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Effect of Magnesium Sulphate on intraoperative hemodynamic responses in laparoscopic cholecystectomy

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Abstract:
Background: *Laryngoscopy and intubation are mandatory for patients undergoing general anesthesia. Direct laryngoscopy and intubation along withpneumoperitoneum with carbon dioxide (CO_2) insufflation for laparoscopic surgery cause afferent sympatho-adrenal response, this causes increase in blood pressure (BP), heart rate (HR) and cardiac arrhythmias in some patients.Magnesiumsulphate has been recently shown to have a potential to prevent such harmful responses.*
Aim*: To evaluate the efficacy of administration of magnesium sulphate to attenuate hemodynamic responses due to laryngoscopy, intubation and pneumoperitoneum during laparoscopic surgery.*
Methods*: After taking informed consent, 60 patients were systematicallyrandomised into two groups of 30 each. Patients were kept NPO 8 hours prior and given Tablet Alprazolam 0.25mg and Omeprazole 20 mg at bed time day before surgery and morning of surgery.Group1 received Magnesium sulphate 50 mg/kg in 250 ml of isotonic 0.9%N.S intravenously over 15 to 20 minutes in the preoperative room and Group II ,Same volume of isotonic 0.9%N.S iv. over 15 to 20 minutes ,before shifting the patient immediately afterwards to the operation room.*
Results: *Magnesium sulphate pretreatment in a dose of 50 mg/kg body weight intravenously before laryngoscopy and intubation effectively attenuates hemodynamic responses during intubation and pneumoperitoneum during laparoscopic cholecystectomy.*
Conclusion: *Magnesium sulphate effectively attenuates hemodynamic responses during intubation and pneumoperitoneum during laparoscopic cholecystectomy.*
Key Words*: Magnesium Sulphate, hemodynamic responses, Laparoscopic Cholecystectomy*

I. Introduction:

Laryngoscopy and intubation are mandatory for patients undergoing general anesthesia. Direct laryngoscopy and intubation causes afferent vagal stimulation and efferent sympatho-adrenal response, this causes increase in blood pressure (BP), heart rate (HR) and cardiac arrhythmias in some patients. These reflex changes in cardiovascular system are most marked and lead to average increase in blood pressure by 20-40% and increase in heart rate by 20%.[1]Usually these changes are well tolerated by healthy individuals. However these changes may be fatal in patients with hypertension, coronary artery disease, intracranial hypertension and aneurysms.[2]

Pneumoperitoneum with carbon dioxide (CO_2) insufflation for laparoscopic surgery induces abrupt elevations of arterial pressure and systemic vascular resistance with no significant change in heart rate possibly due to an increase in intraperitoneal pressure and stimulation of the peritoneum by CO_2,and due to humoral mediators like catecholamines, prostaglandins, the renin-angiotensin system, and vasopressin which cause an increase in systemic vascular resistance.[3][4][5]These disturbances could be mediated both mechanically and humorally, mechanically by increased venous resistance, compression of the abdominal aorta contributing to the increase in cardiac afterload and tilting the patient to the head-up position reducing venous return.[6][7]

Magnesium blocks the release of catecholamines from both adrenergic nerve terminals and the adrenal gland and i.v. magnesium sulphate inhibits catecholamine release associated with tracheal intubation .[8] Moreover, magnesium produces vasodilatation by acting directly on blood vessels and high-dose magnesium attenuates vasopressin-stimulated vasoconstriction and normalizes sensitivity to vasopressin. studies have suggested that magnesium can inhibit catecholamine release in vitro and in vivo.[9] Magnesium also has endothelium derived nitric oxide induced vasodilatory effect and produces vasodilatation by directly acting on

the blood vessels by interfering with a wide range of vasoconstrictor substances.[10] Nitric oxide causes activation of guanylcyclase and increase in cyclic guanine monophosphate, which mediates the relaxation of vascular smooth muscles. Magnesium is now regarded first and foremost as a cardiovascular drug with calcium antagonistic and antiadrenergic properties that may be accompanied by minimal myocardial depression.

The present study was designed primarily to study the effects of Magnesium Sulphate on patient's hemodynamic responsesbefore induction andduring pneumoperitoneumin laparoscopic cholecystectomy.

