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Original Research

Study Of Dexmedetomidine On Intraoperative Haemodynamic Changes During Laparoscopic Hysterectomy

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ABSTRACT

Background: During general anesthesia laryngoscopy, tracheal intubation and extubation are the critical events provoking transient, but marked sympathoadrenal response manifesting as hypertension and tachycardia. In addition, in laparoscopic surgery, CO_2 is routinely used to create pneumoperitoneum, which causes increased plasma level of catecholamine and vasopressin. Aim & Objective: 1. To compare the hemodynamic changes- heart rate and mean arterial pressure. 2.To study the postoperative emergence and recovery.3. To study the postoperative nausea and vomiting incidence. Methods: Study design: Randomized comparative study. Study setting: Department of Anaesthesia, Kamineni Institute of Medical Sciences, Sreepuram Narketpally, India. Study duration: From January 2021 to January 2022 (1 year) Sample size: 56. Results: There was a statistically significant difference in mean SBP at pre operative of subjects between group (i.e, p=0.024). There was no statistically significant difference in mean SBP after bolus of subjects between group. There was a statistically significant difference in mean SBP At 2 hour of subjects between group (i.e, p=0.012). There was a statistically significant difference in mean DBP at pre operative of subjects between group. There was a statistically significant association between other side effects and group (p=0.033) and strength of association was 0.290. Conclusion: The addition of dexmedetomidine provides better hemodynamic stability

Key words: Dexmedetomidine, hemodynamic changes, postoperative emergence, Adverse effect

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INTRODUCTION

Laparoscopic surgeries are becoming popular due to several postoperative benefits like quick recovery, less tissue damage, avoiding big surgical incision, shorter hospital stay with consequent reduction in health care cost. During general anesthesia laryngoscopy, tracheal intubation and extubation are the critical events provoking transient, but marked sympathoadrenal response manifesting as hypertension and tachycardia.[1,2]

In addition, in laparoscopic surgery, CO_2 is routinely used to create pneumoperitoneum, which causes increased plasma level of catecholamine and vasopressin. Elevation of intra-abdominal

pressure with raised diaphragm causes various adverse effects on the cardiovascular system such as decreased cardiac output, elevated arterial pressure and increased systemic and pulmonary vascular resistance leading to hypertension and tachycardia.[3]

The physiological changes during laparoscopic surgery occur mainly due to two reasons: a) both mechanical and chemical effects of CO_2-induced pneumoperitoneum and b) position of patient during surgery. The pneumoperitoneum leads to an increase in the intra-abdominal pressure with a consequent elevation of the diaphragm.[4]

This results in collapse of basal lung tissue ultimately causing decreased functional residual capacity (FRC), ventilation perfusion ratio (V/Q) mismatch, increase intrapulmonary shunting of blood which all lead to hypoxemia and increased alveolar arterial oxygen gradient [$(A-a)DO_2$].[5]

In Trendelenburg position, there is an increased preload due to an increased in the venous return from lower extremities. This position results in cephalic shifting of viscera, which accentuates the pressure on the diaphragm. In case of reverse Trendelenburg position, pulmonary function tends to improve as there is caudal shifting of viscera, which improves tidal volume by decrease in the pressure on the diaphragm.[6,7]

This position also decreases the preload on heart and causes a decrease in the venous return leading to hypotension. The pooling of blood in the lower extremities increases the stasis and predisposes the deep vein thrombosis (DVT).

Hence, a drug, which can blunt hemodynamic responses to laryngoscopy, intubation and pneumoperitoneum without having any adverse effects like respiratory depression and postoperative nausea and vomiting (PONV) was required for the purpose.[8]

Dexmedetomidine is an alpha-2-adrenergic agonist, which is the pharmacologically active dextro-isomer of medetomidine. It has properties of analgesia, anxiolysis, sympatholysis and titrating sedation without major respiratory depression.

Dexmedetomidine, an $\alpha 2$ agonist, when used as an adjuvant in general anaesthesia attenuates stress response to various noxious stimuli, maintains perioperative haemodynamic stability and provides sedation without significant respiratory depression postoperatively. It is potent and highly selective for $\alpha 2$-receptors with an $\alpha 2{:}\alpha 1$ ratio of 1620:1.[9]

Hemodynamic effects, which include transient hypertension, bradycardia, and hypotension result from the drug's peripheral vasoconstrictive and sympatholytic properties. Dexmedetomidine exerts its hypnotic action through activation of central pre- and postsynaptic $\alpha 2$-receptors in the locus coeruleus, thereby inducting a state of unconsciousness similar to natural sleep, with the unique aspect that patients remain easily rousable and cooperative. Dexmedetomidine has been used as an anesthetic adjuvant; however, hypotension is a concern especially in prone patients.[10]

Hence, we have undertaken a study to evaluate the haemodynamic effects (heart rate and mean arterial pressure), postoperative emergence and recovery, postoperative nausea and vomiting incidence of dexmedetomidine in laparoscopic hysterectomy surgeries.

