Original Article

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Anaesthesia Section

Dexmedetomidine versus Clonidine for Improved Quality of Emergence from General Anaesthesia: A Randomised Placebo-Controlled Study

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ABSTRACT

Introduction: Extubation of the trachea upon emergence from General Anaesthesia (GA) is often accompanied by potentially dangerous events, like coughing, hypertension, tachycardia, and agitation. The centrally acting α-2 agonist, dexmedetomidine, has been evaluated to attenuate the emergence/extubation response. However, there is insufficient evidence regarding the effectiveness of clonidine for the same purpose.

Aim: This study aimed to evaluate the quality of emergence from GA in patients receiving clonidine infusion versus dexmedetomidine infusion.

Materials and Methods: In this randomised, double-blinded trial conducted over a period of 5 months, 105 patients aged 18-70 years, of either sex, with American Society of Anaesthesiologists (ASA) grade I-III, scheduled for elective laparotomies with an estimated duration of 1-4 hours, were randomly assigned to groups D, C, and P. Group D received inj. dexmedetomidine 1 µg/kg, group C received clonidine 3 µg/kg, and group P received placebo (normal saline) via Intravenous (i.v.) route over 10 minutes using a syringe pump, 10 minutes prior to the anticipated end of surgery. Haemodynamic parameters, cough, agitation, shivering, time to extubation, sedation, Visual Analogue Score (VAS), and Postoperative Nausea and Vomiting (PONV) scores were recorded before, during, and after extubation. The incidence of complications (hypotension, bradycardia, or others) was also recorded. Categorical data were expressed as proportions, while numerical data were presented as mean±Standard Deviation (SD) or median±Interquartile Range (IQR). Appropriate data were compared using Statistical Package for Social Sciences (SPSS) version 16.0.

Results: A total of 105 patients were included, with 53 males and 52 females. There was no difference in the demographic characteristics, such as age, gender, and Body Mass Index (BMI), amongst the three groups. Haemodynamic parameters (Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP)) were significantly lower in patients of group D and group C compared to the placebo group at 5, 10, 10, and 15 minutes, respectively, after the beginning of drug infusion (p-value <0.05). Patients in groups D and C had significantly lower median cough scores at 20-25 minutes compared to the placebo group (p-value at 20 and 25 minutes was 0.012 and <0.001, respectively). There was a significant reduction in postoperative pain, as measured by VAS score, and an increase in sedation, as measured by Ramsay sedation score, in groups D and C compared to the placebo group. There was no statistical difference in agitation score, shivering score, PONV score, time to extubation, and incidence of complications among the three groups (p-value >0.05).

Conclusion: Administration of 1 µg/kg of dexmedetomidine or 3 µg/kg of clonidine over 10 minutes prior to recovery from General Endotracheal Tube Anaesthesia (GETA) results in a better quality of recovery, as evidenced by a statistically significant reduction in cough scores in patients undergoing elective laparotomies when compared to patients of placebo group.

Keywords: Clonidine, Dexmedetomidine, Emergence coughing, Extubation, Haemodynamic response

INTRODUCTION

General anaesthesia with endotracheal intubation and controlled ventilation is a widely accepted mode of providing anaesthesia worldwide. With the advent of modern drugs, state-of-the-art monitoring, and enhanced understanding of body physiology, this mode of anaesthesia is safer than ever. However, there are still several shortcomings that need to be addressed.

Extubation of the trachea following GA is often accompanied by cough and agitation. All these events are undesirable and may have repercussions ranging from discomfort to the patient to serious complications. In particular, patients who are susceptible to an increase in Intracranial Pressure (ICP) [1], Intraocular Pressure (IOP) [2], and sudden swings of blood pressure may be at an enhanced risk. Coughing may also lead to laryngospasm, desaturation, and rarely, negative pressure pulmonary oedema [3].

Various drugs have been investigated for the prevention or treatment of these undesirable effects, including opioids, lidocaine, ketamine, and dexmedetomidine [4,5]. The centrally acting selective α-2 agonist dexmedetomidine and clonidine have sympatholytic, analgesic, sedative, and antishivering properties [6].