II. Methods

After obtaining informed patient consent and approval from institutional ethical committee, this randomized control trial was conducted between May 2010 to May2013in a tertiary care medical college hospital. Study included 60 patients divided into two groups of 30 each, of ASA grade I and II of either sex between the age of 18-65 years, undergoing laparoscopic cholecystectomy under general anesthesia with endotracheal intubation after a detailed preanesthetic check up

Following patients were excluded from the study;

- Anticipated difficult intubation.
- ASA grade III or greater.
- History of consumption of antihypertensive drugs, sedatives, Hypnotics and antidepressants preoperatively.
- Pre-existing cardiovascular disease, significant respiratory, renal And hepatic disorder.
- Patients on treatment with calcium channel blockers or Magnesium.
- History of drugs or alcohol abuse.
- Pregnant women.

Patients were prepared by 8 hours preoperative fasting, receiving Tablet Alprazolam 0.25mg and Omeprazole 20 mg at bed time day before surgery and morning of surgery. After obtaining informed consent, patients were randomly allocated into two groups using computer-generated Microsoft excel programme.The two groups of patients received the following treatment in the preoperative room, monitors were attached to the patients and all parameters like heart rate, noninvasive blood pressure, oxygen saturation and ECG were recorded.

Group I. Magnesium sulphate 50 mg/kg in 250 ml of isotonic 0.9% sodium chloride solution were administered intravenously over 15 to 20 minutes in the preoperative room, immediately before induction of anesthesia.

Group II. Same volume of isotonic 0.9% sodium chloride solution intravenously over 15 to 20 minutes in the preoperative room just before induction of anesthesia.

During the administration of the preoperative medication patients pulse, blood pressure, and oxygen saturation were monitored. The anesthesiologistsin charge of intraoperative management and those responsible for postoperative observation of patient were not aware of the treatment given before anesthesia in the preoperative room (Magnesium Sulphate or normal saline).After this a Ringer lactate infusion at rate of 10ml /kg was started through the intravenous 18G or 20G cannula inserted in a peripheral vein and patients were shifted immediately to operation room along with proper monitoring of vitals, which is continued. Injection Ondansetron 0.1mg/ kg and Fentanyl 0.5 µg/kg was given 5 minutes before induction. After 3 minutes of preoxygenation, anesthesia was induced with Propofol 2.0 mg/kg body weight over 30 seconds and injection Atracurium 0.5 mg/kg body weight. All intubations were performed after 3 min, by experienced anesthesiologist. The duration of laryngoscopy and intubation was limited to minimum possible time being similar to all patients. Depending upon the type and duration of surgery all the patients were maintained with 33% Oxygen, 66% Nitrous oxide, 0.4% Halothane and Atracurium 5mg as intermittent boluses. Anesthesia was supplemented with 10-20 mg Propofol if there was any sudden increase in heart rate and blood pressure. The additional supplements were made note of in patient record form. During surgery CO2 pneumoperitoneum was established and maintained at a pressure of around 12-14 mm Hg by an automatic insufflation unit till the completion of surgery. The surgical technique used was identical in the two groups. Arterial pressure and heart rate was measured before induction (baseline); after intubation, before pneumoperitoneum (P0) and at 5(P5), 10(P10), 20(P20), and 30(P30) min after commencement of insufflations.

At the end of the surgery residual neuromuscular blockade was reversed with injection Neostigmine 0.05mg/kg and injection Glycopyrolate 0.01mg/kg and patient extubated. All the observations made in the study were compared for each parameter within the group and intergroup comparison. All the data obtained was analyzed and subjected to subsequent statistical analysis using, student Independent T- test were intergroup means were compared, paired T- tests for intragroup comparisons and Chi Square tests were non-parametric data was compared.

III. Results

We studied 60 patients divided into two groups of ASA grade I and II of either sex between age of 18-65 years, who underwent laparoscopic cholecystectomy under general anesthesia with endotracheal intubation Parameters like heart rate, noninvasive blood pressure (SBP, DBP and MAP) and oxygen saturation were monitored before administration of study drug, after administration of study drug, before induction, after intubation, before pneumoperitoneum and 5 ,10, 20 and 30 minutes after pneumoperitoneum in both groups. Any adverse increase in hemodynamic response during surgery was treated by propofol administration and was made note of.

The difference of age, sex, weight, ASA grading and duration of surgery were statistically non-significant. (p> 0.05 which is not significant)

IV. Effect On Heart Rate:

The mean ± SD values of heart rate in Group I and II are shown in Table No 1.

