

COMPARISON OF INTRAVENOUS LIGNOCAINE AND MAGNESIUM SULPHATE FOR ATTENUATION OF PRESSOR RESPONSE DURING TRACHEAL INTUBATION

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ABSTRACT: BACKGROUND: Laryngoscopy and Endotracheal intubation are the heart of airway management. But it induces stress response which is very detrimental for the patient. Various drugs are been tried to reduce this stress response. Magnesium Sulphate and lignocaine is been tried to reduce the pressor response during laryngoscopy and endotracheal intubation. **AIM:** To compare the effectiveness of Magnesium sulphate and lignocaine to reduce the pressor response during tracheal intubation. **STUDY DESIGN:** Controlled clinical trial was undertaken which included three groups having fifty patients in each group. **METHOD:** ASA I patients were included in the study. In Control group [group 1] normal saline 10 ml was given 1 min before induction. In magnesium sulfate [group 2] 50% in dose of 50mg/kg diluted in 10 ml magnesium sulfate was given 1min before induction over a period of 1min. In lignocaine group [group3] lignocaine 2% [xylocard] was given in the dose of 1.5mg /kg diluted in 10 ml, 90 seconds before induction. Haemodynamic changes were noted in all the three groups. **STATISTICAL ANALYSIS:** The students paired[t] test was used in statistical analysis. **RESULT:** Both the drugs produced tachycardia and hypotension. Increase in pulse rate in [group 2] was 20.44% which was comparatively more and statistically significant to 7.55% increase in pulse rate produced by lignocaine. Reduction in systolic blood pressure in lignocaine group was 13.23% which was more and statistically significant to 5.25% decrease produced by magnesium sulphate. Reduction in rate pressure product was due to attenuation of hypertensive response alone in magnesium sulfate group. Whereas attenuation of both hypertensive and tachy cardiac response contributed to decrease in rate pressure product in lignocaine group. **CONCLUSION:** It can be concluded that magnesium sulfate is effective in protecting against the hypertensive response alone, while lignocaine is effective in attenuating both tachycardiac and hypertensive response associated with tracheal intubation.

KEYWORDS: Endotracheal, Intubation, Laryngoscopy, Lignocaine, Magnesium Sulphate.

INTRODUCTION: There are new advances in each and every aspect of anaesthesia. Laryngoscopy and endotracheal intubation^[1] till today is the gold standard for airway management. But this evokes a stress response which is exhibited in the form of changes in heart rate, blood pressure and there can be arrhythmias.^[2,3]

During laryngoscopy there is compression of the soft tissues of epipharynx. It is due to afferent stimulation of vagus^[4] and sympathoadrenal response.^[5]

The increase in pulse rate and blood pressure occurring during laryngoscopy and intubation is not so harmful in normotensive patients as it is in hypertensive patients.^[6] In those

patients sympathoadrenal stimulation with sudden rise in heart rate and blood pressure can lead to left ventricular failure, myocardial ischaemia, cerebral haemorrhage, pulmonary oedema, ruptured cerebral aneurysm, leaking or dissection of aortic aneurysm, increase in intracranial pressure. It can lead to convulsions in pre-eclamptic patients undergoing intubation.

Due to such life threatening conditions various attempts have been made at different levels to attenuate the cardiovascular responses. Magnesium sulfate which is an established agent of anti-consultant in eclampsia is recently under trial for its utility in reducing cardiovascular effects associated with tracheal intubation, when used in relatively small doses.^[7,8] Intravenous lignocaine is also under trial for the last few years for the same purpose.^[9,10,11,12] In the present we have tried to compare the efficiency of intravenous lignocaine and magnesium sulfate for above purpose in normotensive patients.

METHOD: Purpose of study was to compare the effectiveness of intravenous lignocaine and magnesium sulfate in attenuating the cardiovascular responses associated with tracheal intubation in normotensive patients. For this purpose a controlled clinical trial was undertaken at Indira Gandhi Government Medical College and Hospital, Nagpur, during the period from January 1996 to April 1997.

