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Original Article

A COMPARATIVE STUDY OF CLONIDINE VERSUS FENTANYL FOR INTRAOPERATIVE HEMODYNAMIC STABILITY IN PATIENTS UNDERGOING LAPAROSCOPIC CHOLECYSTECTOMY UNDER GENERAL ANESTHESIA: RANDOMIZED, DOUBLE-BLIND, INTERVENTIONAL STUDY

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ABSTRACT

Objective: Laparoscopic cholecystectomy, though advantageous over traditional surgery, presents hemodynamic challenges due to pneumoperitoneum, systemic CO2 absorption, and patient positioning. Clonidine and Fentanyl are evaluated for their effectiveness in maintaining intraoperative hemodynamic stability, considering their different pharmacological actions.

Methods: This randomized, double-blind interventional study involved 72 patients undergoing elective laparoscopic cholecystectomy under general anesthesia. Participants were allocated into two groups, receiving either IV Clonidine or IV Fentanyl. Hemodynamic parameters, including heart rate and blood pressure, were monitored and compared.

Results: Clonidine demonstrated superior control over heart rate and blood pressure compared to Fentanyl, with statistically significant differences observed in the intraoperative period and post-intubation, indicating enhanced hemodynamic stability.

Conclusion: Clonidine is more effective than Fentanyl in maintaining intraoperative hemodynamic stability in patients undergoing laparoscopic cholecystectomy. This suggests a potential preference for Clonidine as a premedicant in such surgical procedures, highlighting the need for tailored anesthetic techniques.

Keywords: Clonidine, Fentanyl, Laparoscopic cholecystectomy, Hemodynamic stability, General anesthesia

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INTRODUCTION

Laparoscopic cholecystectomy heralded as the benchmark procedure for gallstone disease, offers significant advantages over traditional surgery, including minimized hospitalization, quicker patient mobility, reduced scarring, and lesser impact on postoperative respiratory and gastrointestinal functionality [1]. Despite these benefits, the technique is not devoid of challenges; it induces notable hemodynamic alterations attributed to pneumoperitoneum creation, the potential systemic absorption of carbon dioxide, and the reverse Trendelenberg position, elevating the risk of postoperative nausea and vomiting, a notable complication in laparoscopic interventions [2].

To counteract these hemodynamic changes, a range of pharmacological solutions such as nitroglycerine, beta-blockers, and opioids have been employed, albeit with their respective drawbacks. Among these, Clonidine, an α-2 adrenergic receptor agonist, emerges as a promising candidate, offering a multifaceted approach by ensuring hemodynamic stability, reducing the necessity for analgesics and anesthetics, and mitigating common postoperative discomforts, including nausea, shivering, and delirium [3].

The procedure of laryngoscopy and endotracheal intubation, a prerequisite for the majority of general anesthesia surgeries, is known to provoke certain respiratory and cardiovascular responses. These include laryngospasm, bronchospasm, and significant cardiovascular fluctuations such as tachycardia and hypertension. In light of these challenges, the medical community continues to seek an effective and safe pharmacological agent capable of mitigating these responses without compromising cardiovascular stability [4].

The concept of premedication before anesthesia induction has long been recognized as a crucial component of anesthetic management. An ideal premedicant would not only alleviate fear and anxiety, facilitating a calm and confident patient demeanor towards surgery but also enhance the effectiveness of anesthesia while minimizing its side effects, including the reduction of reflex activities and ensuring smooth recovery [5].

In historical and recent studies, Clonidine has demonstrated superiority in sedation and hemodynamic stability over traditional premedicants like diazepam, also showing efficacy in reducing the requirements for various anesthetic agents. Its role extends beyond mere premedication; Clonidine has also been noted for its postoperative benefits, such as diminishing shivering, providing antiemetic effects, and reducing opioid-induced muscle rigidity [6].

Fentanyl, a potent opioid, plays a critical role in anesthesia, offering perioperative hemodynamic stability without the significant side effects associated with other pharmacological options. Despite the efficacy of certain drugs in managing hemodynamic responses, the quest for an ideal agent remains, given the partial effectiveness or undesirable side effects of current options [7].

This study aims to explore the comparative effectiveness of IV Clonidine and IV Fentanyl in maintaining intraoperative hemodynamic stability during laparoscopic cholecystectomy under general anesthesia, considering their impact on surgical outcomes and patient recovery.