Aouad MT et al., demonstrated that intravenously administered dexmedetomidine 1 µg/kg was found to be very effective in controlling cough, agitation, hypertension, tachycardia, and shivering in adult patients undergoing elective surgery under General Endotracheal Tube Anaesthesia (GETA) [7]. Yang X et al., analysed >2500 paediatric patients and showed that dexmedetomidine significantly reduced the incidence of emergence agitation by 70% [8]. Dexmedetomidine also led to a longer emergence time compared to patients who received placebo.

Considering the above, the present study aimed to compare the effectiveness of clonidine to that of dexmedetomidine in evaluating the quality of emergence in patients undergoing elective laparotomies under GA with endotracheal intubation.

The authors hypothesised that the use of intravenous clonidine would result in a significant reduction in the postextubation cough score (primary outcome) compared to placebo. The secondary

outcome measures included haemodynamic parameters (HR, SBP, DBP, MAP), VAS score, sedation score, agitation score, shivering score, PONV score, and time to extubation.

MATERIALS AND METHODS

A double-blind, randomised, placebo-controlled trial was carried out in the Department of Anaesthesia General Surgery operating theatre at MB Government Hospital, attached to RNT Medical College, Udaipur, Rajasthan, India, from October 2022 to February 2023. The study was approved by the Institutional Ethical Committee (No. RNT/Stat./IEC/2021/474) and registered with the Clinical Trial Registry of India (CTRI/2022/11/047121). Informed written consent was obtained from all patients.

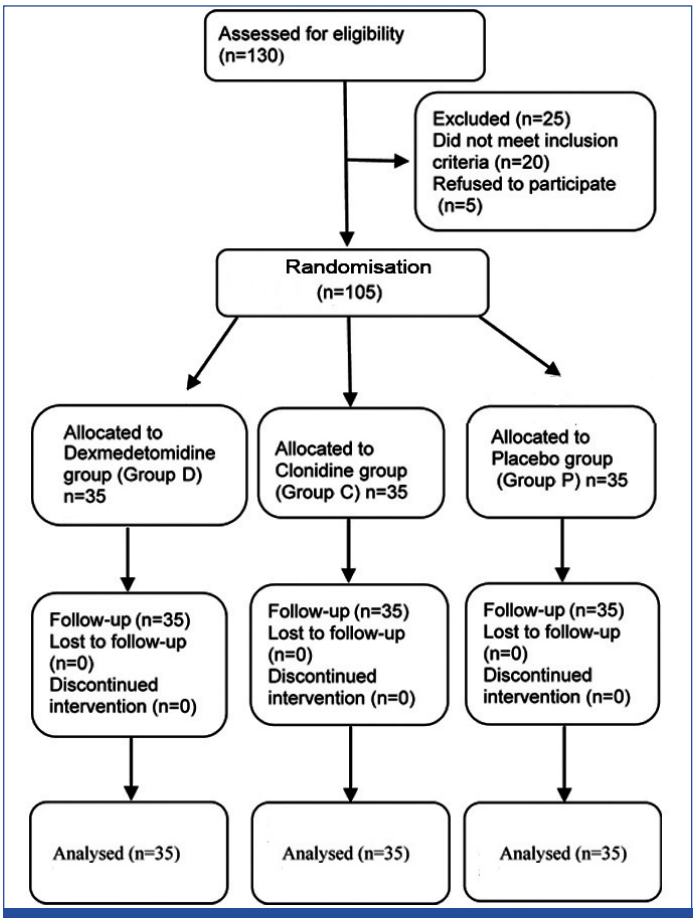
Inclusion criteria: Patients of either gender, aged between 18-70 years, with ASA grade I-III, undergoing elective laparotomies with an estimated surgery time of 1 to 4 hours were enrolled in the study.

