RESEARCH PAPER

Comparison of an intraoperative infusion of dexmedetomidine and remifentanil on intraoperative hemodynamic and postoperative recovery after laparoscopic sterilization: A Prospective Randomized Controlled Trial

Mahesh Kumar Murugan[1]*, Shalini T[2], Karthik Krishnamoorthy[3], Vishak Manoj Baskar[4], Jayaprithika Arumugam[5]

[1]Final Year Postgraduate, Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: muruganmahesh97@gmail.com

[2]Final Year Postgraduate, Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: st3990@srmist.edu.in

[3]Professor, Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: karthikkrishnamoorthy1981@gmail.com

[4]Assistant Professor, Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: manojvishak@gmail.com

[5]Senior Resident, Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: preethikaarumugam2025@gmail.com

Corresponding Author
*Dr. Mahesh Kumar Murugan
Final Year Postgraduate,Department of Anesthesiology, SRM Medical College Hospital and Research Centre, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, India.
Email:ID: muruganmahesh97@gmail.com

ABSTRACT

Background: Laparoscopic sterilization is often related with intraoperative hemodynamic changes and post-operative discomfort. Dexmedetomidine and remifentanil are widely used as adjuncts to anesthesia for hemodynamic stability and better recovery. This study investigated the effects of intraoperative infusion of dexmedetomidine and remifentanil on intraoperative hemodynamics and postoperative recovery after laparoscopic sterilization.

Methodology:

This was a prospective double blinded randomized controlled trial conducted on 84 ASA grade I and II patients receiving laparoscopic sterilization at SRM Medical College Hospital. Patients were randomly allocated to Group D (dexmedetomidine) and Group R (remifentanil), with 42 patients in each group. Hemodynamic parameters, Modified Aldrete recovery scores, postoperative pain scores, need for rescue analgesics and surgical sequelae were measured and compared.

Result:

Compared to remifentanil, dexmedetomidine significantly reduced systolic and diastolic blood pressure and heart rate ($p<0.001$). Immediate postoperative recovery was slightly better in the remifentanil group but recovery scores were comparable at 15 and 30 min. Postoperative pain levels were considerably lower in the dexmedetomidine group (VAS 2.55±0.50 vs. 5.05±0.85; $p<0.001$) and required less rescue analgesia. Dexmedetomidine was associated with considerably less postoperative nausea and shivering.

Discussion

Dexmedetomidine showed better sympatholytic and analgesic effects compared to remifentanil, which led to better hemodynamic stability and fewer opioid-related postoperative problems.

Conclusion:

Dexmedetomidine provides a good postoperative recovery for patients undergoing laparoscopic sterilization. Remifentanil provided rapid recovery and hemodynamic stability while dexmedetomidine provided superior perioperative analgesia, and fewer postoperative complications..

Keywords: Dexmedetomidine, Remifentanil, Laparoscopic sterilization, Hemodynamic stability, Postoperative recovery, Postoperative analgesia.

*Author for Correspondence: muruganmahesh97@gmail.com

Comparison of an intraoperative infusion of dexmedetomidine and remifentanil on intraoperative hemodynamic and postoperative recovery after laparoscopic sterilization: A Prospective Randomized Controlled Trial

How to cite this article: Murugan MK, Shalini T, Krishnamoorthy K, Baskar VM, Arumugam J. Comparison of an intraoperative infusion of dexmedetomidine and remifentanil on intraoperative hemodynamic and postoperative recovery after laparoscopic sterilization: A Prospective Randomized Controlled Trial. Int J Drug Deliv Technol. 2026;16(59s): 1188-1195. DOI: 10.25258/ijddt.16.59s.135

Source of support: Nil.

Conflict of interest: Nil.