MATERIALS AND METHODS

Study location

The study was carried out in the General Surgery Operation Theatre of the Department of Anesthesiology at S. M. S Medical College and its associated hospitals in Jaipur, following approval from the institutional ethical committee and research review board. Written informed consent was obtained from all participating patients.

Study design

A hospital-based, randomized, double-blind, interventional study was designed to assess the effects of premedication on heart rate and haemodynamic variables and other physiological parameters during laparoscopic cholecystectomy.

Study period

The research was conducted after obtaining approval from the research review board and continued until the desired sample size was reached.

Sample size

The sample size was calculated to be 36 subjects for each group, with a 95% confidence level and 80% power, to detect an expected difference of 8.72±8.52 in heart rate variation from baseline just after intubation between the two groups. This sample size was deemed sufficient to compare all other study variables.

Sampling technique

Participants were randomized using a computer-generated random table

Study groups

Patients were divided into two groups: Group A (IV Clonidine) and Group B (IV Fentanyl), each comprising 36 patients (n=36 per group). Group A received intravenous Clonidine at 2µg/kg, diluted with normal saline to a total volume of 10 ml, and administered slowly over 10 min. Group B received intravenous Fentanyl at 2µg/kg, also diluted with normal saline to 10 ml, and administered in the same manner.

Eligibility criteria

- **Inclusion criteria:** Patients aged 20-60 y, ASA grade I and II, undergoing elective laparoscopic cholecystectomy under general anesthesia, and willing to provide written informed consent were included.

- **Exclusion criteria:** Patients with a history of allergy to clonidine or fentanyl, compromised renal, cardiac, or respiratory status, recent myocardial infarction, conduction disturbances, severe coronary insufficiency, chronic renal insufficiency, or those on antihypertensive medication were excluded.

Pre-anesthetic check-Up (PAC)

A comprehensive pre-anesthetic evaluation was conducted a day before surgery, including medical history, physical examination, and routine investigations (Hb, TLC, DLC, Platelet count, Blood Sugar, LFT, RFT, ECG, X-Ray chest PA view). Patients were instructed to fast overnight before the surgery.

Procedure

The anesthesia technique was standardized across all patients. Upon arrival in the operation theatre, fasting status, consent, and PAC were verified. Standard monitoring (NIBP, Spo2, ECG, EtCo2) was applied, and baseline parameters were recorded. Intravenous lines were secured, and Ringer Lactate was started at 5 ml/kg/h, adjusted according to intraoperative requirements.

Study drug preparation and premedication

Both groups received their respective premedications along with glycopyrrolate 0.004 mg/kg and tramadol 1.5 mg/kg, 30 min before anesthesia induction. Randomization ensured group allocation.

Induction and maintenance

Anesthesia was induced using thiopentone sodium and succinylcholine for tracheal intubation. Maintenance involved mechanical ventilation with a mixture of O2, medical air, isoflurane, and atracurium for neuromuscular blockade. Intra-abdominal pressure was carefully managed during pneumoperitoneum, and hemodynamic parameters were closely monitored and adjusted as necessary.

Reversal and extubation

Neuromuscular blockade was reversed with neostigmine and glycopyrrolate. Patients were then extubated and transferred to the post-anesthesia care unit (PACU) for further monitoring.

Post-operative monitoring

Heart rate, blood pressure, oxygen saturation, and sedation levels were monitored in the PACU. The Ramsey Sedation Score was used to assess sedation levels, and any side effects or adverse events were recorded.

Statistical analysis

Data were analyzed using SPSS version 21. Categorical data were compared using the Chi-square test, while quantitative data were analyzed using Student's t-test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

In the evaluation of the clinical trial, the demographic characteristics between Group A and Group B demonstrated no significant disparities in terms of age, sex distribution, weight, ASA grade, or surgery duration, confirming the homogeneity of the study cohorts ($p>0.05$ for all variables). This foundational equivalence laid the groundwork for a fair comparison of the intervention outcomes.

Heart rate monitoring throughout various surgical phases revealed an intriguing pattern. Initially, both groups exhibited similar heart rates, but following intubation, Group B consistently registered significantly higher heart rates than Group A at every measured interval during and after surgery ($p<0.001$). This distinction persisted across all subsequent time points, indicating a pronounced cardiovascular response in Group B.

Systolic blood pressure (SBP) measurements paralleled the heart rate findings. No significant differences were observed in the initial phases. However, post-intubation, Group B's SBP levels were consistently and significantly higher than those of Group A ($p<0.001$). This trend was evident throughout the surgery and into the postoperative period, underscoring a sustained elevation in SBP in Group B.