The study was carried out in 3 groups of patients. One group served as control and other two groups of patients were subjected to the trial for the drugs under study. Each group included 50 adult patients of either sex ranging in age from 18-50 years belonging to ASA class I, undergoing various types of elective surgical procedures. All the patients were thoroughly examined during pre-operative visit. Patients anticipated to have difficult airway, intubation problem, and known history of allergy to lignocaine were not included in the study. All the patients in each group underwent necessary investigations. This included routine urine examination, estimation of Hb%, serum creatinine, blood sugar, blood urea in addition chest X-ray, and ECG were done depending upon individual patients' requirements.

Premedication was uniform for all the patients in the three groups in the form of tablet diazepam 5mg orally with a sip of water one to one and half an hour before anaesthesia. Patients from trial groups were given I. V magnesium sulfate 50% in doses of 50 mg/kg over a period of 1 min, 3 mins, before induction of anaesthesia and I. V lignocaine (2% which is available as preparation xylocard containing lignocaine hydrochloride 21.3 mg/ml). No preservative was used. 1.5 mg/kg I. V lignocaine was given over a period of one minute, 90 secs before induction. Anaesthetic technique was same for all the three groups of patients.

INDUCTION OF ANAESTHESIA: After pre-oxygenation for three minutes all the patients were given intravenous thiopentone till the disappearance of eyelash reflex, followed by intravenous suxamethonium 2mg/kg to facilitate tracheal intubation. Following the induction of apnoea patients were ventilated on mask using high oxygen flow rate until the disappearance of fasciculation. Laryngoscopy was carried out with McIntosh curved blade laryngoscope. Oral intubation was achieved with red rubber cuffed tube of appropriate size. **NOTE:** Study included only those patients in whom intubation was achieved in single attempt within 30 seconds. Surgical stimulation was not allowed until 5 minutes after intubation.

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Maintenance of Anaesthesia: Anaesthesia was maintained with (N₂O+O₂) (66:33) and 0.5-1% halothane in semi-closed circle system. Ventilation was controlled using Pancuronium as non-depolariser, initial dose being 0.08 mg/kg body weight. At the end of surgery the residual neuromuscular block was reversed with neostigmine and atropine in the usual manner. Intravenous fluid and/or plasma volume was given as per requirement. Observations were made as under:

Record of systolic blood pressure and pulse rate at following time intervals.

1. Basal level.
2. After magnesium sulfate and lignocaine in trial groups.
3. After induction.
4. At laryngoscopy.
5. Just after intubation.
6. Two mins after intubation.
7. Five mins after intubation.

In addition observations were made for other effects of lignocaine and magnesium sulfate such as any untoward response to the drug, difficulty in reversing neuromuscular block attributable to magnesium sulfate, reduction in severity of the fasciculation following suxamethonium after magnesium sulfate pretreatment. Routine observations of pulse and systolic blood pressure were made throughout anaesthesia until the recovery of the patient for every 5 minute interval.

The mean value for systolic blood pressure and pulse rate observed at different time interval for the study were derived and percentage change of these values over basal values were calculated. Rate pressure product at all the above stages of observation was also calculated. The data were subjected to statistical analysis to know whether the difference between the three groups were statistically significant or not.

RESULTS: The demographic profile of the patients and preoperative physical status were comparable in all the three groups.

In doses mentioned above both the drugs produced tachycardia and hypotension. Increase in pulse rate in magnesium sulfate group was 20.44% which was comparatively more and statistically significant to 7.55% increase in pulse rate produce by lignocaine.

Tachycardia in magnesium sulfate group persisted, mean values for pulse rate were maintained high above the control values until 5 minutes after intubation and the drug proved to be ineffective in attenuating the tachycardiac response associated with tracheal intubation. In fact the increase in pulse rate in magnesium sulfate group was statistically significant at 5 minutes and very highly significant at laryngoscopy and 2 minutes after intubation.

Lignocaine which produced lesser degree of tachycardia was effective in protecting against the tachycardia response at all-time intervals from laryngoscopy until 5 minutes after intubation. The decrease in mean value in comparison to control group were statistically significant at all these time intervals.