Exclusion criteria: Patients who refused to participate in the study, were allergic to the study drug, had pre-existing uncontrolled hypertension, a history of cerebrovascular accident, obesity, pregnancy, were on antidepressant therapy or chronic use of opioids or NSAIDs, or were already on study drugs.

Sample size calculation: A previous study by Aouad MT et al., (2019) demonstrated that the incidence of coughing in patients who received dexmedetomidine was 48% compared to 84% in the control group [7]. Based on this, for the present study to have a power of 80% with a type 1 error of <0.05, 27 patients were required in each group. To compensate for dropouts, 35 patients in each group were considered.

Study Procedure

Consecutive patients scheduled for elective laparotomies after September 2, 2021, who fulfilled the eligibility criteria were enrolled in the study. The patients were randomly allocated to the following groups based on a computer-generated sequence of random numbers in opaque, sealed envelopes [Table/Fig-1].



[Table/Fig-1]: CONSORT Flow diagram.

Group D: Patients received 1 µg/kg of dexmedetomidine diluted up to 10 mL normal saline given over 10 minutes i.v.

Group C: Patients received 3 µg/kg of clonidine diluted up to 10 mL normal saline given over 10 minutes i.v.

Group P: Patient received 10 mL of normal saline over 10 minutes i.v.

The study solution was prepared by an anaesthesiologist who was not involved any further in the study. The patients themselves and the anaesthesiologist who conducted anaesthesia and recorded observations were also unaware of the group allocation. Patients were randomly assigned to one of three groups according to a computer-generated table of random numbers: Group Dexmedetomidine 1 µg/kg (D), Group Clonidine 3 µg/kg (C), and 10 mL of normal saline (P).

Routine monitors were applied: blood pressure cuff, electrocardiogram, pulse oximeter, capnogram, oesophageal temperature probe, and neuromuscular monitoring using Nihon Kohden and Drager monitors. Train Of Four (TOF) was monitored throughout the surgery [7]. Anaesthesia was induced using i.v. midazolam 1 mg, propofol 1.5-2 mg/kg, lidocaine 1 mg/kg, fentanyl 1-2 mcg/kg, and atracurium 0.5 mg/kg. After orotracheal intubation, anaesthesia was maintained using N_2O in oxygen 2:1, sevoflurane 1%-3%, and incremental doses of fentanyl to keep blood pressure and heart rate within 20% of baseline, and atracurium as needed. The operating room temperature was kept between 21°C and 22°C. Patients were covered with surgical drapes and actively warmed by forced air warming blankets.

At the end of the surgery, the anaesthesiologist, who was blinded to the group allocation, stopped sevoflurane and nitrous oxide (defined as time zero or baseline of the emergence process). The fresh gas flow was increased from 3 to 6 L/min, and 10 mL of the study drug was delivered over 10 minutes using a syringe pump. Ondansetron 4 mg i.v. was given before extubation, and orogastric suction was performed. From time zero until one hour in the Post Anaesthesia Care Unit (PACU), the following parameters were recorded every 5 minutes until 30 minutes and then every 15 minutes for the next 30 minutes: SBP, DBP, MAP, HR, agitation score, sedation score, cough score, shivering score, VAS, and PONV. Residual neuromuscular blockade, defined as TOF <0.9, was reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg [7]. Patients were extubated when they were fully awake and responsive with a TOF ≥0.9. The following data were also recorded: patient's temperature, total intraoperative fentanyl dose, duration of anaesthesia and surgery, and time to extubation (from time zero).

In the PACU, the anaesthesiologist, who was blinded to the study drug, recorded the following parameters: SBP, HR, shivering score, sedation score, VAS, and PONV score. i.v. meperidine 0.35 mg/kg was the rescue medication for shivering (shivering scale ≥2). In the presence of pain (VAS ≥4), paracetamol 1 g i.v., ketoprofen 100 mg i.v., and morphine i.v. at 1-2 mg increments were used. Discharge from the PACU was based on the institution's discharge criteria, which were determined using the modified Aldrete score [7].