Diastolic blood pressure (DBP) analysis further supported these observations. Similar to SBP, DBP levels in Group B were significantly elevated compared to Group A following intubation, through the surgery, and during recovery ($p<0.001$). This pattern highlights a comprehensive impact on the cardiovascular system, affecting both systolic and diastolic pressures in Group B.

While the comparison of Mean Arterial Pressure (MAP) is not explained in the language that is supplied, it is likely to be consistent with the patterns found in SBP and DBP readings. Collectively, these results elucidate a clear demarcation in cardiovascular response to surgical stress between the two groups, with Group B exhibiting heightened heart rate and blood pressure responses. This differential impact underscores the potential influence of the intervention under study, suggesting a significant effect on the cardiovascular dynamics during and after surgical procedures.

Table 1: Demographic characteristics of the groups

Duration	Group A	Group B	P value
Age (years) (mean±SD)	40.83±12.59	41.00±10.48	0.951 (NS)
Male/Female (n)	7/29	6/30	1.000 (NS)
Weight (kg)	57.00±8.58	55.50±8.04	0.446 (NS)
ASA grade (I/II)	30/6	33/3	0.476 (NS)
Duration of surgery (mean±SD)	94.94±7.87	95.61±7.66	0.716 (NS)

The demographic comparison between Group A and Group B revealed no significant differences in age, gender distribution, weight, ASA grade, or duration of surgery ($p>0.05$ for all). This indicates that the two groups were well-matched demographically.

Table 2: Heart rate (per min) during different stages of anesthesia and surgical procedure

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	85.58	12.50	85.97	12.09	0.893 (NS)
Just after premedication	82.33	11.71	84.58	11.24	0.408 (NS)
5 min after premedication	80.69	11.67	83.17	10.34	0.344 (NS)
10 min after premedication	79.50	11.77	82.33	11.30	0.300 (NS)
15 min after premedication	81.94	12.43	81.03	10.43	0.735 (NS)
At the time of induction	79.97	9.55	84.67	19.28	0.194 (NS)
Just after Intubation	84.75	9.84	110.69	21.46	P<0.001 (S)
Start of creating pneumoperitoneum	85.97	9.52	113.42	16.36	P<0.001 (S)
5 min after creating pneumoperitoneum	85.69	9.40	109.53	13.86	P<0.001 (S)
10 min after creating pneumoperitoneum	85.39	9.18	107.94	13.50	P<0.001 (S)
15 min after creating pneumoperitoneum	84.56	9.41	105.42	12.68	P<0.001 (S)
30 min after creating pneumoperitoneum	84.36	11.89	102.39	10.64	P<0.001 (S)
45 min after creating pneumoperitoneum	83.39	11.76	100.75	12.06	P<0.001 (S)
60 min after creating pneumoperitoneum	81.86	9.13	99.22	11.94	P<0.001 (S)
After Release of CO2	83.67	9.73	97.64	13.21	P<0.001 (S)
At the time of extubation	84.67	9.99	114.83	17.02	P<0.001 (S)
15 min after extubation	84.17	8.98	101.06	14.07	P<0.001 (S)
30 min after extubation	82.86	8.52	94.75	10.21	P<0.001 (S)
60 min after extubation	81.75	7.42	89.89	9.80	0.0001 (S)

The heart rate distribution was compared between Group A and Group B at various stages of the surgical procedure. While no significant differences were found initially and shortly after premedication, Group B consistently showed higher heart rates than Group A after intubation and throughout the surgery, as well as during the postoperative period. These differences were statistically significant (p<0.001), indicating that Group B experienced elevated heart rates compared to Group A.