Reduction in systolic blood pressure in lignocaine group was 13.23% which was more and statistically significant to 5.25 % decrease in systolic blood pressure produced by magnesium

sulfate. Hypertensive response was attenuated by magnesium sulfate from laryngoscopy until 5 minutes after intubation but decrease in comparison to control group was statistically significant after intubation only, indicating maximum attenuation at this stage. Attenuation of hypertensive response by lignocaine was observed only after laryngoscopy and intubation. At laryngoscopy there was insignificant increase in systolic blood pressure in comparison to control level. There after decrease in systolic blood pressure was statistically significant until last observation viz. 5 minutes after intubation.

Reduction in rate pressure product was due to attenuation of hypertensive response alone in magnesium sulfate group. Whereas attenuation of both hypertensive and tachycardiac response contributed to decrease in rate pressure product in lignocaine group. Reduction in rate pressure product in magnesium sulfate was statistically significant just after intubation only, whereas it was so at all-time interval in lignocaine group. The difference between both trial groups was statistically significant even at laryngoscopy when attenuation of hypertensive response was absent.

DISCUSSION: Pharmacological agents are amongst the various methods which help to attenuate pressor response during endotracheal intubation. These include deep general anaesthesia,^[5] translaryngeal nerve block, superior laryngeal nerve block and laryngotracheal lidocaine^[13,14] transtracheal lidocaine,^[11,15] IV sodium nitroprusside,^[16] topical nitroglycerine^[17] etc.,

In this study we have tried to compare the effectiveness of magnesium sulphate and lignocaine for attenuation of pressor response to laryngoscopy and tracheal intubation by conducting a controlled clinical trial.

The increase in pulse rate after pretreatment in magnesium sulfate group was 20.44 % and 7.55 % in lignocaine group respectively above the basal level. The mean increase in both groups were statistically very highly significant ($P < 0.001$) over the basal level. The difference between the 2 groups were also found to be statistically very highly significant ($P < 0.001$).

It might be expected that magnesium sulfate would decrease the pulse rate by inhibition of calcium mediated depolarizing current in pace maker tissue, an effect has been demonstrated in isolated animal heart.^[18] However in the intact animal, the ability of magnesium to inhibit the release of acetylcholine from the vagus nerve predominates and therefore, the overall effect to the mild increase in heart rate is seen in this study. The fall in blood of pressure may be attributed to the vasodilator effect of magnesium sulfate.

Our observations regarding the effects of magnesium sulfate on pulse rate are in agreement with those of James et al.^[19] However the mean increase of 13 ± 3.9 beats / min found by these workers is comparatively less than the mean value of 17.80 ± 7.28 Beats / min in our study, in spite of the fact that the dose of magnesium sulfate used by those workers was higher than that used in our study. In their study the drug has been used after induction, dose of diazepam is also double than dose used in our study. These reasons as well as difference in time at which basal record was made may account for the disparity in magnitude of increase in pulse rate in 2 groups.

The increase in pulse rate in lignocaine group is correlating with the finding of Mounir et al.^[9] The mean percentage rise in their study was 8.5% while in our study with lignocaine pretreatment it was 7.55%. Thus the difference between the 2 groups is not statistically significant.

The tachycardia in magnesium sulfate which caused vagal inhibition although there was greater fall in systolic blood pressure in magnesium sulfate group after induction as compared to control group. The tachycardia produced by lignocaine was reduced after induction of anesthesia and the systolic blood pressure was further reduced. It was due to the central nervous system depressant, such as general anesthetic which inhibited the indirect stimulant effect of lignocaine. The mean pulse rate was lowest in control group than the other 2 groups and systolic blood pressure was lowest in lignocaine group than the other two groups.

There was reduction of systolic blood pressure after pretreatment by 5.25% and 13.23% in magnesium sulfate and lignocaine group respectively. The difference between the 2 groups for systolic blood pressure was statistically very highly significant ($P < 0.001$). There was increase of pulse rate after induction of anaesthesia by 1.36%, 20.44% and 4.36% in control, magnesium sulfate and lignocaine group respectively than the basal level.

