubation	-8.0±11.8	<.01	-3.68±13.1	>.05	-2.16±11.3	>.05
2	Just after laryngoscopy & intubation	46.56±12.4	<.001	30.9±17.7	<.001	30.8±13.4	<.001
3	After Laryngoscopy & intubation						
	a. 1 min	35.28±12.35	<.001	20.96±17.9	<.001	30.6±14.3	<.001
	b. 2 min	22.4±16.7	<.001	9.3±15.2	<.01	19.36±15.8	<.05
	c. 3 min	18.36±15.5	<.001	1.44±13.2	>.05	13.3±13.1	>.05
	d. 5 min	12.4±15	<.01	-0.08±15.56	>.05	8.08±11.9	>.05
	e. 10 min	3.68±13.5	>.05	-6.4±17.59	>.05	2.32±12.8	>.05
	f. 15 min	-1.28±12.3	>.05	-12.24±17.5	<.01	-4±11.13	>.05

**Table 6: Diastolic Blood Pressure mmHg (Mean ± S.D.)**

S.No.	Time	Groups		
		Control	Nifedipine	Nitroglycerine
1	After pre-medication (basal value)	84.4±5.43	86.00±5.24	85.92±5.81
2	Before Laryngoscopy & intubation	89.16±8.44	90.64±12.30	93.36±7.97
3	Immediately after laryngoscopy & intubation	126.56±12.94	111.52±13.84	120.56±9.2
4	After laryngoscopy and intubation at different time intervals			
	a. 1 min	119.92±9.68	106.72±12.57	118.24±9.56
	b. 2 min	111.12±8.89	102±10.45	110.32±10.30
	c. 3 min	108.56±12.31	96.48±12.14	107.68±10.62
	d. 5 min	104.32±9.68	97.04±14.34	103.6±11.61
	e. 10 min	97.6±10.35	92.0±12.2	98.4±10.66
	f. 15 min	91.76±7.49	87.04±12.65	90.4±9.08

**Table 7: Mean changes and p value of Diastolic Blood Pressure (Compared to Basal value)**

S.No.	Observation time	Groups					
		Control		Nifedipine		Nitroglycerine	
		Mean Changes	p value	Mean Changes	p value	Mean Changes	p value
1	Before laryngoscopy & intubation	5.52±8.36	<.05	4.64±10.38	<.001	7.44±9.75	<.001
2	Just after laryngoscopy & intubation	42.16±10.63	<.001	25.52±11.94	<.001	34.64±9.5	<.001
3	After Laryngoscopy & intubation						
	a. 1 min	33.36±9.96	<.001	20.72±10.63	<.001	32.32±10.17	<.001
	b. 2 min	27.2±9	<.001	16±9.64	<.001	27.2±9	<.001
	c. 3 min	24.96±11.44	<.001	11.84±10.77	<.001	24.96±11.44	<.001
	d. 5 min	19.92±9.2	<.001	11.04±13.39	<.001	19.92±9.2	<.001
	e. 10 min	13.2±10.71	<.001	6±12.3	<.05	13.2±10.71	<.001
	f. 15 min	7.68±6.43	v	1.04±12.45	>.05	7.68±6.43	<.05

**Table 8: Rate Pressure Product (Mean ± S.D.)**

S.No.	Time	Groups		
		Control	Nifedipine	Nitroglycerine
1	After pre-medication (basal value)	9203±1812.8	10070.72±1647.98	9809±1482.9
2	Before Laryngoscopy & intubation	10741.8±1944.4	12208.8±2563.66	12154.84±1638.58
3	Immediately after laryngoscopy & intubation	18400±2801.5	17127.44±3107.28	17491±3133.76
4	After laryngoscopy and intubation at different time intervals			
	a. 1 min	15724.52±26.46	15742.48±2894.63	16253.4±2320.9
	b. 2 min	13713±2614.6	14303.8±2196.17	14468.36±2058.76
	c. 3 min	13324.8±26.58	13310.32±2196.26	13317.2±2115.11
	d. 5 min	12465.9±2475.3	12763.24±2206.49	12535.56±2379.52
	e. 10 min	11527.8±2343.3	11933.16±2077.97	11606.04±1663.04
	f. 15 min	10377.5±1675	11201.16±2276	10590.08±1633.99

Table 9: Mean changes and p value of Rate Pressure Products (Compared to Basal value)