Table 1:

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II
BEFORE MEDICATION		76.43 ± 8.858	76.43 ± 6.719
AFTER MEDICATION		76.50 ± 9.012	76.30 ± 7.680
BEFORE INDUCTION (BASE-LINE)		75.83 ± 8.554	74.50 ± 7.436
AFTER INTUBATION		76.13 ± 8.645	98.50 ± 6.684
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	76.60 ± 8.046	78.17 ± 6.347
	5 MINUTES AFTER PNEUMOPERITONEUM	75.13 ± 8.705	77.77 ± 7.947
	10 MINUTES AFTER PNEUMOPERITONEUM	76.43 ± 8.916	78.50 ± 5.824
	20 MINUTES AFTER PNEUMOPERITONEUM	77.13 ± 7.938	78.07 ± 7.007
	30 MINUTES AFTER PNEUMOPERITONEUM	75.53 ± 8.464	78.60 ± 6.856

The values before medication, after medication and before induction (baseline) were comparable with no statistical significant difference among them. There was an increase in heart rate in Group II (control) only at, after intubation, due to laryngoscopy and intubation, which was statistically significant. It was gradually and uneventfully corrected with administration of Halothane. No such change was seen in Group I (Magnesium sulphate group).

Heart rates at different time intervals during insufflations (upto 30 min) remained comparable within the two groups as shown in Table No 2.

Table 2: Inter Group comparison (Ivs II) of Mean Heart rate (min^{-1})

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II	Group I vs II	
				't' value	p value
BEFORE MEDICATION		76.43 ± 8.858	76.43 ± 6.719	0.000	1.000
AFTER MEDICATION		76.50 ± 9.012	76.30 ± 7.680	0.093	0.927
BEFORE INDUCTION (BASE-LINE)		75.83 ± 8.554	74.50 ± 7.436	0.644	0.522
AFTER INTUBATION		76.13 ± 8.645	98.50 ± 6.684	11.211	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	76.60 ± 8.046	78.17 ± 6.347	0.837	0.406
	5 MINUTES AFTER PNEUMOPERITONEUM	75.13 ± 8.705	77.77 ± 7.947	1.224	0.226
	10 MINUTES AFTER PNEUMOPERITONEUM	76.43 ± 8.916	78.50 ± 5.824	1.063	0.292
	20 MINUTES AFTER PNEUMOPERITONEUM	77.13 ± 7.938	78.07 ± 7.007	0.483	0.631
	30 MINUTES AFTER PNEUMOPERITONEUM	75.53 ± 8.464	78.60 ± 6.856	1.542	0.128

Unpaired (independent) 't' test (NS: p > 0.05; Not Significant; p < 0.05; Significant;) .The difference in mean heart rates at various intervals was found to be statistically significant only at, after intubation, rest were non significant.

This shows magnesium sulphate attenuated the hemodynamic response of increase in heart rate during intubation. This observation was similar to James et al study , which concluded that magnesium sulfate attenuates the catecholamine mediated responses after tracheal intubation improving control of heart rate and blood pressure in the magnesium group.[8]

Within group II, the changes in mean heart rate at various intervals after intubation and during insufflations (upto 30 min.) as compared to base-line, were higher and statistically significant. Within group I difference in mean heart rate at various intervals with respect to base-line were found to be statistically not significant as in Table No 3.

Table 3: Intra Group comparisons (within Group I and II) of Mean Heart rate (min^{-1})

TIME		MEAN±SD Group I	Intra Group p value Compared with BI	MEAN±SD Group II	Intra Group p value Compared with BI
BEFORE MEDICATION		76.43 ± 8.858	_	76.43 ± 6.719	_
AFTER MEDICATION		76.50 ± 9.012	_	76.30 ± 7.680	_
BEFORE INDUCTION (BASE-LINE)		75.83 ± 8.554	_	74.50 ± 7.436	_
AFTER INTUBATION		76.13 ± 8.645	0.398	98.50 ± 6.684	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	76.60 ± 8.046	0.407	78.17 ± 6.347	0.017
	5 MINUTES AFTER PNEUMOPERITONEUM	75.13 ± 8.705	0.481	77.77 ± 7.947	0.030
	10 MINUTES AFTER PNEUMOPERITONEUM	76.43 ± 8.916	0.555	78.50 ± 5.824	0.005
	20 MINUTES AFTER PNEUMOPERITONEUM	77.13 ± 7.938	0.247	78.07 ± 7.007	0.009
	30 MINUTES AFTER PNEUMOPERITONEUM	75.53 ± 8.464	0.806	78.60 ± 6.856	0.003

Paired 't' test (NS: p > 0.05; Not Significant; p < 0.05; Significant; p <0.001: Highly significant. Within group II difference in mean heart rate at various intervals compared to base-line were higher and statistically significant. Whereas, within group I difference in mean heart rate at various intervals with respect to base-line were found to be statistically not significant.