- The grade of postextubation cough was assessed using a 4-point scale (0=no cough; 1=mild, single cough; 2=moderate, >1 cough lasting for 5 seconds; and 3=severe, gross muscular activity involving the entire body).
- The shivering score was assessed using a 3-point scale (0=no shivering; 1=mild fasciculations of the face or neck; 2=moderate, visible tremor in >1 muscle group; and 3=severe, gross muscular activity involving the entire body).
- The sedation score was assessed using a 6-point scale of the Ramsay sedation score (1=anxious and agitated or restless, 2=cooperative, oriented, 3=responds to commands only, 4=asleep with a brisk response to glabellar tap, 5=asleep with a sluggish response to glabellar tap, 6=no response).

- The PONV score was assessed using a 4-point scale (1=absent; 2=mild nausea; 3=severe nausea; and 4=vomiting).
- Agitation score was assessed using Aono's agitation score (1 =calm, 2=not calm but can be easily calmed, 3=not easily calm, moderately agitated or restless, 4=combative, excited or disoriented) and
- Numerical rating of pain, VAS score, was assessed using a 10-point scale. The VAS score consists of a 10 cm horizontal and vertical line with two ends labeled as 'no pain' and 'worst pain ever.' The patient is required to mark the 10 cm line at the point corresponding to the level of pain intensity they feel [7].

STATISTICAL ANALYSIS

Data were entered into MS Excel and analysed using SPSS version 16.0. All qualitative data were expressed as percentages and compared using the Chi-square test. All continuous quantitative variables were expressed as mean±Standard Deviation (SD) and compared using Analysis of Variance (ANOVA). Ordinal non-continuous data were expressed as median±IQR and compared between groups using the Kruskal-Wallis test. A p-value <0.05 was considered statistically significant.

RESULTS

All three groups were comparable with respect to age, weight, ASA grading, and gender distribution. No statistically significant difference was found between the groups [Table/Fig-2].

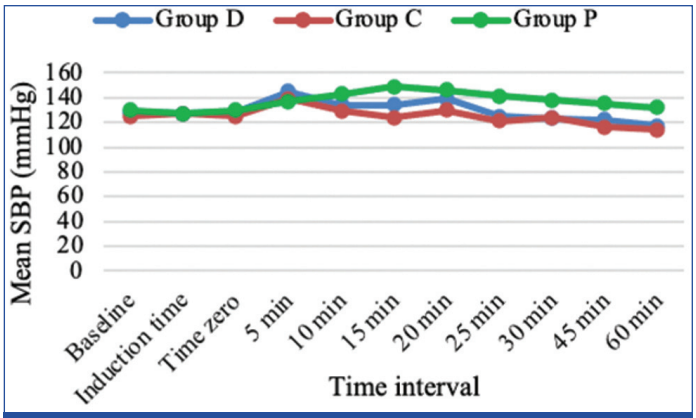
Parameters	Group D n (%)	Group C n (%)	Group P n (%)	p-value
Age (in years)				
18-35	12 (34.2%)	12 (34.2%)	13 (37.1%)	0.348
36-50	11 (31.4%)	13 (37.1%)	10 (28.5%)	
51-70	12 (34.2%)	10 (28.5%)	12 (34.2%)	
BMI (in kg/m^2)				
18.5-24.9	30 (85.7%)	30 (85.7%)	32 (91.4%)	0.702
25-29.9	05 (14.2%)	05 (14.2%)	03 (8.5%)	
Gender				
Male (n=53)	19 (54.2%)	18 (51.4%)	16 (45.7%)	0.533
Female (n=52)	16 (45.7%)	17 (48.5%)	19 (54.2%)	
ASA grading				
I	17 (48.5%)	16 (45.7%)	16 (45.7%)	0.143
II	15 (42.8%)	16 (45.7%)	17 (48.5%)	
III	03 (8.5%)	03 (8.5%)	02 (5.7%)	

[Table/Fig-2]: Demographic profile of patients (N=105).
Test used: Chi-square test, p-value >0.05 (Non significant)
Test applied for age and weight: ANOVA test, Test applied for gender: Chi-square; BMI: Basal metabolic index; ASA: American society of anaesthesiologists