Aim & Objective:

1. To compare the hemodynamic changes- heart rate and mean arterial pressure
2. To study the postoperative emergence and recovery.
3. To study the postoperative nausea and vomiting incidence.

MATERIAL AND METHODS

Study design: Randomized comparative study.

Study setting: Department of Anaesthesia, Kamineni Institute of Medical Sciences, Sreepuram Narketpally, India.

Study duration: From January 2021 to January 2022 (1 year) **Sample size:** 56

Inclusion criteria:

1.Patients undergoing laparoscopic hysterectomy
2.Patients belonging to ASA 1 and 2 patients
3.Female patients belonging to age group 35-60 years
4.Patients giving valid informed consent

Exclusion criteria:

1.Patients with known allergy to dexmedetomidine.
2.Patients with history of bradyarrhythmia [heart rate < 50]
3.Patients with history of bronchial asthma
4.Patients with anticipated difficult intubation
5.Patients with known history of renal, cardiac and hepatic ailments
6.Patients with allergic diathesis,Patients on chronic steroid therapy

Sample size - 56 cases

Sampling technique – All 56 patients included in the study will be randomized equally into two study groups. Patients in Group A will receive dexmedetomidine. Patients in Group B will receive normal saline.

Justification of sample size

In comparison of A and B, study made by G acharya et al (2016) was a base line of the present study. It was found that 1 min after intubation, A (120.35+/-14.120) was higher/lower than that of B (109.85+/_13.132). Assuming it as a bench mark, a software named jmp 10 of SAS 9.3 found a sample of 55 would be sufficient for detecting clinically relevant difference of 10.5 with 95% confidence and 99 % power.

Data collection technique and tools Data collection technique

- Primary data- History and clinical examination.
- Secondary data- Systematic reviews and research synthesis.

Tools

- Direct observations, interviews, protocols, tests, examination of records, and collections of writing samples.

METHODOLOGY

A hospital-based prospective study was done. The study was conducted on 56 newly consulted/admitted patients in Apollo International Hospitals according to the above- described inclusion and exclusion criteria in the 1 year study period. 56 consecutive cases planned for laparoscopic hysterectomy were included in the study. Consent was taken from the patients/parents.

PRE-OPERATIVE ASSESSMENT

At the time of preoperative visit, patient's detailed history, general physical examination and systemic examination were performed. Basic demographic data like age, sex, height and weight were recorded. Other relevant previous history was asked and recorded.

INFORMED CONSENT

Those patients who satisfied the inclusion and exclusion criteria were explained in detail regarding anesthesia procedure for the surgery and the details of the study viz the drug used in their vernacular language. A written consent was obtained in each case.

CONDUCT OF ANAESTHESIA

When patient was received in the operating theatre, identity of the patient was verified and consent forms and fasting status were checked. Routine preoperative review examination was carried out.

Once the patient was inside the operating theatre, routine pre-induction monitors - NIBP, ECG and pulse-oximeter were attached and baseline vitals were recorded. An I.V line was secured,

either 18 or 20 gauge, preferably on the left hand and 0.9% normal saline was started. All patients received Inj. Fentanyl (2mcg/kg) 5 minutes before induction. All patients were pre-oxygenated with 100% oxygen for 3 minutes prior to induction. Patients were then induced with Inj. Propofol (2 mg/kg) intravenously and atracurium used for muscle relaxation. Anesthesia was maintained with a mixture of 50% N_2O in O_2 with Sevoflurane (1.25-1.75%) and assisted ventilation.

STATISTICAL METHODS

Demographic clinical parameters, history, comorbidities, drug response with respective physiological parameters were considered as relevant variables.

Descriptive analysis: Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram.

Various tests of statistical significance were applied accordingly and the statistical associations were analyzed. Their respective P- values were presented. P-value < 0.05 was considered as statistically significant. IBM SPSS version 22 was used for statistical analysis.