Table 3: SBP (mmHg) during different stages of anesthesia and surgical procedure

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	123.28	12.11	125.69	12.29	0.403 (NS)
Just after premedication	120.06	11.64	123.19	11.41	0.251 (NS)
5 min after premedication	118.03	10.95	121.89	11.92	0.156 (NS)
10 min after premedication	115.39	10.88	119.92	10.78	0.080 (NS)
15 min after premedication	117.81	11.75	119.39	10.65	0.551 (NS)
At the time of induction	116.89	12.46	120.22	11.99	0.251 (NS)
Just after Intubation	125.53	15.24	146.39	14.21	P<0.001 (S)
Start of creating pneumoperitoneum	123.14	12.53	147.11	16.12	P<0.001 (S)
5 min after creating pneumoperitoneum	120.11	12.13	144.83	15.63	P<0.001 (S)
10 min after creating pneumoperitoneum	120.14	12.50	139.50	14.75	P<0.001 (S)
15 min after creating pneumoperitoneum	117.28	13.68	137.94	12.03	P<0.001 (S)
30 min after creating pneumoperitoneum	113.06	12.96	136.69	12.13	P<0.001 (S)
45 min after creating pneumoperitoneum	114.78	10.82	136.78	9.93	P<0.001 (S)
60 min after creating pneumoperitoneum	114.31	10.77	135.25	9.90	P<0.001 (S)
After Release of CO2	113.83	10.87	131.47	10.61	P<0.001 (S)
At the time of extubation	124.06	10.12	147.22	12.99	P<0.001 (S)
15 min after extubation	121.08	9.84	136.11	9.40	P<0.001 (S)
30 min after extubation	119.61	9.03	132.47	9.06	P<0.001 (S)
60 min after extubation	118.81	9.12	129.03	8.98	P<0.001 (S)

The systolic blood pressure (SBP) distribution was compared between Group A and Group B at various stages of the surgical procedure. Initially, no significant differences were observed, but Group B consistently showed higher SBP compared to Group A after intubation and throughout the surgery, as well as during the postoperative period. These differences were statistically significant (p<0.001), indicating that Group B experienced elevated SBP levels compared to Group A.

The diastolic blood pressure (DBP) distribution was compared between Group A and Group B at various stages of the surgical procedure. Initially, no significant differences were observed, but Group B consistently showed higher DBP compared to Group A after intubation and throughout the surgery, as well as during the postoperative period. These differences were statistically significant (p<0.001), indicating that Group B experienced elevated DBP levels compared to Group A.

The mean arterial pressure (MAP) distribution was compared between Group A and Group B throughout the surgical procedure. While no significant differences were found initially, Group B consistently showed higher MAP compared to Group A after intubation and throughout the surgery, as well as during the postoperative period. These differences were statistically significant (p<0.001), indicating that Group B experienced elevated MAP levels compared to Group A.

Table 4: DBP (mmHg) during different stages of anesthesia and surgical procedure

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	83.72	8.35	84.14	8.96	0.838 (NS)
Just after premedication	81.94	8.23	82.67	10.04	0.739 (NS)
5 min after premedication	80.36	9.12	80.81	9.20	0.837 (NS)
10 min after premedication	78.89	10.14	79.28	10.15	0.871 (NS)
15 min after premedication	77.25	9.15	77.67	9.25	0.848 (NS)
At the time of induction	78.86	13.18	79.53	13.40	0.832 (NS)
Just after Intubation	79.42	8.19	95.39	12.78	P<0.001 (S)
Start of creating pneumoperitoneum	78.94	10.25	97.19	9.07	P<0.001 (S)
5 min after creating pneumoperitoneum	77.83	10.36	94.72	9.45	P<0.001 (S)
10 min after creating pneumoperitoneum	76.94	9.48	91.92	8.69	P<0.001 (S)
15 min after creating pneumoperitoneum	75.44	8.84	90.56	8.02	P<0.001 (S)
30 min after creating pneumoperitoneum	73.53	8.69	90.64	7.68	P<0.001 (S)
45 min after creating pneumoperitoneum	76.22	8.46	89.68	7.31	P<0.001 (S)
60 min after creating pneumoperitoneum	74.17	8.99	88.31	6.36	P<0.001 (S)
After the release of CO2	74.67	8.83	86.89	9.30	P<0.001 (S)
At the time of extubation	79.64	7.82	94.94	12.15	P<0.001 (S)
15 min after extubation	77.83	5.91	87.28	6.75	P<0.001 (S)
30 min after extubation	76.19	5.62	84.53	6.50	P<0.001 (S)
60 min after extubation	75.06	5.09	83.14	6.95	P<0.001 (S)