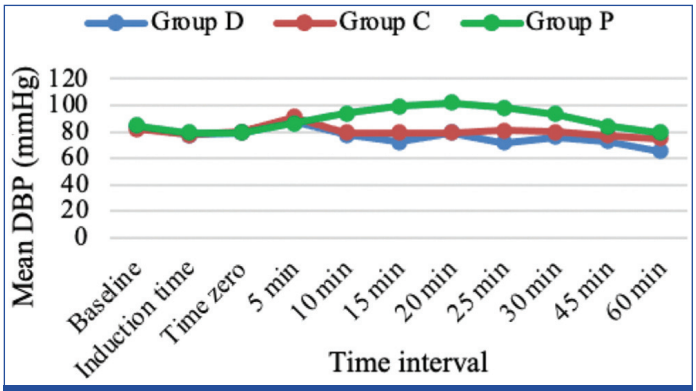
On intergroup comparison, SBP and DBP were significantly lower in group D and group C compared to group P from 10 minutes after the beginning of infusion of respective drugs until the end of the study period. A p-value <0.001 was considered statistically significant [Table/Fig-3,4], respectively.

On intergroup comparison, MBP and HR were significantly lower in group D and group C compared to group P from 10 and 5 minutes, respectively, after the beginning of infusion of respective drugs until the end of the study period. A p-value <0.001 was considered statistically significant [Table/Fig-5,6].

Patients in group D and group C had significantly lower median cough scores at 20-25 minutes after starting the infusion of study drugs compared to the placebo. This time period corresponds to the time of extubation, when maximum cough was expected [Table/Fig-7,8]. There was no statistical difference amongst the three groups in terms of agitation score, shivering score, and PONV score (p-value >0.05).



[Table/Fig-3]: Comparison of mean Systolic Blood Pressure (SBP) (mmHg) among three groups.



[Table/Fig-4]: Comparison of mean Diastolic Blood Pressure (DBP) (mmHg) among three groups.

Time interval	Group D	Group C	Group P	p-value
Baseline	98.3±11.5	96.3±10.8	99.7±11.6	0.952
Induction time	94±17.95	94±18	95.3±17.5	0.996
Time zero	95.3±10.97	95±10.6	96±10.9	0.806
5 min	107±9.78	107±11.2	103±10.9	0.926
10 min	96.3±11.1	95.8±8.92	110±12	<0.001
15 min	92.7±13.6	93.8±11.3	116±11.4	<0.001
20 min	99.3±12.9	95.8±11.8	117±10.7	<0.001
25 min	89.3±11.2	94.2±11.3	112±10.7	<0.001
30 min	91.7±8.46	94.5±10.6	108±11.8	<0.001
45 min	89.3±8.35	89.8±8.62	101±11.2	<0.001
60 min	82.3±6.72	88±7.72	96.7±11.1	<0.001

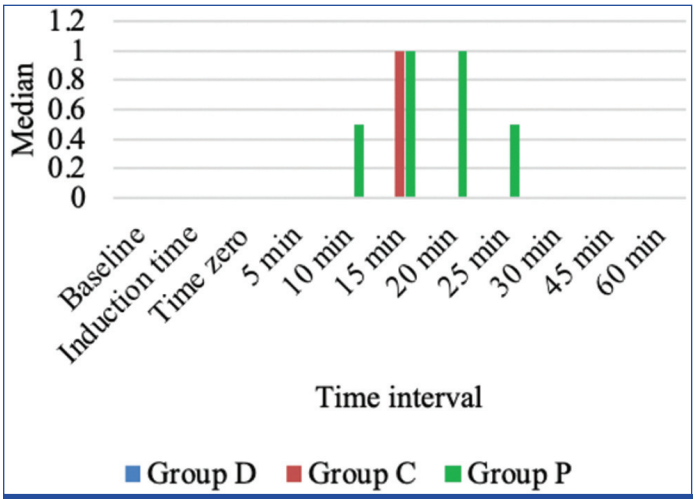
[Table/Fig-5]: Comparison of mean blood pressure among three groups: Data are presented as Mean±SD.
Test used: ANOVA, p-value <0.05 (Significant)