RESULT AND OBSERVATIONS

Table 1: Analysis of SBP in study population (N=56)

Unpaired t test					
	group	**N**	**Mean**	**Std. Deviation**	**p**
SBP pre operative	Dexmedetomidine	28	141.5000	14.82116	0.024
	Normal Saline	28	133.4643	10.66487	
SBP after bolus	Dexmedetomidine	28	144.0357	219.28123	0.742
	Normal Saline	28	130.2857	11.92215	
SBP at 1 min (induction)	Dexmedetomidine	28	116.6429	12.99349	<0.001
	Normal Saline	28	137.3214	13.78151	
SBP at 1 min (intubation)	Dexmedetomidine	28	127.4643	10.67528	<0.001
	Normal Saline	28	144.3929	11.36707	
SBP after pneumoperitoneum	Dexmedetomidine	28	133.6071	10.17018	0.007
	Normal Saline	28	141.4643	10.89166	
SBP At 15 minutes	Dexmedetomidine	28	129.6786	10.37109	0.092
	Normal Saline	28	134.5714	10.93898	
SBP At 30 minutes	Dexmedetomidine	28	129.7857	12.23945	0.376
	Normal Saline	28	132.6786	12.00634	
SBP At 45 minutes	Dexmedetomidine	28	125.0000	13.84839	0.026
	Normal Saline	28	132.8571	11.72119	
SBP At 1st Hour	Dexmedetomidine	28	128.6786	11.01868	0.106
	Normal Saline	28	134.3929	14.71542	
SBP At 75 minutes	Dexmedetomidine	28	127.0714	9.77119	0.162
	Normal Saline	28	131.0000	10.95445	
SBP At 90 minutes	Dexmedetomidine	28	127.5357	10.84053	0.135
	Normal Saline	28	132.1429	141.87189	
SBP At 105 minutes	Dexmedetomidine	26	126.69	9.595	0.047
	Normal Saline	28	132.64	11.710	
SBP At 2nd Hour	Dexmedetomidine	19	126.21	7.307	0.012
	Normal Saline	16	134.25	10.428	

SBP At 135 minutes	Dexmedetomidine	2	129.50	3.536	0.984
	Normal Saline	3	129.33	9.713	
SBP at end of pneumoperitonium	Dexmedetomidine	28	131.8571	8.06783	0.785
	Normal Saline	28	131.2500	8.53587	
SBP at post operative	Dexmedetomidine	28	131.6786	5.47082	0.718
	Normal Saline	28	132.2857	6.94346	

There was a statistically significant difference in mean SBP at pre operative of subjects between group There was no statistically significant difference in mean SBP after bolus of subjects between group. There was a statistically significant difference in mean SBP at 1 min (induction) of subjects between group. There was a statistically significant difference in mean SBP at 1 min (intubation) of subjects between group. There was no statistically significant difference in mean SBP At 15 minutes of subjects between group. No statistically significant difference in mean SBP at post-operative of subjects between group

Table 2: Analysis of DBP in study population (N=56)

Unpaired t test					
	group	**N**	**Mean**	**Std. Deviation**	**p**
DBP pre operative	Dexmedetomidine	28	93.4286	13.43690	0.022
	Normal Saline	28	86.3929	8.23875	
DBP after bolus	Dexmedetomidine	28	66.9286	11.76602	<0.001
	Normal Saline	28	84.9286	8.50677	
DBP at 1 min (induction)	Dexmedetomidine	28	76.6071	10.58419	<0.001
	Normal Saline	28	92.2500	11.57784	
DBP at 1 min (intubation)	Dexmedetomidine	28	84.2857	9.36841	<0.001
	Normal Saline	28	98.8929	11.56092	
DBP after pneumoperitoneum	Dexmedetomidine	28	88.8214	9.03923	0.008
	Normal Saline	28	96.0357	10.35833	
DBP At 15 minutes	Dexmedetomidine	28	85.8929	9.82189	0.067
	Normal Saline	28	91.2857	11.69000	
DBP At 30 minutes	Dexmedetomidine	28	86.0714	9.03052	0.059
	Normal Saline	28	91.5714	12.10273	
DBP At 45 minutes	Dexmedetomidine	28	83.7143	11.73111	0.103
	Normal Saline	28	89.5000	14.25820	
DBP At 1st Hour	Dexmedetomidine	28	83.4286	10.46132	0.053
	Normal Saline	28	90.0357	14.28929	
DBP At 75 minutes	Dexmedetomidine	28	81.6071	9.84449	0.033
	Normal Saline	28	87.8929	11.55130	
DBP At 90 minutes	Dexmedetomidine	28	82.2857	12.43608	0.013
	Normal Saline	28	90.1786	10.40674	
DBP At 105 minutes	Dexmedetomidine	26	83.42	11.662	0.102
	Normal Saline	28	88.82	12.138	
DBP At 2nd Hour	Dexmedetomidine	20	81.65	7.727	0.014
	Normal Saline	16	88.81	8.879	
DBP At 135 minutes	Dexmedetomidine	2	84.50	12.021	0.832
	Normal Saline	3	82.33	9.292	

