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ORIGINAL ARTICLE

Comparative Study of Dexmedtomidine & Propofol Infusion for Intro-Operative Hemodynamic & Recovery Characteristics in Laparoscopic Cholecystectomy – A Prospective, Randomized Control Study

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ABSTRACT

Objective: This study aims to compare the effectiveness of dexmedetomidine and propofol in responding to hemodynamic changes to pneumoperitoneum during laparoscopic cholecystectomy, as well as to evaluate differences in the time it takes to extubate, the patient's hemodynamic status upon extubation, the patient's level of sedation following extubation, and the occurrence of any side effects.

Study Design: Prospective, Randomized Controlled Trial

Study Place and Duration: Liaquat National Hospital and Medical College, Karachi. Conducted over a period of 6months from January 2022 to June 2022

Methods: A total of 100 patients (aged 20-60) in Physical Status Classes 1 and 2 as defined by the American Society of Anesthesiologists were randomly split into two groups (P and D). Patients in Group P were given propofol at a rate of 100 micrograms per kilogramme per minute (g/kg/min) after intubation until the end of pneumoperitoneum, while those in Group D were given dexmedetomidine at a rate of 1 micro Multiple readings of HR and MAP were taken at different points in the operation. Measurements of the Resuscitation Success Rate (RSR) and the Modified Alderate Scale (MAS) were also taken 15 and 30 minutes after operation.

Results: Showed that during pneumoperitoneum, Group D significantly decreased HR and MAP compared to Group P, which allowed for superior preservation of hemodynamic stability. In contrast to Group P, patients in Group D remained sleepy for up to 30 minutes after surgery.

Conclusion: Dexmedetomidine is more effective at suppressing the hemodynamic stress response to pneumoperitoneum during infusion than propofol is, whereas propofol is more effective at speeding up recovery time.

Keywords: Dexmedetomidine, hemodynamics, laparoscopy, propofol, pneumoperitonuim

INTRODUCTION

Since its introduction some decades ago, laparoscopic surgeriesare commonly preferred over traditional open method due it its numerous advantages. Most of the laparoscopicsurgeries are now done asabulatory procedures. Early recovery, less discomfort and getting patients back to work faster may be enough to justify the higher price tag of the operation.[1] Despite these advantages, intraoperative hemodynamic abnormalities such as hypertension, tachycardia, and other surgical-related disorders are common and must be considered a potential downside of surgery.[2]

Pneumoperitoniumis one of the major cause of morbidity in laparoscopic procedures. After peritoneal insufflation, considerable increases were seen in mean arterial pressureand systemic and pulmonary vascular resistance.[11] Many methods have been employed to minimize these changes including nitroglycerin, beta blockers, opioids, gabapentin, and dexmedetomidine have been used to varying degrees to maintain hemodynamic stability during pneumoperitoneum.[3]

Dexmedetomidine is effective as a sedative, anxiolytic, analgesic and a sympatholytic agent. It acts specifically on the alpha 2 adrenergic receptor. It mainly causes a decrease in heart rate, Blood pressure and sedoanalgesia.[4] Various studies have employed infusion rates of dexmedetomidine between 0.1 and 1.0 g/kg/h showing that dexmedetomidine reduces the need for morphine during and after surgery.[5]

Propofol is often used to maintain hemodynamic stability during pneumoperitonueum. Propofol have a rapid onset and short duration of action, as wellas a rapid recovery profile. It provides good hemodynamic control during the surgical procedure.[6] Its anaesthetic effect is achieved by inhibiting GABA's activity. This results in decreased cardiac output despite a somewhat unaltered heart rate.[7]

During laparoscopic cholecystectomy, pneumoperitoneum results in significant changes in hemodynamic. This study compares the effects of dexmedetomidine and propofol for addressing these changes. We also aim to evaluate the two drugs in terms of their respective times to extubation, hemodynamics during extubation, post-extubation sedation scores, and adverse events.

MATERIAL AND METHODS

Study design: Prospective, Randomized controlled trial

Study place and duration: Main operation Theatre, Department of anaesthesia, Liaquat National Hospital and Medical College. After the approval from the research and ethical committee, data was collected from January 2022 to June 2022

Sample Size: According to the standard deviation of MAP in Pakistan (according to the cited sources), a sample size of at least 30 is needed for each group if the difference in MAP between the control and testing groups is to be detected with an alpha error of 5% and a beta error of 20%. (control and test group).[8,9,10]

Inclusion and Exclusion Criteria: This study comprised patients ages 20 to 60 undergoing elective laparoscopic cholecystectomy who were classified as ASA class 1 or 2. Exclusion criteria included patients with ASA grades 3 or 4, those in need of emergency surgery, those who were morbidly obese, those who had an allergy to any of the study drugs, those who had hepatic or renal insufficiency, and those who refused to take part in the study.

Data Collection Procedure: Any time a person was identified as a possible patient, they were given a comprehensive explanation of the study before giving their consent. Patients who were unable to read or write had the informed consent form read to them, and if they gave their consent, the witness who was not associated with the principal investigator signed and stamped the document. An evaluation Performa was filled out by the researcher to gather data for the perioperative phase.