The difference for the mean pulse rate in magnesium sulfate group was statistically very highly significant than control group ($P < 0.001$). Whereas in the lignocaine group it was statistically not significant. The difference of pulse rate between magnesium sulfate and lignocaine group was statistically very highly significant ($P < 0.001$).

There was decrease of systolic blood pressure after induction of anaesthesia by 4.31%, 7.08% and 18.98% in control group, magnesium sulfate and lignocaine group respectively. The mean systolic blood pressure was statistically not significant in magnesium sulfate group as compared to control group. But it was statistically very highly significant in lignocaine group as compared to control group ($P < 0.001$). The difference between magnesium sulfate and lignocaine group was statistically very highly significant ($P < 0.001$).

At laryngoscopy the percentage increase in pulse rate in control and magnesium sulfate group were 6.32% and 20.34% respectively, while the percentage decrease in lignocaine group was 1.76% as compared basal level. The increase in magnesium sulfate group was statistically very highly significant as compared to control group ($P < 0.001$). Thus there was no attenuation of tachycardiac response by magnesium sulfate but the same was not true for lignocaine.

The percentage increase of systolic blood pressure at laryngoscopy in lignocaine group was 1.99%. While the percentage decrease in control and magnesium sulfate group were 2.62 % and 2.1% respectively. Thus there was attenuation of pressor response by magnesium sulfate at laryngoscopy, although the decrease of systolic blood pressure was statistically not significant than the control group. But there was no attenuation of pressor response by lignocaine but the mean increase in systolic blood pressure in lignocaine group was statistically not significant than the control value. The difference of mean systolic blood pressure between magnesium sulfate and lignocaine group was statistically not significant.

Immediately after intubation the mean pulse rate was found to be greater in comparison to basal values in all groups. The increase control group and magnesium sulfate group was 26.88% and 21.99% above basal value. In lignocaine group, the percentage increase in pulse

rate was 11.47% over basal level. There was no attenuation of tachycardiac response by magnesium sulfate. The decrease in lignocaine group was statistically very highly significant than the control group ($P < 0.001$).

The percentage increase in systolic blood pressure recorded just after intubation in control, magnesium sulfate and lignocaine group was 28.82%, 10.43% and 2.65% respectively. There was reduction in blood pressure in both trial groups. The blood pressure remained above the basal level, which was statistically very highly significant in magnesium sulfate group ($p < 0.001$) and highly significant in lignocaine group ($p < 0.001$). Thus there was attenuation of pressor response by both the trial drugs.

Calcium exerts a major role in stimulus response coupling including the release of catecholamines from the adrenal gland and adrenergic nerves terminals in response to sympathetic stimulation. Magnesium, because it competes with calcium for membrane channel has been described as the physiological calcium antagonist and can modify many calcium mediated response. The ability of magnesium ions to inhibit the release catecholamines from both adrenal glands and peripheral adrenergic nerves terminals have been known for 25 years and is now well established in laboratory experiments.

The improved control of blood pressure in the magnesium group was probably therefore due to a combination of vasodilator effect of the ion and inhibition of catecholamine release. It might be argued that magnesium is producing effect by a central sedative mechanism crosses the blood brain barrier with difficulty and has little or no central sedative effect even at much higher doses than those in the present study.

Lignocaine has a direct cardiac depressant and also vasodilating effect on the peripheral circulation reported by Mounir et al.^[9]

It has direct action on innervating autonomic nerves and evoked reflexes. It also has central depressant action which is also helpful to reduce blood pressure. Lignocaine readily crosses blood brain barrier causing due to its stabilizing action on the cell membrane.^[20]

The mean increase in pulse rate in control, magnesium sulphate and lignocaine group over the basal level was 16.12 ± 4.24 beats/min, 17.14 ± 8.89 beats/min and 4.24 ± 9.14 beats/min resp at 2 min after intubation. The difference between group 2 and 3 was statistically very highly significant [$P < 0.001$]. The percentage increases in systolic blood pressure at 2 min after intubation in control and magnesium sulphate group was 12.44% and 22.25% resp. While the percentage decrease in lignocaine group was 6.96%. Thus the difference between group 2 and 3 was statistically highly significant [$P < 0.01$].