INTRODUCTION

When compared with conventional open surgical approaches, laparoscopic treatments are associated with less tissue trauma, shorter hospital stay, rapid post-operative healing, early ambulation and improved patient satisfaction. (2) Laparoscopic sterilization, although less invasive, is associated with significant perioperative physiological stress reactions, which are related to pneumoperitoneum, patient posture, airway instrumentation, and surgical stimulation. Insufflation of carbon dioxide during laparoscopy can generate major hemodynamic changes such as tachycardia, hypertension, increase in systemic vascular resistance and changes in cardiac output. (3) These responses can have deleterious effects on intraoperative stability and postoperative recovery and hence require the use of anesthetic adjuvants that can provide appropriate analgesia, sedation and hemodynamic control without increasing recovery time. (4) The goal of modern ambulatory anesthesia is speedy recovery, early discharge, minimum postoperative pain and incidence of nausea and vomiting with appropriate intraoperative settings. Thus, the use of short-acting anesthetic drugs and opioid sparing strategies has acquired more attention in the modern anaesthetic practice. (5) Dexmedetomidine and remifentanil showed better adjuvant anaesthetic agents among many pharmacologic agents due to their desirable pharmacokinetic and pharmacodynamic characteristics. Both medicines are capable of attenuating sympathetic responses to surgical stress but differ markedly in their mechanisms of action and side-effect profiles. (6)

Dexmedetomidine is a highly selective α2-adrenergic receptor agonist that causes drowsiness, anxiolysis, sympatholysis, and analgesia with no severe respiratory depression. It produces sedation similar to natural sleep and has been demonstrated to lessen the need for anesthesia and opioids during surgery. (7) Dexmedetomidine has also been associated with enhanced perioperative hemodynamic stability and may lower postoperative pain and narcotic use. However, concerns persist regarding the risk for bradycardia, hypotension, delayed emergence and prolonged sedation, especially when given as a continuous intraoperative infusion. (8)

Remifentanil, in contrast, is a μ-opioid receptor agonist with an ultra-short duration of action, quick onset, predictable titratability and metabolism irrespective of hepatic or renal function. Remifentanil is metabolized by nonspecific plasma esterases in a unique ester metabolism, resulting in excellent management of intraoperative analgesia with rapid recovery after withdrawal. (9) This is especially helpful in ambulatory surgery where early postoperative recovery is required. However, remifentanil has been associated with side effects such as respiratory depression, postoperative hyperalgesia, nausea, vomiting and immediate opioid tolerance which may adversely affect postoperative comfort and quality of recovery. (10)

Dexmedetomidine and remifentanil have been individually evaluated in several laparoscopic and ambulatory surgical procedures, but there is limited evidence regarding their comparative effects on intraoperative hemodynamic responses and postoperative recovery profiles of patients undergoing laparoscopic sterilization. (11) Laparoscopic gynecological operations induce certain physiological changes and have special anesthetic management to get the best perioperative outcome. Therefore, it is of great clinical importance to find an agent that gives better hemodynamic stability with speedy and smooth recovery. (12)

The present prospective randomized controlled trial was designed to examine the effects of intra-operative infusion of dexmedetomidine and remifentanil on intra-operative hemodynamic parameters and post-operative recovery characteristics in patients undergoing laparoscopic sterilization. The randamized control trial is to evaluate their effectiveness in reducing the stress response, preserving cardiovascular stability and promoting post-operative recovery to provide evidence based anesthetic management protocols for ambulatory laparoscopic gynecological operations.

METHODOLOGY:

This prospective double blinded randomized controlled trial was performed for a period of six months in the Department of Anesthesiology, SRM Medical College Hospital and Research Institute, Kattankulathur, Chengalpattu, Tamil Nadu. The study was approved by the Institutional Scientific Committee and Institutional Ethics Committee. All patients signed written informed consent after being educated about the nature of the study, anesthetic method, possible risks and benefits in their native language. All the patient-related information was kept totally confidential during the entire study. No trial or hazardous substances were employed in the trial and all medicines used were part of normal anesthetic practice.

Sample size was determined by the usual formula for mean difference based on prior studies with 95% confidence interval and sufficient study power. (13) The sample size was calculated to be 42 patients per group, for a total of 84 patients. The study comprised patients aged between 18 to 35 years, in American Society of Anesthesiologists (ASA) physical status classes I and II, scheduled for elective laparoscopic sterilization under general anesthesia. Patients were excluded from the trial if they refused to participate, had severe cardiovascular, pulmonary, renal or hepatic disorders, known hypersensitivity to dexmedetomidine or remifentanil, severe obesity (body mass index ≥35–40 kg/m²) or a history of substance misuse or opiate dependency.