These results were comparable, which suggested that i.v magnesium sulphate before pneumoperitoneum attenuates arterial pressure and heart rate increase during laparoscopic cholecystectomy.[11]

Effect On Blood Pressure

The mean ± SD values of systolic blood pressure (SBP) in Group I and II are shown in Table No 4.

Table 4 :

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II
BEFORE MEDICATION		129.20 ± 7.871	128.27 ± 7.372
AFTER MEDICATION		126.90 ± 8.973	128.93 ± 8.917
BEFORE INDUCTION (BASE-LINE)		127.27 ± 9.059	126.60 ± 8.826
AFTER INTUBATION		128.80 ± 7.125	152.07 ± 7.634
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	128.87 ± 8.617	140.43 ± 6.745
	5 MINUTES AFTER PNEUMOPERITONEUM	128.30 ± 8.571	140.00 ± 6.422
	10 MINUTES AFTER PNEUMOPERITONEUM	129.07 ± 9.262	140.17 ± 6.455
	20 MINUTES AFTER PNEUMOPERITONEUM	128.83 ± 8.726	139.73 ± 6.858
	30 MINUTES AFTER PNEUMOPERITONEUM	129.27 ± 8.246	140.70 ± 6.374

Above table shows differences in mean systolic blood pressure at different time intervals within and among group I and II.

The values before medication, after medication and before induction (baseline) were comparable with no statistical significant difference among them. In between the two groups the difference in mean systolic blood pressures at various intervals after intubation and during insufflation(upto 30 min), were found to be statistically significant, the values being higher in group II as compared to group I as in Table No 5.

Table 5 : Inter Group comparison (I vs II) of Mean systolic blood pressure (mmHg)

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II	Group I vs II	
				't' value	p value
BEFORE MEDICATION		129.20 ± 7.871	128.27 ± 7.372	0.474	0.637
AFTER MEDICATION		126.90 ± 8.973	128.93 ± 8.917	0.880	0.382
BEFORE INDUCTION (BASE-LINE)		127.27 ± 9.059	126.60 ± 8.826	0.289	0.774
AFTER INTUBATION		128.80 ± 7.125	152.07 ± 7.634	12.165	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	128.87 ± 8.617	140.43 ± 6.745	5.789	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	128.30 ± 8.571	140.00 ± 6.422	5.984	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	129.07 ± 9.262	140.17 ± 6.455	5.385	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	128.83 ± 8.726	139.73 ± 6.858	5.379	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	129.27 ± 8.246	140.70 ± 6.374	6.008	0.000

Unpaired (independent)'t' test (NS: p > 0.05; Not Significant; p < 0.05; Significant; p<0.001:Highly significant). With the exception of before medication, after medication and before induction which were non significant. The rest difference in mean systolic blood pressures at various intervals were found to be statistically significant, the values being higher in group II as compared to group I.

This increase was corrected with the administration of halothane and propofol to avoid any adverse consequences if and when needed.

Within group II the changes in mean systolic blood pressure at various intervals, after intubation and during insufflation (upto 30 min) compared to base-line were statistically significant. Whereas, within group I difference in mean systolic blood pressures at various intervals, after intubation and during insufflation with respect to base-line were found to be statistically not significant as shown in table 6.