S.No.	Observation time	Groups					
		Control		Nifedipine		Nitroglycerine	
		Mean Changes	p value	Mean Changes	p value	Mean Changes	p value
1	Before laryngoscopy & intubation	1636.4±1524.1	<.001	2138.08±2315.29	<.001	2345.84±1804.78	<.001
2	Just after laryngoscopy & intubation	9197.5±2368.3	<.001	7056.72±2905.15	<.001	8402.2±3085.8	<.001
3	After Laryngoscopy & intubation						
	a. 1 min	6521.2±2578	<.001	5671.76±2442	<.001	6444.4±2488.26	<.001
	b. 2 min	4643.1±2536.5	<.001	4233.08±2062.35	<.001	4659.36±2117.77	<.001
	c. 3 min	4193.67±2539.9	<.001	3239.6±2238.67	<.001	3508.2±2156.13	<.001
	d. 5 min	3518.5±2087.4	<.001	2692.52±2217.24	<.001	2726.56±2448.2	<.001
	e. 10 min	2798.7±1936.6	<.001	1862.44±2269.37	<.001	1797.04±1951.4	<.001
	f. 15 min	1704.8±1265.8	<.001	1130.44±2426.47	<.05	781.08±1966.98	>.05

## Discussion

Since years the anaesthesiologist and pharmacologist have been in search of the drug which may attenuate the cardiovascular effects of laryngoscopy and intubation. There is an urgent need to find the suitable drug of choice as more and more patients with cardiovascular system diseases are presenting themselves for surgery. Keeping the above facts in mind the current study was taken up to find the safest and most effective drug to reduce the harmful cardiovascular effects of laryngoscopy and intubation.

During the study the effects of Nifedipine and Nitroglycerine were compared with control group for changes in heart rate, blood pressure and rate pressure products after laryngoscopy and endotracheal intubation. The differences between the three groups in relation to age and body weight were found to be statistically non-significant. Normal variation of heart rate was seen when the patients were brought to the operation room. In all the three groups heart rate was settled after premedication as the anxiety and apprehension factors were eliminated. These were taken as the basal value.

A significant increase in heart rate was observed in all three groups before laryngoscopy, to be more specific after induction. The rise in heart rate was maximum in Nitroglycerine group.

The rise in pulse rate after laryngoscopy and intubation were highly significant in all the three groups when compared with the basal value. It was maximum in 40.38% in control group compared to 34.27% and 34.1% in Nifedipine and Nitroglycerine groups respectively. This increase in pulse rate may be due to two reasons. First is cardiac stimulation as a result of sympathetic overactivity and also perhaps administration of glycopyrrolate with thiopental sodium. Similar studies in which rise in heart rate during endotracheal intubation in untreated patients was reported by Regmi & Singh[8] (2018), Kumari et al[9]. (2016) and Singh et al[10]. (2018) reported rise in pulse rate in Nitroglycerine group.

In Nifedipine group no protective effect on reflex tachycardia during laryngoscopy and intubation. The results were supported by Manne & Paluvadi[11] (2017). The systolic blood pressure and diastolic blood pressure increased significantly after laryngoscopy and intubation in all the three groups. The rise systolic blood pressure was 46.56 mmHg (34.52%), 30.88 mmHg (23.78%) and 30.8 (22.58%) in Control, Nifedipine and Nitroglycerine groups respectively.

The rise of diastolic blood pressure was of greater degree in control group 42.16 mmHg (49.9%), compared to basal value i.e., after premedication. Rise of diastolic blood pressure in Nifedipine and Nitroglycerine were 25.52 mmHg (29.67%) and 34.64 mm Hg (40.3%) respectively.

Our results were in agreement with the studies conducted by Helfman SM et al.[12] (1991) and Sahare KK et al.[13] (1977)

The rate pressure product is an indirect measure of myocardial oxygen consumption calculated by multiplying the heart rate and mean arterial pressure.

In all the three groups the rate pressure product settled down after premedication. Significant rise was observed after induction of anaesthesia in all the three groups. Rate pressure product was maximum immediately after laryngoscopy and intubation and rise in the control group was maximum (99.9%) and persisted upto 15 minutes. While in Nifedipine and Nitroglycerine groups the rise in rate pressure product was 70% and 85.6% respectively. Similar observations were reported by Jain P et al.[14] (1997).

## Conclusion

There was significant rise in pulse rate, systolic blood pressure and diastolic blood pressure in all the three groups after laryngoscopy and intubation, it was maximum in the control group. The rise in systolic blood pressure persisted upto 5 minutes after laryngoscopy and intubation in Control and Nitroglycerine group while it persisted upto 3 minutes in Nifedipine group. The rise in diastolic blood pressure persisted upto 15 minutes in Control and Nitroglycerine group while Nifedipine group it persisted upto 10 minutes.

The rate pressure product increased in all the three groups. Electrocardiogram monitoring did not show any dysarrhythmia in any of the patient. There was marked tachycardia in Nifedipine pre-treated patients.

Thus, to conclude, it can be said that sublingual Nifedipine was found to be superior to topical Nitroglycerine in controlling hypertensive responses to both systolic blood pressure and diastolic blood pressure.

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