Eligible patients were randomly assigned by computer-generated randomization to Group D and Group R. Throughout the trial period, both the patients and the anesthesiologists who performed the postoperative assessment were blinded to the group allocation. On arrival in the operation room, all patients were linked to standard ASA monitors (electrocardiography, non-invasive blood pressure monitoring, pulse oximetry and capnography). Baseline haemodynamic values were taken before induction of anesthesia.

The randomization sequence was established by a computer-based randomization process and group allocation was disguised in sequentially numbered opaque sealed envelopes for an effective double blinding. The study medicines were produced by an independent anesthesiologist who had no involvement in patient management, intraoperative monitoring, postoperative assessment, or data analysis. Dexmedetomidine and remifentanil were diluted to similar amounts and put into identical 50-mL masked syringes labeled only with the trial code (Group D or Group R) thus avoiding identification of the drug by visual appearance. The loading dosage and maintenance infusion were provided using calibrated syringe infusion pumps with the same infusion settings. Patients, operating surgeons, attending anesthesiologists responsible for intraoperative monitoring, recovery room personnel and postoperative outcome assessors were blinded to group allocation for the duration of the trial period. All patients received premedicant intravenous glycopyrrolate 0.2 mg and ondansetron 4 mg. General anesthesia was induced with intravenous propofol 2 mg/kg and laryngeal mask airway (I-gel) was applied. Sevoflurane anesthesia was maintained at a minimum alveolar concentration (MAC) of 2% following the procedures of the study medication infusion. For Group D patients, a loading dose of dexmedetomidine 0.7 μg/kg was given over 10 min before induction of anesthesia, followed by a continuous infusion of dexmedetomidine 0.5 μg/kg/h with propofol infusion at 3 μg/ml. Group R patients received a remifentanil loading dosage of 1.5 μg/kg before induction, a remifentanil continuous infusion of 0.15 μg/kg/min and a propofol infusion of 3 μg/ml. At the end of surgery (skin suturing completed), infusions of propofol and study medications were withdrawn.

Intraoperative hemodynamic parameters including heart rate and blood pressure were continually monitored and recorded at preset intervals. The key outcome indicators for the study were the incidence of hypotension and bradycardia which were of particular interest. Postoperative recovery was assessed by Modified Aldrete Recovery Score. Secondary endpoints included evaluation of postoperative opioid-related adverse effects such as nausea, vomiting, shivering and the need for rescue analgesia. All observations were meticulously recorded and statistically evaluated to assess the efficacy of dexmedetomidine versus remifentanil in preserving intraoperative hemodynamic stability and improving postoperative recovery in patients undergoing laparoscopic sterilization.

RESULTS:

Table 1 Table 1 shows the demographic characteristics of the study population. Most of the patients belonged to 31–35 years age group (46.6% in Group D and 40.0% in Group R) followed by 26–30 years age group (28.6% and 35.7% respectively). In both groups, 23.8% of the patients were 20–25 years old. The BMI distribution was similar between the groups (50.0% normal BMI, 26.2% overweight, and 23.8% obese in both groups), indicating similar baseline characteristics between the study groups..

Table 2: Intraoperative vital parameters in Group D and Group R. Group D (Dexmedetomidine) Group R (Remifentanil) The hemodynamic parameters were steady in the first 25 min. in both the groups however the heart rate was lower in Group D (61-62 bpm.) than Group R (81-82 bpm). Group R had better steady blood pressure and mean arterial pressure during operation. SBP in Group D decreased progressively from 74.2 ± 3.2 mmHg at 30 min to 68.0 ± 4.2 mmHg at 60 min, but in Group R, SBP remained steady at 100–111 mmHg. SpO2 was maintained at 100% in both groups during the entire procedure. The differences were statistically significant ($p<0.001$) with better intraoperative hemodynamic stability with the Remifentanil infusion.

Comparison of postoperative recovery profile according to Modified Aldrete Score is shown in Table 3. The mean (±SD) Aldrete score at 0 min postoperatively was 10 (perfect score) in Group R and somewhat lower, 9.76±0.43 in Group D. This difference was statistically significant ($p=0.001$) with a little faster initial recovery in the remifentanil group. In both groups, all the patients reached the full Aldrete score of 10 at 15 and 30 minutes postoperatively, and the intergroup differences were statistically insignificant. These results indicate that, whereas remifentanil offered a marginally earlier acute recovery, similar recovery profiles were seen in the early postoperative period with both medications.