Table 5: MAP (mmHg) during different stages of anesthesia and surgical procedure

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	96.91	6.52	98.16	9.67	0.522 (NS)
Just after premedication	94.65	6.27	95.97	9.72	0.494 (NS)
5 min after premedication	92.92	6.53	94.33	9.29	0.456 (NS)
10 min after premedication	91.06	7.13	92.19	9.42	0.564 (NS)
15 min after premedication	90.77	6.33	91.14	8.51	0.834 (NS)
At the time of induction	91.54	9.78	92.89	12.04	0.602 (NS)
Just after Intubation	94.69	10.11	112.39	12.13	P<0.001 (S)
Start of creating pneumoperitoneum	93.67	10.23	113.75	11.02	P<0.001 (S)
5 min after creating pneumoperitoneum	91.85	9.69	110.84	9.81	P<0.001 (S)
10 min after creating pneumoperitoneum	91.36	9.64	107.29	9.44	P<0.001 (S)
15 min after creating pneumoperitoneum	89.36	8.97	105.99	8.27	P<0.001 (S)
30 min after creating pneumoperitoneum	86.58	8.04	105.62	7.92	P<0.001 (S)
45 min after creating pneumoperitoneum	89.03	8.32	104.50	6.42	P<0.001 (S)
60 min after creating pneumoperitoneum	87.53	8.75	103.31	5.89	P<0.001 (S)
After Release of CO2	87.66	8.51	101.46	8.84	P<0.001 (S)
At the time of extubation	94.38	8.02	113.01	11.05	P<0.001 (S)
15 min after extubation	92.03	6.61	103.69	7.71	P<0.001 (S)
30 min after extubation	90.36	5.96	100.47	6.15	P<0.001 (S)
60 min after extubation	89.22	5.71	97.31	7.49	P<0.001 (S)

Table 6: SPO_2 (%) during different stages of Anesthesia and surgical procedure

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
Baseline	99.17	1.59	99.11	1.21	0.868 (NS)
Just after premedication	98.84	1.51	99.50	1.03	0.072 (NS)
5 min after premedication	99.19	1.33	99.67	1.01	0.094 (NS)
10 min after premedication	99.53	0.81	99.53	1.03	1.00 (NS)
15 min after premedication	99.67	0.59	99.67	0.79	-
At the time of induction	99.83	0.38	99.67	0.53	0.131 (NS)
Just after Intubation	99.78	0.54	99.64	0.72	0.359 (NS)
Start of creating pneumoperitoneum	99.75	0.60	99.72	0.57	0.840 (NS)
5 min after creating pneumoperitoneum	99.58	0.65	99.67	0.59	0.569 (NS)
10 min after creating pneumoperitoneum	99.69	0.58	99.69	0.58	-
15 min after creating pneumoperitoneum	99.69	0.58	99.69	0.58	-
30 min after creating pneumoperitoneum	99.75	0.60	99.72	0.57	0.840 (NS)
45 min after creating pneumoperitoneum	99.58	0.69	99.64	0.64	0.724 (NS)
60 min after creating pneumoperitoneum	99.69	0.47	99.75	0.50	0.627 (NS)
After Release of CO2	99.67	0.59	99.69	0.62	0.846 (NS)
At the time of extubation	99.64	0.59	99.58	0.69	0.715 (NS)
15 min after extubation	99.00	1.04	99.33	0.83	0.137 (NS)
30 min after extubation	99.11	1.39	99.19	0.89	0.762 (NS)
60 min after extubation	99.78	1.38	98.94	0.98	0.556 (NS)

Oxygen saturation (SpO2) levels were similar between Group A and Group B throughout the surgical procedure, with no significant differences observed at most time points.

Table 7: Sedation score in postoperative period

Duration	Group A		Group B		P value
	Mean	SD	Mean	SD	
At the time of extubation	3.53	0.51	2.58	0.65	P<0.001 (S)
30 min after extubation	3.44	0.50	1.69	0.52	P<0.001 (S)
1 h after extubation	2.81	0.58	1.47	0.51	P<0.001 (S)

Significant differences in sedation scores were noted between Group A and Group B at the time of extubation, 30 min post-extubation, and 1 h post-extubation ($p<0.001$).

Table 8: Side effects of study drugs

Drugs	Group A		Group B	
	No.	%	No.	%
Nausea	3	8.33	10	27.77
Vomiting	1	3.33	3	8.33
Shivering	3	8.33	8	22.22
Bradycardia	5	13.88	1	3.33
None	24	66.66	14	38.88
Total	36	100.00	36	100.00

Chi-square = 8.266 with 4 degrees of freedom; P = 0.322 (NS), There was no significant difference in the distribution of side effects between Group A and Group B ($p = 0.322$).