The percentage increase of pulse rate at 5 mins after intubation in control and magnesium sulphate was 10.49% and 11.76% resp. The percentage decrease in lignocaine group was 1.6%. The difference between group 2 and 3 was statistically highly significantly [0.01]. There was increase of 2.50% in systolic blood pressure in control group 5 mins after intubation. There was decrease of 3.35% and 12.93% in group 2 and 3 resp in BP. And difference was statistically very highly significant [$P < 0.001$].

Observations were made for other effects attributed to the use of the drugs. The fasciculation following suxamethonium appeared to be less severe in magnesium sulphate treated patients. Clinically there was no evidence to suggest that neuromuscular block produced by

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pancuronium was prolonged by magnesium sulphate. Also there was no difficulty in reversing the block in any of the patients. Some patients complained of warm sensation at the time of receiving I V magnesium sulphate. This was considered to be due to vasodilatation produced by the drug. Only 2 patients when given lignocaine had a feeling of dizziness which is due to depression of CNS by lignocaine. There was no other effect clinically evidenced due to lignocaine.

CONCLUSION: Magnesium sulphate is effective in protecting against the hypertensive response alone, while lignocaine is effective in attenuating both tachycardiac as well as hypertensive response associated with tracheal intubation. Both the drugs are free from side effects.

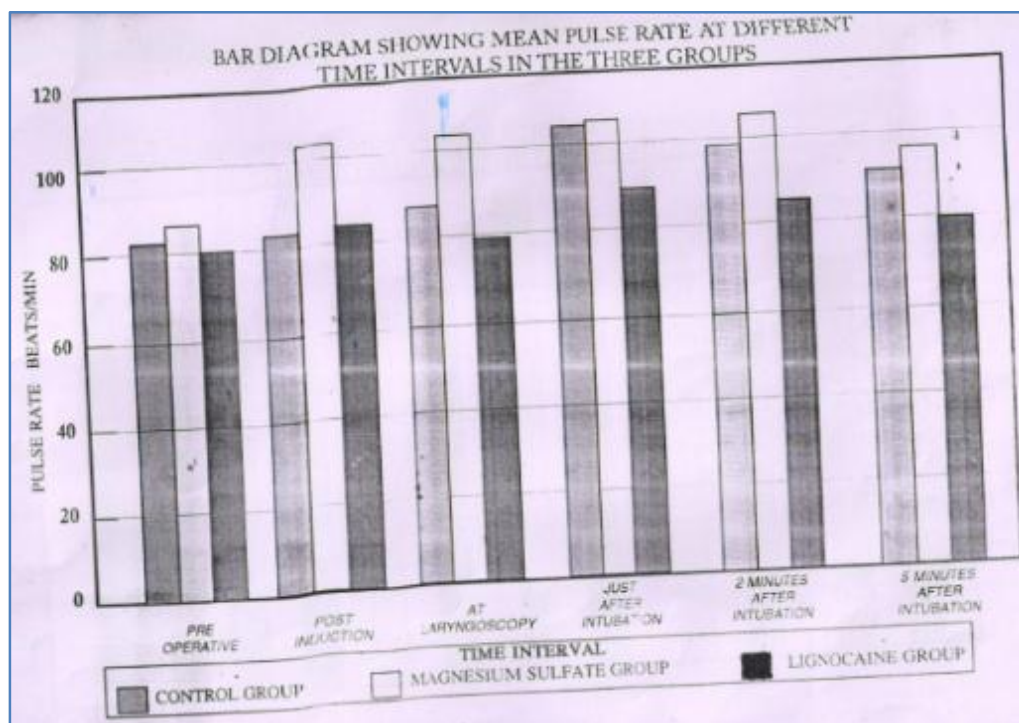
At the end it is worth mentioning that both these drugs if at all, they should be used with great caution in normotensive patients.