Table 4 shows comparison of postoperative pain measures between the two groups. The mean of postoperative analgesia in Group D was substantially longer when compared to Group R ($p<0.001$) (mean duration: 24.21 ± 2.93 minutes and 0.95 ± 0.31 minutes, respectively). The time to commencement of pain with Visual Analogue Scale (VAS) score > 4 was longer in the dexmedetomidine group (21.05 ± 31.18 minutes) than in the remifentanil group (11.64 ± 4.88 minutes), although the difference was not statistically significant ($p=0.057$). Furthermore, the postoperative VAS scores were substantially lower in Group D (2.55 ± 0.50) than in Group R (5.05 ± 0.85) with $p < 0.001$. These results showed more postoperative analgesic effect with dexmedetomidine infusion.

Table 5 compares postoperative complications in the two groups. Postoperative nausea was much lower in Group D, occurring in only 9.5% of patients compared with 26.2% in Group R ($p=0.046$). The incidence of vomiting was lower in the dexmedetomidine group (9.5%) than in the remifentanil group (23.8%), although the difference was not statistically significant ($p=0.079$). The use of rescue analgesics was much less in Group D where only 33.3% patients required additional analgesia as compared to 76.2% in Group R ($p<0.001$). There was no postoperative

shivering in the dexmedetomidine group; 28.6% of patients in the remifentanil group had shivering, and the difference was highly significant ($p<0.001$). In conclusion, dexmedetomidine was related with lesser postoperative complications and better postoperative recovery than remifentanil.

DISCUSSION:

The aim of the present prospective randomized controlled trial was to assess the dexmedetomidine and remifentanil during laparoscopic sterilization with respect to intraoperative hemodynamic stability and post-operative recovery results. The study showed that Remifentanil provided better hemodynamic control, and dexmedetomidine showed better postoperative analgesia and less surgical complications while remifentanil gave slightly faster rapid recovery. The two groups were matched in demographic variables such as age and body mass index, the variations found could reliably be attributed to the pharmacological effects of the drugs.

The present trial found that intraoperative hemodynamic stability was marked improved with Remifentanil, which was an important outcome of the present study. The patients in the dexmedetomidine group had considerably lower systolic blood pressure, diastolic blood pressure and heart rate than the remifentanil group. The results show a better attenuation of the sympathetic responses related to the pneumoperitoneum and surgical stimulation . Similar data have been reported by Janatmakan et al. (2021) who showed that dexmedetomidine maintained more steady mean arterial pressure and heart rate than remifentanil during spinal surgery. (14) In addition, Ye et al. (2021) also reported that dexmedetomidine was efficient in reducing changes in blood pressure and heart rate during laparoscopic surgery, thus enhancing perioperative cardiovascular stability. The lower hemodynamic variability in our study could be explained by the better sympatholytic effect of dexmedetomidine through selective α2-adrenergic receptor agonism. (15)

However, our findings were partially different from the meta-analysis by Xu et al. (2023) who revealed no significant difference between dexmedetomidine and remifentanil in terms of minimum mean arterial pressure and heart rate during managed hypotension. This variance may be attributed to the diversity in the surgical situation, the anesthetic technique and the dose regimen. However, Xu et al. concluded that both medications are effective in controlled hypotension, but dexmedetomidine provided better postoperative comfort and analgesia, which significantly confirms our findings. (16)

In the present study the postoperative recovery (Modified Aldrete Score) was a little faster in the remifentanil group immediately at 0 minutes postoperatively. However, both groups attained full recovery ratings at 15 and 30 min indicating similar overall recovery profiles. These findings are consistent with the data of Xu et al. (2023) who reported shorter extubation and recovery times with remifentanil due to its ultra-short duration of action and rapid metabolism. (16) Similarly, Xiong et al. (2025) reported similar recovery rates across opioid-free and opioid-sparing anesthetic procedures with modest changes in early emergence. (17) Although dexmedetomidine may somewhat delay rapid awakening because of its sedative action, such delay was clinically negligible in our study and did not impact the quality of postoperative recovery. (17)