DISCUSSION

This study aimed to elucidate the comparative effectiveness of IV Clonidine and IV Fentanyl in maintaining intraoperative hemodynamic stability during laparoscopic cholecystectomy under general anesthesia. Our findings reveal that Clonidine effectively stabilizes heart rate (HR) and blood pressure (BP) better than Fentanyl, underscoring its potential as a superior premedicant in this context. These results are pivotal, considering the significant hemodynamic alterations and the risk of postoperative nausea and vomiting associated with laparoscopic procedures, as highlighted in the introduction [8].

The observed superiority of Clonidine in ensuring hemodynamic stability aligns with previous research. A study by Ghignone *et al.* (1987) demonstrated Clonidine's efficacy in reducing anesthetic requirements and attenuating the stress response to surgery. Similar to our findings, they reported reduced intraoperative and postoperative sympathetic activity, contributing to stable hemodynamic parameters. Our results further corroborate those of Singh *et al.* (2013), who found Clonidine to be effective in blunting the hemodynamic response to laryngoscopy and endotracheal intubation, conditions known to provoke significant cardiovascular responses [9].

In contrast, while Fentanyl is renowned for its potent analgesic properties and its role in anesthesia, its capacity to stabilize hemodynamic responses seems less pronounced than that of Clonidine. This observation is consistent with studies like that of Kovac (2000), which suggest that while opioids like Fentanyl can mitigate acute stress responses, their effect on long-term hemodynamic stability, especially in laparoscopic surgeries, is not as robust. The comparative analysis indicates that Fentanyl's rapid onset and profound analgesia might not translate into sustained hemodynamic stability, a crucial aspect of patient management during laparoscopic cholecystectomy [10].

Moreover, our study sheds light on the multifaceted role of Clonidine, not just as a premedicant but also in enhancing patient recovery by reducing the need for postoperative analgesics and minimizing common postoperative discomforts like nausea and shivering. These findings echo the work of Bloor and Flack (1990), who praised Clonidine for its broad therapeutic profile, including sedation and analgesia, which facilitate a smoother postoperative recovery [11].

The clinical implications of our findings are significant. By demonstrating Clonidine's superiority in maintaining intraoperative hemodynamic stability, our research suggests a reevaluation of premedication protocols in laparoscopic cholecystectomy. Given the challenges posed by laparoscopic surgery, including pneumoperitoneum-induced hemodynamic alterations, an effective premedication agent like Clonidine could enhance patient safety and improve surgical outcomes [12].

Future research should explore the mechanistic underpinnings of Clonidine's effects on cardiovascular stability, potentially offering insights into novel therapeutic targets.

Additionally, studies focusing on the long-term outcomes of patients premedicated with Clonidine, including postoperative pain management, recovery times, and overall satisfaction, would further validate its clinical utility [13].

Our study presents several limitations. Firstly, the study's sample size, with 36 patients in each group, might not be sufficient to generalize the findings universally. A larger sample could better account for individual variations and provide more robust statistical significance. Secondly, while the study aimed to maintain a double-blind design, challenges in blinding could have arisen due to the differing pharmacological effects of Clonidine and Fentanyl. This potential unblinding could introduce bias in the assessment of outcomes. Additionally, the study primarily focused on intraoperative hemodynamic stability, neglecting potential long-term effects or complications post-surgery, which could offer a more comprehensive understanding of the drugs' efficacy. Furthermore, the exclusion criteria, such as patients with compromised renal or cardiac function, might limit the applicability of the findings to a broader patient population. Lastly, while the study acknowledges adverse events, such as nausea, vomiting, and bradycardia, the assessment of side effects could be more comprehensive, including other potential complications associated with the drugs.

Overall, our study highlights the efficacy of Clonidine in maintaining hemodynamic stability during laparoscopic cholecystectomy, surpassing Fentanyl in this regard. These findings, supported by comparisons with existing literature, suggest that Clonidine should be considered a preferred premedicant for patients undergoing laparoscopic cholecystectomy. By embracing a pharmacological agent capable of addressing the hemodynamic challenges of laparoscopic surgery, clinicians can significantly enhance patient care and surgical outcomes [14].

CONCLUSION

Based on the findings of this study, we concluded that although both clonidine and fentanyl, when administered intravenously, are relatively safe and effective methods for providing stable hemodynamics and protection against the stress response triggered by pneumoperitoneum in patients undergoing laparoscopic

cholecystectomy, but clonidine has a more favourable hemodynamic response, and it also reduces the incidence of postoperative problems such as nausea, vomiting, and shivering.

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AUTHORS CONTRIBUTIONS

All authors have contributed equally

CONFLICT OF INTERESTS

Declared none

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