Group P received propofol infusions while Group D received dexmedetomidine infusions; both groups were selected at random.

Participants in the study were randomly given either propofol or dexmedetomidine by selecting a card from a bowl labelled "P" or "D." Group D received a dexmedetomidine infusion with a loading dosage of 1 g/kg over 10 minutes before to intubation, and maintenance doses of 0.2 g/kg/h thereafter.

A loading dose of 1 g/kg dexmedetomidine was administered to Group D over the course of 10 minutes. In both groups, the doses of propofol, nalbuphine, and atracurium were adjusted to achieve the desired effects. After making sure the patient was getting oxygen from both sides, a cuffed endotracheal tube was inserted and fixed with plasters to finish the intubation. Then, in Group P, an infusion of 50-100 g/kg/h of injectable propofol was begun, while in Group D, an infusion of 0.2 g/kg/h of dexmedetomidine was initiated.

Patients were given breathing agents like sevoflurane or isoflurane 0.8% connected to a closed circuit and a 1:1 O2:Air mixture to maintain anaesthesia. Muscle relaxation was sustained after an intratracurium infusion of 0.1 mg/kg. After pneumoperitoneum, the infusion of the test drug was halted.

Once the patients' muscle strength and protective reflexes had returned to normal, they were extubated after receiving intravenous doses of neostigmine (0.05 mg/kg) and glycopyrolate (8 g/kg). Sedation after extubation was measured using Ramsey's score.

Mean arterial pressure changes were the primary objective, with heart rate, Ramsay Sedation scores, and modified alderate ratings at 15 and 30 minutes as secondary outcomes.

Statistical Analysis: IBM SPSS Statistics version 26 was used for the statistical analysis. Quantitative data were analysed by computing means and standard deviations. The percentage and frequency distributions of qualitative variables were determined. The means were compared with the use of the paired t-test, the independent t-test, and the repeated measures analysis of variance when necessary. p<0.05 was deemed as significant.

RESULTS

The average age of Group P was 45.08±10.31 compared with Group D 43.66±9.69. Male patients of group P was 14(28%) and female 36(72%). In Group D there was 17(34%) and female 33(66%), weight in group P 63.96±8.82 compared with 62.52±7.51 in group D. (Table 1)

Heart rate base line in group P 82.02±11.193 compared with other group D as 82.1±11.978 with p-value 0.973. Heart Rate Pre Pneumo before 88.5±7.476 in group P compared with group D 84.94±8.658 with p-value 0.030.(Table 2)

The comparison of Mean Artial Pressure (mmHg) of Before and after difference between P and D groups showed that MAP baseline in group P as 82.44±8.162 compared with other group was 84.32±7.593 with insignificant p-value 0.236. MAP after pneumo Start and at end of pneumoperitoneum as 86.34±7.139 and in group D as 78.34±6.252. and 80.96±6.286 & 71.88±6.07 respectively with statistically significant in reducing pressor response to pneumoperitoneum.(Table 3)

Patients in Group D demonstrated a higher sedation scores at 30 min postoperatively than Group P 3±0.99 while patients in Group P 2.52±0.61 compared Alderate 5.88±0.87 & 7.02±0.79 had higher alderate scores at both 15 and 30 postoperatively compared to group D, (Table 4)

Table-1: Demographic Information of Research Participants

	Group P	Group D
Age(years) Mean±SD	45.08±10.31	43.66±9.69
Weight(kg)	63.96±8.82	62.52±7.51
Duration(Minutes)	74.54±14.94	79.20±14.45
Gender n(%)		
Male	14(28)	17(34)
Female	36(72)	33(66)

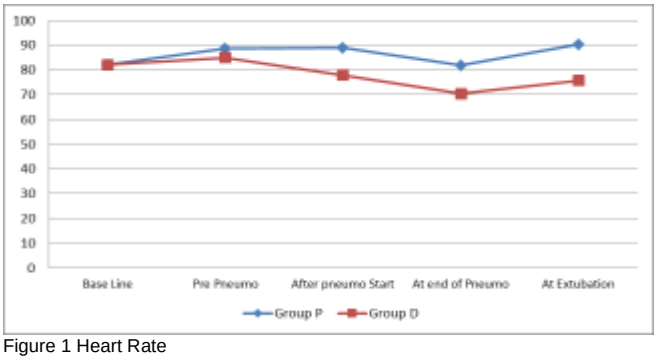

Figure 1 Heart Rate

Table-2: Comparison of Heart Rate between P and D Groups

Heart Rate	Mean± Std. Dev		P-Value ǂ
(Beats per minute)	Group P	Group D	
Heart Rate Base Line	82.02±11.193	82.1±11.978	0.973
Heart Rate Pre Pneumo	88.5±7.476	84.94±8.658	0.030
Heart Rate after Pneumo Start	88.82±10.456	77.88±8.957	0.000
Heart Rate at end of Pneumo	81.78±6.662	70.3±6.264	0.000
Heart Rate at Extubation	90.16±6.855	75.7±6.929	0.000
P-Valuell	0.000	0.000	

ǂ Independent t test was applied.
ǁ Repeated Measures of ANOVA was applied; P<0.05 was considered as significant.