Another notable finding of the present investigation was the analgesic benefit of dexmedetomidine. The patients treated with dexmedetomidine had significantly lower VAS scores after the surgery, delayed onset of severe pain and less need for analgesics than the remifentanil group. Koo et al. (2023) found that patients undergoing gynecological laparoscopy who received dexmedetomidine had considerably lower postoperative pain levels and a decreased need for rescue analgesics. (18)The authors attributed these results to the blockade of remifentanil-induced hyperalgesia. Janatmakan et al. (2021) similarly showed considerably less postoperative pain intensity and analgesic usage with dexmedetomidine infusion. (14) In addition, Xu et al. (2023) found that the meta-analysis considerably reduced postoperative visual analogue pain scores compared with remifentanil. The enhanced analgesic profile observed in our study may be explained by the central antinociceptive and opioid-sparing actions of dexmedetomidine. (16)

Postoperative complications were also much reduced in dexmedetomidine group. The incidence of nausea, shivering and need of rescue analgesics was significantly lower than remifentanil. Postoperative vomiting was less with dexmedetomidine although the difference was statistically not significant. These results coincide closely with those of Koo et al. (2023) who found considerably decreased rates of postoperative nausea, vomiting and shivering when dexmedetomidine was used. (18) Xu et al. (2023) also found that the incidence of postoperative nausea, vomiting and shivering was lower in the dexmedetomidine group than in the remifentanil group. (16) In the study by Janatmakan et al. (2021), the dexmedetomidine group showed lesser postoperative side effects and analgesic needs. The lower incidence of opioid-associated side effects in our trial could be attributable to the opioid sparing feature of dexmedetomidine and lack of remifentanil-induced hyperalgesia. (14)

Thus, the current study indicates that dexmedetomidine provides a better balance between postoperative recovery for patients undergoing laparoscopic sterilization. Remifentanil provided rapid recovery and stable hemodynamic stablity while dexmedetomidine provided superior perioperative analgesia, and fewer postoperative complications. These features make dexmedetomidine a valuable supplementary anesthetic in gynecologic laparoscopic procedures, where optimum analgesia and rapid recovery are important clinical goals.

RECOMMENDATION:

Dexmedetomidine may be preferred to remifentanil as an adjuvant for intraoperative anesthesia in laparoscopic sterilization due to better hemodynamic stability, increased postoperative analgesia and a lower incidence of opioid-related side effects.

LIMITATION:

The investigation was done in a single tertiary care center and the sample size was quite small and this may restrict the generalizability of the findings. Long-term post-operative results and patient satisfaction scores were not assessed.

CONCLUSION:

This study showed that Dexmedetomidine provides a better balance between postoperative quality of recovery for patients undergoing laparoscopic tubal sterilization. Remifentanil provided somewhat faster rapid recovery and stable hemodynamic stablity while dexmedetomidine provided superior perioperative analgesia, and fewer postoperative complications. In conclusion, dexmedetomidine was a safer and more effective anesthetic adjunct in balanced anesthesia for ambulatory laparoscopic gynecologic procedures.

ACKNOWLEDGEMENT:

The authors sincerely acknowledge the support of the Department of Anesthesiology, SRM Medical College Hospital and Research Institute, and thank all the patients who participated in this study.

Conflict of Interest:

The authors declare that there is no conflict of interest related to this study.

Results:

Table 1: Demographic Details

Variables	Group D (Dexmedetomidine) n=42	Group R (Remifentanil) n=42	Total n=84
Age Group			
20 – 25 years	10 (23.8%)	10 (23.8%)	20 (23.8%)
26 – 30 years	12 (28.6%)	15 (35.7%)	27 (32.2%)
31 – 35 years	20 (46.6%)	17 (40.0%)	37 (44.0%)
BMI Category			
Normal (18.5 – 24.9)	21 (50.0%)	21 (50.0%)	42 (50.0%)
Overweight (25 – 29.9)	11 (26.2%)	11 (26.2%)	22 (26.2%)
Obese (≥ 30)	10 (23.8%)	10 (23.8%)	20 (23.8%)

Table 2: Comparison Of Intraoperative Vitals (Independent Samples T-Test)