Table 6: Intra Group comparisons (within Group I and II) of Mean Systolic blood pressure (mmHg)

TIME		MEAN±SD Group I	Intra Group p value Compared with BI	MEAN±SD Group II	Intra Group p value Compared with BI
BEFORE MEDICATION		129.20 ± 7.871	_	128.27 ± 7.372	_
AFTER MEDICATION		126.90 ± 8.973	_	128.93 ± 8.917	_
BEFORE INDUCTION (BASE-LINE)		127.27 ± 9.059	_	126.60 ± 8.826	_
AFTER INTUBATION		128.80 ± 7.125	0.052	152.07 ± 7.634	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	128.87 ± 8.617	0.247	140.43 ± 6.745	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	128.30 ± 8.571	0.283	140.00 ± 6.422	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	129.07 ± 9.262	0.108	140.17 ± 6.455	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	128.83 ± 8.726	0.262	139.73 ± 6.858	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	129.27 ± 8.246	0.145	140.70 ± 6.374	0.000

Paired 't' test. (NS: p > 0.05; Not Significant; p < 0.05; Significant; p <0.001: Highly significant). Shows the intra-group comparison of mean systolic blood pressure within group I and II. Within group II difference in mean systolic blood pressure at various intervals compared to base-line were statistically significant. Whereas, within group I difference in mean systolic blood pressures at various intervals with respect to base-line were found to be statistically not significant.

Results were comparable to study which suggested that i.v magnesium sulphate before pneumoperitoneum attenuates increase in arterial pressures during laparoscopic cholecystectomy.[11]
The mean ± SD values of mean diastolic blood pressure (DBP) in Group I and II are shown in Table No.7

Table 7 :

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II
BEFORE MEDICATION		69.13 ± 8.153	70.47 ± 6.907
AFTER MEDICATION		66.63 ± 7.968	68.30 ± 7.438
BEFORE INDUCTION (BASE-LINE)		67.73 ± 7.825	66.83 ± 6.374
AFTER INTUBATION		67.93 ± 8.221	94.73 ± 5.759
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	67.67 ± 8.053	90.23 ± 6.426
	5 MINUTES AFTER PNEUMOPERITONEUM	78.50 ± 6.962	88.23 ± 6.334
	10 MINUTES AFTER PNEUMOPERITONEUM	77.93 ± 6.690	87.80 ± 7.863
	20 MINUTES AFTER PNEUMOPERITONEUM	79.27 ± 6.838	89.87 ± 6.107
	30 MINUTES AFTER PNEUMOPERITONEUM	77.83 ± 8.200	87.83 ± 7.076

Above table shows differences in mean diastolic blood pressure at different time intervals within and among group I and II.

The values before medication, after medication and before induction (baseline) were comparable with no statistical significant difference among them. In between the two groups the difference in mean diastolic blood pressures at various intervals after intubation and during insufflation (upto 30 min), were found to be statistically significant, the values being higher in group II as compared to group I as in table 8.

Table 8: Inter Group comparison (Ivs II) of Mean diastolic blood pressure (mmHg)

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II	Group I vs II	
				't' value	p value
BEFORE MEDICATION		69.13 ± 8.153	70.47 ± 6.907	0.683	0.497
AFTER MEDICATION		66.63 ± 7.968	68.30 ± 7.438	0.838	0.406
BEFORE INDUCTION (BASE-LINE)		67.73 ± 7.825	66.83 ± 6.374	0.488	0.627
AFTER INTUBATION		67.93 ± 8.221	94.73 ± 5.759	14.624	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	67.67 ± 8.053	90.23 ± 6.426	11.997	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	78.50 ± 6.962	88.23 ± 6.334	5.664	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	77.93 ± 6.690	87.80 ± 7.863	5.235	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	79.27 ± 6.838	89.87 ± 6.107	6.333	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	77.83 ± 8.200	87.83 ± 7.076	5.057	0.000

Unpaired (independent) 't' test (NS: p > 0.05; Not Significant; p < 0.05; Significant; p <0.001: Highly significant)

Above table shows Observations before medication, after medication and before induction were non significant .Rest the difference in mean diastolic blood pressures at various intervals were found to be statistically significant .

Within group II (control), the changes in mean diastolic blood pressure at various intervals, after intubation and during insufflation (upto 30 min) compared to base-line were statistically significant. Whereas, within group I difference in mean diastolic blood pressures at various intervals with respect to base-line were found to be statistically significant with exception of, after intubation and before pneumoperitoneum which were both not significant statistically as shown in Table No 9.