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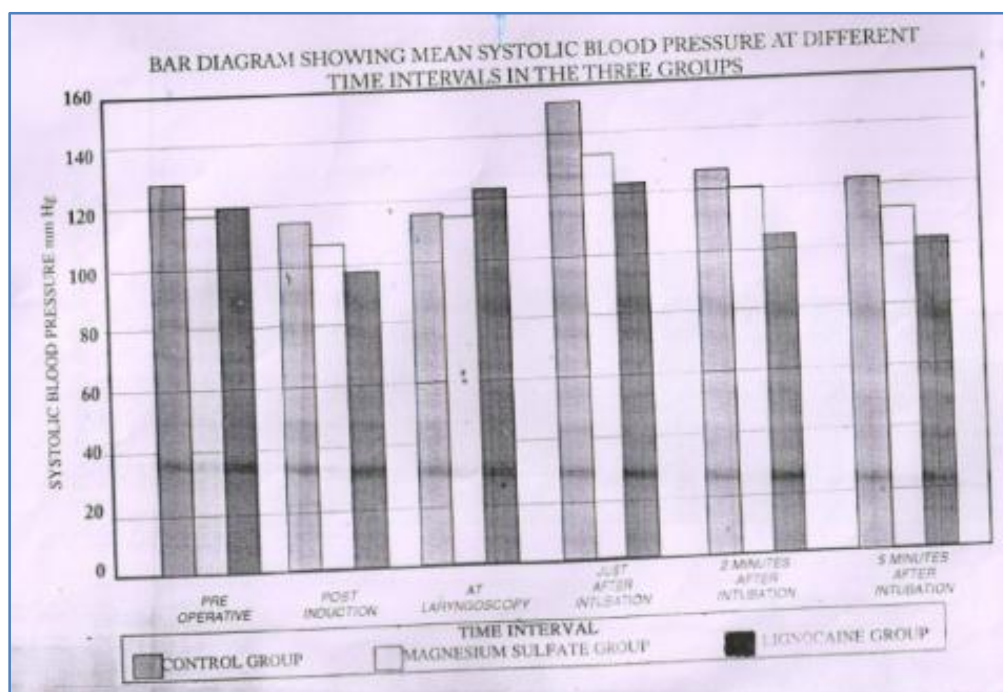
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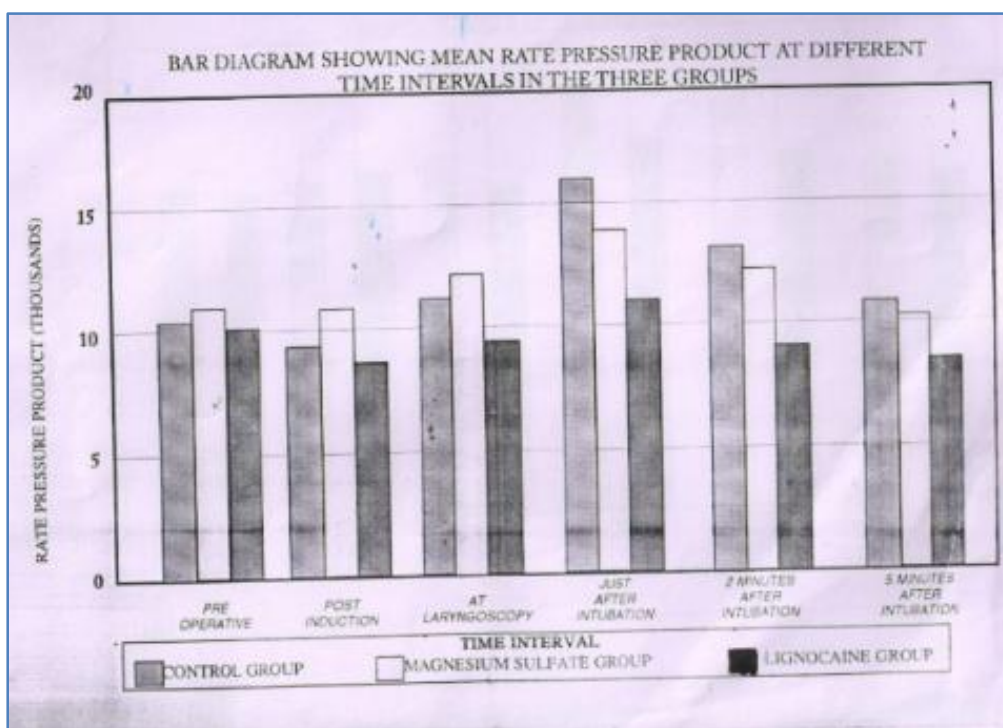
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Graph 1