	GROUP D – Dexmedetomidine				GROUP R – Remifentanil			
TIME (Min)	**HR (bpm)**	**BP (mmHg) Sys/Dia**	**MAP (mmHg)**	**SpO2 (%)**	**HR (bpm)**	**BP (mmHg) Sys/Dia**	**MAP (mmHg)**	**SpO2 (%)**
5 MIN	62.3 ± 1.8	84.3/55.5 (±3.1/±2.7)	65.1 ± 2.3	100 ± 0.0	81.7 ± 4.5	100.8/64.7 (±4.4/±2.5)	80.0 ± 2.1	100 ± 0.0
10 MIN	62.0 ± 1.7	84.3/55.4 (±3.3/±2.6)	65.0 ± 2.1	100 ± 0.0	81.7 ± 4.9	100.5/65 (±4.5/±2.9)	80.2 ± 2.8	100 ± 0.0
15 MIN	61.9 ± 1.7	84.6/55.8 (±2.7/±2.4)	65.4 ± 2.0	100 ± 0.0	82 ± 4.7	100.7/65 (±4.6/±2.7)	80.2 ± 2.4	100 ± 0.0
20 MIN	61.9 ± 1.7	83.5/55.4 (±3.5/±2.4)	64.8 ± 2.1	100 ± 0.0	81.5 ± 4.5	100.8/65.2 (±4.2/±2.3)	80.4 ± 2.0	100 ± 0.0
25 MIN	62.1 ± 1.6	83.9/54.8 (±3.3/±2.8)	64.5 ± 2.3	100 ± 0.0	81.8 ± 4.6	100.6/64.6 (±4.2/±2.2)	79.9 ± 2.1	100 ± 0.0
30 MIN	61.1 ± 1.7	74.2/54.2 (±3.2/±3.0)	63.9 ± 2.4	100 ± 0.0	81.9 ± 4.6	101.6/65.0 (±5.3/±2.3)	80.6 ± 2.2	100 ± 0.0
35 MIN	61.0 ± 1.7	74.2/54.3 (±3.6/±2.8)	64.0 ± 2.3	100 ± 0.0	81.6 ± 4.9	106.8/65.1 (±4.3/±2.2)	80.4 ± 1.9	100 ± 0.0
40 MIN	61 ± 1.7	72.3/54.4 (±3.5/±2.9)	63.7 ± 2.4	100 ± 0.0	81.8 ± 4.8	108.7/65.3 (±4.6/±2.4)	80.4 ± 2.2	100 ± 0.0
45 MIN	61.1 ± 1.6	72.3/53.8 (±3.7/±2.9)	63.3 ± 2.4	100 ± 0.0	81.9 ± 4.5	110.1/65.0 (±4.6/±2.7)	80.1 ± 2.4	100 ± 0.0
50 MIN	61.1 ± 1.7	68.3/54.1 (±4.2/±2.8)	63.2 ± 2.4	100 ± 0.0	81.0 ± 4.8	110.9/65.3 (±4.7/±2.9)	80.5 ± 2.4	100 ± 0.0
55 MIN	60.0 ± 1.7	68.6/53.9 (±4.1/±2.6)	63.1 ± 2.3	100 ± 0.0	81.6 ± 4.2	111.1/64.7 (±4.8/±2.4)	80.2 ± 2.3	100 ± 0.0

60 MIN	60.0 ± 1.8	68/54.0 (±4.2/±2.6)	63.3 ± 2.5	100 ± 0.0	81.5 ± 5.0	110.4/65.6 (±4.6/±2.5)	80.5 ± 2.2	100 ± 0.0
70 MIN	60 ± 1.8	70.7/53.8 (±4.4/±3.1)	62.7 ± 2.7	100 ± 0.0	81.7 ± 4.5	110.6/64.9 (±4.8/±2.5)	80.1 ± 2.2	100 ± 0.0
P VALUE	**<0.001**			**-**	**<0.001**			**-**

Table 3: Comparison Of Aldrete Score

Parameter	Group	N	Mean	SD	Mean Difference	95% CI Lower	95% CI Upper	p-value
Aldrete Score at 0 min	Group D (Dexmedetomidine)	42	9.76	0.431	−0.238	−0.370	−0.106	0.001
	Group R (Remifentanil)	42	10	0				
Aldrete Score at 15 min	Group D (Dexmedetomidine)	42	10	0	—	—	—	NS*
	Group R (Remifentanil)	42	10	0				
Aldrete Score at 30 min	Group D (Dexmedetomidine)	42	10	0	—	—	—	NS*
	Group R (Remifentanil)	42	10	0				