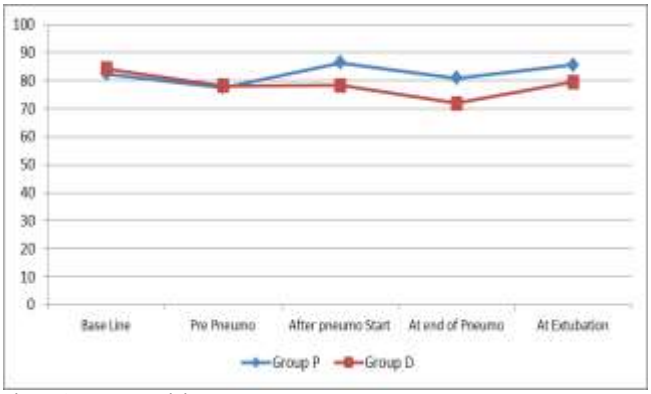

Figure 2 Mean Arterial Pressure

Table 3: Comparison of Mean Artial Pressure (mmHg) of Before and after Difference Between P and D groups

Variables	Mean±Std. Dev		P-Value ǂ
	Group P	Group D	
	Mean Artial Pressure(mmHg)		
MAP Base Line	82.44±8.162	84.32±7.593	0.236
MAP Pre Pneumo	77.6±8.516	78.12±6.275	0.729
MAP after pneumo Start	86.34±7.139	78.34±6.252	0.000
MAP at end of Pneumo	80.96±6.286	71.88±6.07	0.000
MAP at Extubation	85.64±9.282	79.6±8.214	0.001
P-Valuell	0.000	0.000	

Table-4: Comparison Before and after Difference Between P and D groups

Variables			Mean±Std. Dev	p-Value
Group P	Pair 1	Ramsey after 15 minutes	3±0.99	0.008
		Ramsey after 30 minutes	2.52±0.61	
	Pair 2	Alderate after 15 minutes	5.88±0.87	0.000
		Alderate after 30 minutes	7.02±0.79	
Group D	Pair 1	Ramsey after 15 minutes	3.8±0.78	0.000
		Ramsey after 30 minutes	3.08±0.85	
	Pair 2	Alderate after 15 minutes	6.24±0.82	0.014
		Alderate after 30 minutes	6.64±0.80	

Paired t-test was applied; P<0.05 was considered as significant.

DISCUSSION

Pneumoperitoneum and laparoscopy can lead to pathophysiologic changes that make managing anaesthesia more difficult. An 8 to 20 mmHg pneumoperitoneum is created and maintained throughout laparoscopic surgery. Peritoneal insufflation to intra-abdominal pressures (IAPs) greater than 10 mmHg drastically alters hemodynamics.[11] However, employing effective and secure anaesthetic drugs and techniques is the key to success. Light plane of anaesthesia can increase blood pressure, heart rate, and myocardial oxygen consumption, whereas profound anaesthesia might cause postoperative problems such slow recovery and cognitive impairment. [12]

Use of beta-blockers and 2-adrenergic agonists, such as clonidine or dexmedetomidine, significantly reduces hemodynamic changes and the need for anaesthesia. High doses of remifentanil can almost fully prevent the hemodynamic change. Propofol boluses have also been employed to control hemodynamic modifications brought on during laparoscopy. [13]

100 ASA classes 1 and 2 subjects who underwent elective laproscopic cholecystectomy made up our study. We kept the EtCO2 between 30 and 40 while keeping the IAP under 10 mmHg.

According to Yang et al.[14], the combination of dexmedetomidine and propofol effectively lowers the stress response in patients undergoing laparoscopic cholecystectomy, stabilises perioperative hemodynamics, lowers postoperative complications, improves cognitive function, lessens pain and anxiety, and helps with rehabilitation. Although the aforementioned trial encompassed the advantages of both drugs, our goal was to ascertain whichever drug was more efficient at minimizing the pressor response.

Chavan et al.[15] reported the use of dexmedetomidine as an adjuvant in general anaesthesia to minimise a variety of stress reactions during surgery and maintain hemodynamic stability. In contrast to our data, which demonstrate a higher sedation score, they reported that dexmedetomidine does not delay recovery.

Shah et al.[16] examined dexmedetomidine and propofol for intraoperative sedation in 2016 and found that dexmedetomidine produced a greater sedation score. This is consistent with what we discovered when we utilised the Ramsay Sedation Scale and the modified Aldrete score to monitor recovery. The patients in the propofol group recovered more quickly than those in the dexmedetomidine group at 30 minutes, according to the statistically significant findings.

CONCLUSION

When compared to propofol infusion, dexmedetomidine infusion results in greater hemodynamic stability during pneumoperitoneum. Either of the test medication infusions can be used on patients undergoing laparoscopic surgery to achieve stable hemodynamics. Propofol infusion has a faster recovery time than the sedative effects of dexmedetomidine infusion, necessitating longer stay in the PACU.

Conflicts of interest: None
Funding: None
Ethical Approval

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