Graph 2



Graph 3

TABLE I
Mean (± S.D.) Pulse rate Beats /Min. (& % Changes Over Basal Record)

Group	Basal	Post Mgso4 (Preinduction)	Post lignocaine (Preinduction)	Post Induction	At Laryngoscopy	Just after Intubation	2 Minutes after intubation	5 Minutes after intubation
Group I Control	83.48 ± 13.98			84.62 ± 10.47 (+ 1.36%)	88.76 ± 10.57 (+ 6.32%)	105.92 ± 15.83 (+ 26.88%)	99.4 +10.3 (+ 19.07%)	92.24 +11.26 (+10.49%)
Group II MgSo ₄	87.08 ± 11.16	104.88 ± 13.55 (+20.44%)		104.88 ± 12.82 (+ 20.44%)	104.8 ± 12.17 (+20.34%)	106.16 +12.53 (+ 21.91%)	106.46 +0 (+22.25%)	97.32 +12.63 (+11.76%)
Group III Lignocaine	81.56 ± 7.88		87.72 ± 8.56 (+ 7.55%)	85.12 ± 7.28 (+ 4.36%)	80.12 ± 5.90 (-1.76%)	90.92 +6.13 (+ 11.47%)	86.48 +5.54 (+ 6%)	80.12 +6.75 (-1.76%)

TABLE II
Mean (± S.D.) Systolic blood pressure mmHg (and % changes over basal record)

Group	Basal	Post Mgso4 (preinduction)	post lignocaine (preinduction)	post Induction	at Laryngoscopy	Just after intubation	2 minutes after intubation	5 minutes after intubation
Control	128.6 ± 11.38			115.4 ± 0 (- 4.31%)	117.44 ± 22.5 (-2.62%)	155.36 + 18.03 (+28.82%)	135.6 +15.12 (12.44%)	123.62 + 4.39 (+2.50%)
MgSo ₄	119.24 ± 9.57	112.98 ± 11.16 (-5.25%)		110.8 +8.02 (-7.08%)	116.64 ± 10.54 (-2.1%)	131.68 +14.26 (+ 10.43%)	122.72 ± 10 (+2.92%)	115.24 +7.74 (-3.35%)
Lignocaine	120.6 ± 7.93		104.64 ± 4.47 (+13.23%)	97.8 ± 4.18 (- 18.90%)	123 ± 6.776 (+1.99%)	+123.8 + 6.59 (+2.65%)	86.48 + 10.55 (+ 6.96%)	80.12 + 8.86 (12.93%)

TABLE III
Mean (± S.D.) rate pressure product (and % changes over basal record)

Group	Basal	Post Mgso4 (preinduction)	post lignocaine (preinduction)	post Induction	at Laryng- oscopy	Just after intubation	2 minutes after intubation	5 minutes after intubation
Control	10342.84 ±144024			9602.24 +1413.26 (-7.16%)	11022.04 +271.63 (+6.36%)	16629.98 +3068.6 (+60.79%)	135.28 +2329.6 (+30.79%)	11238.8 +1853.78 (+8.66%)
MgSo ₄	10430.96 ±1771.59	11882.38 +984.03 (+13.90%)		11612.60 +1760.20 (11.38 %)	12243.60 +1947.41 (17.38%)	14042 +2526.79 (+34.62 %)	12787.28 +1820.42 (+22.69%)	11189.2 +1732.50 (+7.27%)
Lignocaine	10178.86 ±No3.77		9265.80 +1013.77 (-8.96%)	8330.8 +858.70 (-18.15%)	9884.4 +1117.76 (-2.89%)	112363.04 +1045.48 (+10.65%)	9671.2 +750.09 (-4.98%)	8441.8 +1199.18 (-0.08%)

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