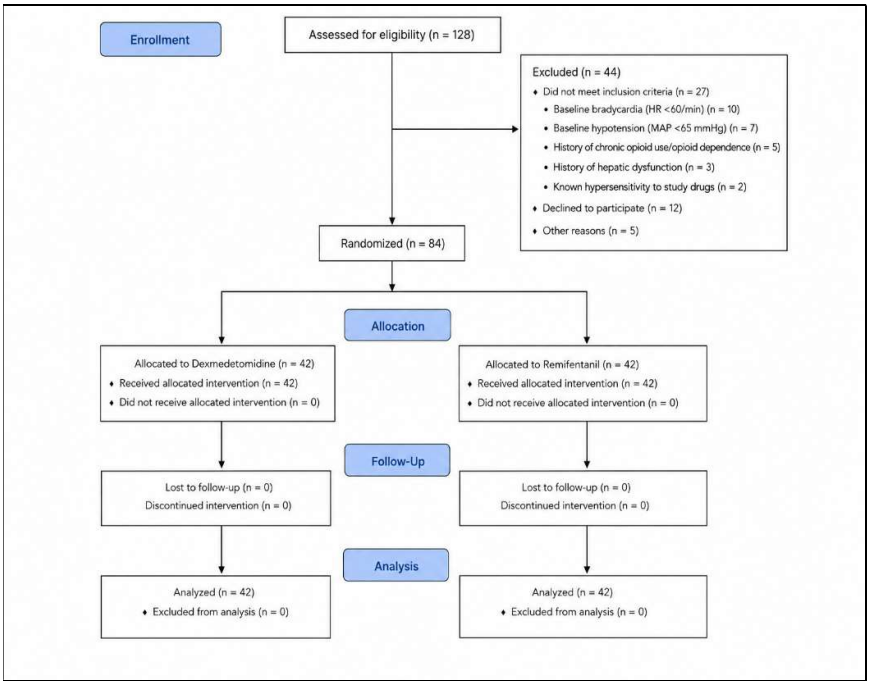
Table 4: Comparison Of Postoperative Pain Parameters (Independent Samples T-Test)

Parameter	Group	N	Mean	SD	Mean Difference	95% CI Lower	95% CI Upper	p-value
Duration of Postop Pain (mins)	Group D (Dexmedetomidine)	42	24.21	2.9321	23.262	22.357	24.167	<0.001
	Group R (Remifentanil)	42	0.948	0.3094				
Time to Pain Onset VAS >4 (min)	Group D (Dexmedetomidine)	42	21.05	31.184	9.405	−0.284	19.093	0.057
	Group R (Remifentanil)	42	11.64	4.878				
VAS Score	Group D (Dexmedetomidine)	42	2.55	0.504	−2.500	−2.804	−2.196	<0.001
	Group R (Remifentanil)	42	5.05	0.854				

Table 5: Comparison Of Postoperative Complications (Chi-Square Test)

Complication	Group D (Dexmedetomidine) n=42	Group R (Remifentanil) n=42	Total n=84	p-value
Nausea	4 (9.5%)	11 (26.2%)	15 (17.9%)	0.046
Vomiting	4 (9.5%)	10 (23.8%)	14 (16.7%)	0.079
Rescue Analgesic Required	14 (33.3%)	32 (76.2%)	46 (54.8%)	<0.001*
Shivering	0 (0.0%)	12 (28.6%)	12 (14.3%)	<0.001*

Figure 1:



REFERENCE

1. Godin, Pierre Arnaud et al. "Laparoscopic Reversal of Tubal Sterilization; A Retrospective Study Over 135 Cases." Frontiers in surgery vol. 5 79. 9 Jan. 2019, doi:10.3389/fsurg.2018.00079.
2. Shi, Zhen. "Laparoscopic vs. open surgery: A comparative analysis of wound infection rates and recovery outcomes." International wound journal vol. 21,3 (2024): e14474. doi:10.1111/iwj.14474.
3. Srivastava, Arati, and Ashutosh Niranjan. "Secrets of safe laparoscopic surgery: Anaesthetic and surgical considerations." Journal of minimal access surgery vol. 6,4 (2010): 91-4. doi:10.4103/0972-9941.72593.
4. Umano, Giuseppina Rosaria et al. "The "Dark Side" of Pneumoperitoneum and Laparoscopy." Minimally invasive surgery vol. 2021 5564745. 19 May. 2021, doi:10.1155/2021/5564745.
5. . Lee, Jeong Han. "Anesthesia for ambulatory surgery." Korean journal of anesthesiology vol. 70,4 (2017): 398-406. doi:10.4097/kjae.2017.70.4.398.
6. Al-Hassan, Abbas et al. "Comparative Efficacy of Dexmedetomidine and Remifentanil in Reducing Postoperative Pain and Opioid Use: A Systematic Review." Cureus vol. 17,2 e79759. 27 Feb. 2025, doi:10.7759/cureus.79759.
7. Lee, Seongheon. "Dexmedetomidine: present and future directions." Korean journal of anesthesiology vol. 72,4 (2019): 323-330. doi:10.4097/kja.19259.
8. Kaye, Alan David et al. "Dexmedetomidine in Enhanced Recovery After Surgery (ERAS) Protocols for Postoperative Pain." Current pain and headache reports vol. 24,5 21. 2 Apr. 2020, doi:10.1007/s11916-020-00853-z.
9. . Okano, Hiromu et al. "Remifentanil use in intensive care units: Current evidence and future perspectives." Acute medicine & surgery vol. 12,1 e70087. 31 Aug. 2025, doi:10.1002/ams2.70087.
10. . Bhatia R, Chawla A, Garg S. Remifentanil in Modern Perioperative Care: Current Evidence and Future Directions. Journal of Indian College of Anaesthesiologists [Internet]. 2026 Jan [cited 2026 May 18];5(1):14–21. . s.l. : https://journals.lww.com/jica/fulltext/2026/01000/remifentanil_in_modern_perioperative_care__current.3.aspx.
11. Xu, Ning et al. "Dexmedetomidine versus remifentanil for controlled hypotension under general anesthesia: A systematic review and meta-analysis." PloS one vol. 18,1 e0278846. 17 Jan. 2023, doi:10.1371/journal.pone.0278846.
12. Koo, Jung Min et al. "Efficacy of Dexmedetomidine vs. Remifentanil for Postoperative Analgesia and Opioid-Related Side Effects after Gynecological Laparoscopy: A Prospective Randomized Controlled Trial." Journal of clinical medicine . s.l. : vol. 12,1 350. 2 Jan. 2023, doi:10.3390/jcm12010350.
13. Jung Min Koo, Chung YJ, Lee M, Young Eun Moon. Efficacy of Dexmedetomidine vs. Remifentanil for Postoperative Analgesia and Opioid-Related Side Effects after Gynecological Laparoscopy: A Prospective Randomized Controlled Trial. . s.l. : Journal of Clinical Medicine. 2023 Jan 2;12(1):350–0.
14. Janatmakan F, Nassajian N, Jarirahmadi S, Tabatabaee K, Zafari M. Comparison of the effect of dexmedetomidine and remifentanil on pain control after spinal surgery: A double-blind, randomized clinical trial. Anesthesiology and pain medicine. . s.l. : 2021 May 8;11(2):e111533.
15. Ye Q, Wang F, Xu H, Wu L, Gao X. Effects of dexmedetomidine on intraoperative hemodynamics, recovery profile and postoperative pain in patients

undergoing laparoscopic cholecystectomy: a randomized controlled trial. BMC anesthesiology. . s.l. : 2021 Mar 1;21(1):63.

16. . Xu N, Chen L, Liu L, Rong W. Dexmedetomidine versus remifentanil for controlled hypotension under general anesthesia: a systematic review and meta-analysis. PLoS One. 2023 Jan 17;18(1):e0278846.
17. 1Xiong M, Liu Y, Liang Y, Wang H, Zhang L, Zhang Z, Fang M. Opioid-Free versus Opioid-Sparing Anesthesia for Postoperative Pain and Early Recovery After Laparoscopic Cholecystectomy: A Randomized Controlled Trial. Journal of Pain Research. 2025 Dec 31:2137.
18. . Koo JM, Chung YJ, Lee M, Moon YE. Efficacy of dexmedetomidine vs. remifentanil for postoperative analgesia and opioid-related side effects after gynecological laparoscopy: a prospective randomized controlled trial. Journal of Clinical Medicine. . s.l. : 2023 Jan 2;12(1):350..