Table 9 : Intra Group comparisons (within Group I and II) of Mean Diastolic blood pressure (mmHg)

TIME		MEAN±SD Group I	Intra Group p value Compared with BI	MEAN±SD Group II	Intra Group p value Compared with BI
BEFORE MEDICATION		69.13 ± 8.153	_	70.47 ± 6.907	_
AFTER MEDICATION		66.63 ± 7.968	_	68.30 ± 7.438	_
BEFORE INDUCTION (BASE-LINE)		67.73 ± 7.825	_	66.83 ± 6.374	_
AFTER INTUBATION		67.93 ± 8.221	0.692	94.73 ± 5.759	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	67.67 ± 8.053	0.839	90.23 ± 6.426	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	78.50 ± 6.962	0.000	88.23 ± 6.334	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	77.93 ± 6.690	0.000	87.80 ± 7.863	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	79.27 ± 6.838	0.000	89.87 ± 6.107	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	77.83 ± 8.200	0.000	87.83 ± 7.076	0.000

Within group II difference in mean diastolic blood pressure at various intervals compared to base-line were statistically significant. Whereas, within group I difference in mean diastolic blood pressures at various intervals with respect to base-line were found to be statistically significant with exception of, after intubation and before pneumoperitoneum which are not significant statistically.

This shows magnesium attenuated the diastolic hemodynamic response during period of intubation and just at time of insufflation. Results were comparable to study which suggested that i.v magnesium sulphate before pneumoperitoneum attenuates increase in arterial pressures during laparoscopic cholecystectomy.[11]The mean ± SD values of mean arterial blood pressure (MAP) in Group I and II are shown in Table No 10.

Table 10:

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II
BEFORE MEDICATION		89.07 ± 7.230	89.47 ± 6.010
AFTER MEDICATION		86.43 ± 7.257	88.77 ± 6.621
BEFORE INDUCTION (BASE-LINE)		87.70 ± 6.944	86.43 ± 6.151
AFTER INTUBATION		88.00 ± 6.628	114.43 ± 5.380
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	87.80 ± 6.845	106.50 ± 5.380
	5 MINUTES AFTER PNEUMOPERITONEUM	95.50 ± 6.601	104.93 ± 4.748
	10 MINUTES AFTER PNEUMOPERITONEUM	95.80 ± 7.572	105.23 ± 5.507
	20 MINUTES AFTER PNEUMOPERITONEUM	96.00 ± 6.417	106.43 ± 4.953
	30 MINUTES AFTER PNEUMOPERITONEUM	95.67 ± 6.200	105.33 ± 5.333

Above table shows differences in mean arterial pressure at different time intervals within and among group I and II.

The values before medication, after medication and before induction (baseline) were comparable with no statistical significant difference among them. In between the two groups the difference in mean arterial blood pressures at various intervals after intubation and during insufflations (upto 30 min), were found to be statistically significant, the values being higher in group II as compared to groupI as shown in Table No 11.

Table 11: Inter Group comparison (Ivs II) of Mean Arterial Pressure (mmHg)

TIME		MEAN±SD GROUP I	MEAN±SD GROUP II	Group I vs II	
				't' value	p value
BEFORE MEDICATION		89.07 ± 7.230	89.47 ± 6.010	0.233	0.817
AFTER MEDICATION		86.43 ± 7.257	88.77 ± 6.621	1.301	0.198
BEFORE INDUCTION (BASE-LINE)		87.70 ± 6.944	86.43 ± 6.151	0.748	0.458
AFTER INTUBATION		88.00 ± 6.628	114.43 ± 5.380	16.960	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	87.80 ± 6.845	106.50 ± 5.380	11.764	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	95.50 ± 6.601	104.93 ± 4.748	6.354	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	95.80 ± 7.572	105.23 ± 5.507	5.519	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	96.00 ± 6.417	106.43 ± 4.953	7.050	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	95.67 ± 6.200	105.33 ± 5.333	6.475	0.000

Unpaired (independent) 't' test
NS: p > 0.05; Not Significant; p< 0.05; Significant; p <0.001: Highly significant

Table shows the Observations before medication, after medication and before induction were non significant .Rest the difference in mean arterial pressures at various intervals were found to be statistically significant after intubation and insufflations.

Within group II difference in mean arterial blood pressure at various intervals, after intubation and during insufflation (upto 30 min) compared to base-line were statistically significant as shown in Table No 12.