DBP at end of pneumoperitonium	Dexmedetomidine	28	85.2500	11.89343	0.150
	Normal Saline	28	89.1071	7.33505	
DBP at post operative	Dexmedetomidine	28	82.1071	6.20238	0.032
	Normal Saline	28	86.5000	8.55700	

There was a statistically significant difference in mean DBP at pre operative of subjects between group. There was no statistically significant difference in mean DBP At 15 minutes of subjects between group. There was a statistically significant difference in mean DBP at post-operative of subjects between group

Table 3: Analysis of other side-effects in study population (N=56)

Measure of association						
			Group		**Phi**	**p**
			Dexmedetomidine	**Normal Saline**		
Other s	PRESENT	Count	1	6	0.290	.033
		% within Others	14.3%	85.7%		
		% within group	3.6%	23.1%		
	ABSENT	Count	27	20		
		% within Others	57.4%	42.6%		
		% within group	96.4%	76.9%		

In present study, other side effects were present in 1(3.6%) of Dexmedetomidine and 6(23.1%) of Normal Saline group and it was absent in 27(96.4%) of Dexmedetomidine and 20(76.9%) of Normal Saline group. There was a statistically significant association between other side effects and group (p=0.033) and strength of association was 0.290.

DISCUSSION

Present study was done with the aim to study the intraoperative haemodynamic response, emergence and recovery with the use of dexmedetomidine during laparoscopic hysterectomy. During laparoscopic cholecystectomy, there will be many physiological changes due to general anaesthesia, patient position, pneumoperitoneum and increased intraabdominal pressure,

The physiological changes reflect a marked sympathoadrenal response manifested as increased heart rate, systolic blood pressure, diastolic blood pressure and mean arterial pressure.

A study was done by **Yennawar DS et al**[7] where the analysis of diastolic blood pressure during various stages was done which showed significant increase in diastolic blood pressure at various levels especially at induction, after intubation, before and after Pneumoperitoneum, at the end of Pneumoperitoneum, after reversal of neuromuscular blockade and 1 hour postoperatively.

The analysis of these values showed that the difference was statistically significant ($P<0.05$), so drug that reduce hemodynamic responses to laryngoscopy, intubation and pneumoperitoneum without any adverse effects is needed to attenuate hemodynamic responses. Hence dexmedetomidine has effect of blunting hemodynamic responses compared to normal saline.

In present study, mean systolic blood pressure (SBP) at 1 min (induction), SBP at 1 min (intubation), mean SBP after pneumoperitoneum, SBP at 45 minutes, SBP at 105 minutes and SBP at 2 hour of subjects, there was a statistically significant difference in mean SBP of

subjects between groups, SBP was found significantly low in group D compared to group NS. This finding was similar to study conducted by **Khafagy FH et al**[5] where regards to hemodynamics, group dexmedetomidine showed statistically significant lower SBP readings versus the preoperative levels compared to group placebo ($p<0.005$).

This was also similar to study results by **Kulkarni NT et al**[6] where SBP was low in group dexmedetomidine compared to control group. A study by **Yennawar DS et al**[7] **s**howed that the use of IV Dexmedetomidine was associated with decrease in both systolic and blood pressure.

In present study, mean DBP at pre-operative, after bolus, DBP at 1 min (induction) , DBP at 1 min (intubation), DBP after pneumoperitoneum , DBP at 75 minutes , DBP at 90 minutes, DBP at 2 hour and DBP at post-operative, there was a statistically significant difference in mean pre-operative DBP of subjects between groups and there was statistically significant reduction of DBP in dexmedetomidine group compared to NS group.

This was similar to study by **Masoori TA et al**[11], where a gradual decrease in diastolic blood pressure after administration of dexmedetomidine was noticed, after induction and intubation and there was a statistically significant difference between the groups. But after creation of pneumoperitoneum and post extubation, the fall in diastolic blood pressure was comparable between the groups. A study by **Panchgar V et al**[3] showed that there was better control of DBP in group dexmedetomidine compared to group NS.

CONCLUSION

The addition of dexmedetomidine provides better hemodynamic stability. In normal patients undergoing laparoscopic surgeries, there were significant changes in hemodynamic changes like pulse rate, SBP, DBP.

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