Table 12: Intra Group comparisons

TIME		MEAN±SD Group I	Intra Group p value Compared with BI	MEAN±SD Group II	Intra Group p value Compared with BI
BEFORE MEDICATION		89.07 ± 7.230	_	89.47 ± 6.010	_
AFTER MEDICATION		86.43 ± 7.257	_	88.77 ± 6.621	_
BEFORE INDUCTION (BASE-LINE)		87.70 ± 6.944	_	86.43 ± 6.151	_
AFTER INTUBATION		88.00 ± 6.628	0.564	114.43 ± 5.380	0.000
PNEUMOPERITONEUM	BEFORE PNEUMOPERITONEUM	87.80 ± 6.845	0.871	106.50 ± 5.380	0.000
	5 MINUTES AFTER PNEUMOPERITONEUM	95.50 ± 6.601	0.000	104.93 ± 4.748	0.000
	10 MINUTES AFTER PNEUMOPERITONEUM	95.80 ± 7.572	0.000	105.23 ± 5.507	0.000
	20 MINUTES AFTER PNEUMOPERITONEUM	96.00 ± 6.417	0.000	106.43 ± 4.953	0.000
	30 MINUTES AFTER PNEUMOPERITONEUM	95.67 ± 6.200	0.000	105.33 ± 5.333	0.000

Paired 't' test (NS: p > 0.05; Not Significant; p < 0.05; Significant; p <0.001: Highly significant). Within group II difference in mean arterial blood pressure at various intervals compared to base-line were statistically significant. Whereas, within group I difference in mean arterial blood pressures at various intervals with respect to base-line were found to be statistically significant with exception of, after intubation and before pneumoperitoneum which are not significant statistically.

Whereas, within group I difference in mean arterial blood pressures at various intervals with respect to base-line were found to be statistically significant with the exception of the measurements, after intubation and before pneumoperitoneum which were not significant statistically as shown in Table No 12,the results being comparableconfirming the attenuating response of magnesium sulphate on blood pressures during laparoscopic insufflations.[11]Table 13 showed Propofol consumption distribution amongst the two groups. There was not much variation in Propofol consumption in the two groups. The results were not statistically significant.

Table 13: Inter Group comparison (Ivs II) of Propofol consumption (mg)

GROUPS	RANGE	MEAN	STANDARD DEVIATION (±)	STATISTICAL INFERENCE	REMARKS
I (N=30)	0-20	4.67	7.761	t value= 0.166 P Value= 0.869	NS
II (N=30)	0-20	5.00	7.768		

T test NS= Not Significant (p> 0.05; Not Significant; p < 0.05; Significant; p <0.001: Highly significant). The above table shows Propofol consumption distribution amongst the two groups. There is not much variation in Propofol consumption in the two groups. The results are not statistically significant.

V. Discussion:

Direct laryngoscopy and intubation causes afferent vagal stimulation and efferent sympatho-adrenal response, this causes increase in blood pressure (BP), heart rate (HR) and cardiac arrhythmias in some patients. The changes in cardiovascular system are significant and lead to average increase in blood pressure by 20-40% and increase in heart rate by 20%.[1] However these changes may be fatal in patients with hypertension, coronary artery disease, intracranial hypertension and aneurysms .[2]

Investigating the ability of magnesium to control cardiovascular disturbances and inhibit the release of catecholamines at the time of intubation in otherwise healthy subjects concluded that magnesium sulfate attenuates the catecholamine mediated responses after tracheal intubation , probably due to a combination of vasodilatory effects of the ion and inhibition of catecholamine release.[8]

Above results were similar to studies involving administration of magnesiumsulphate before the peritoneal insufflation of CO2 attenuate the arterial pressure increase in laparoscopic cholecystectomy.[13] This attenuation results from reduced neurohumoral changes with magnesium. Similar studies concluded use of magnesium sulfate reduced opioid consumption for pain and hemodynamic control after thoracotomy operations.[14] Also during laparoscopic cholecystectomy, carbon dioxide is commonly used to create pneumoperitoneum (PP).[15][16]Causing adverse cardiovascular effects.[17]Leading to the release of catecholaminesfrom both adrenergic nerve terminals and the adrenal gland which magnesium is effectively blocks.[18] In addition to catecholamines, vasopressin is a major contributor to the hemodynamic changes induced by PP. The high concentrations of vasopressin measured during pneumoperitoneum have been shown to be sufficient to have significant cardiovascular effects.[19][20] Magnesium attenuates this vasopressin stimulated vasoconstriction effectively too.[21]

VI. Conclusion:

Magnesium Sulphate administered at induction attenuates haemodynamic responses at intubation and during pneumoperitoneum in laparoscopic cholecystectomy.

Conflict of Interests

The authors declare that there is no conflict of interests regarding publication of this paper.

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