Time interval	Group D	Group C	Group P	p-value
Baseline	88.5±15.15	102±13.5	109±15.1	0.910
Induction time	105.5±13.02	105.5±13.02	107±13.2	0.989
Time zero	91.5±16.79	94±14.49	91.5±16	0.949
5 min	87± 19.2	95±15.7	102±15.7	<0.001
10 min	80±20.5	85±16.8	115±15.5	<0.001
15 min	98±21	99±19.6	127±14.7	<0.001
20 min	95±20	107±16.7	125±13.3	<0.001
25 min	85±17.2	101±19.1	120±14.6	<0.001
30 min	77±15.2	91±18.7	110±15	<0.001
45 min	71±14.7	85±17.7	98.5±15.7	<0.001
60 min	74±13.1	77±16.4	92.5±16.3	<0.001

[Table/Fig-6]: Comparison of mean Heart Rate (HR) among three groups: Data are presented as Mean±SD.
Test used: ANOVA, p-value <0.05 (Significant)

Time interval	Group D	Group C	Group P	p-value
Time zero	NA	NA	NA	-
5 min	NA	NA	NA	-
10 min	0 (0-0.5)	0 (0-0)	0.5 (0.25-0.75)	0.679
15 min	0 (0-1)	1 (0-1)	1 (0.5-1)	0.108
20 min	0 (0-0)	0 (0-0.5)	1 (0-2)	0.048
25 min	0 (0-0)	0 (0-0)	0.5 (0-1)	0.040
30 min	0 (0-0)	0 (0-0)	0 (0-0)	1.000
45 min	0 (0-0)	0 (0-0)	0 (0-0)	1.000
60 min	0 (0-0)	0 (0-0)	0 (0-0)	1.000

[Table/Fig-7]: Comparison of cough score among three groups: Data are presented as Median (IQR1-IQR3).
Test used: Kruskal Wallis test, p-value <0.05 (Significant), NA: Not assessed as patient was not extubated



[Table/Fig-8]: Comparison of cough score (median) among three groups.

A significant difference in the level of postoperative sedation (Ramsay sedation score) was observed between the placebo and both study groups (p-value <0.001), as shown in [Table/Fig-9].

Time interval	Group D	Group C	Group P	p-value
Time zero	NA	NA	NA	-
5 min	NA	NA	NA	-
10 min	3 (3-3.5)	4 (4-4)	2.5 (2.25-2.75)	0.086
15 min	3 (3-3)	2.5 (2-3)	2 (2-2)	0.001
20 min	3 (2.5-3)	3 (2-3)	2 (2-2)	<0.001
25 min	3 (2-3)	2 (2-3)	2 (2-2)	<0.001
30 min	3 (2-3)	2 (2-2)	2 (2-2)	<0.001
45 min	3 (2-3)	2 (2-2)	2 (2-2)	<0.001
60 min	3 (2-3)	2 (2-2)	2 (2-2)	<0.001

[Table/Fig-9]: Comparison of Sedation score among three groups: Data are presented as Median(IQR1-IQR3).
Test used: Kruskal Wallis test, p<0.05 (Significant), NA: Not assessed as patient was not extubatred

On intergroup comparison, there was a significant reduction in postoperative pain as measured by VAS score in group D and group C compared to the placebo from 20 minutes after the beginning of infusion of study drugs (p-value=0.001), as shown in [Table/Fig-10]. The mean duration of surgery and anaesthesia and time to extubation from time zero (starting of infusion of study drug) were statistically comparable between the three groups (p-value >0.05), and patients in group D and group C demonstrated a statistically reduced consumption of fentanyl compared to the placebo group (p-value <0.001), as shown in [Table/Fig-11]. There were no statistically significant cases of hypotension, bradycardia, or any other complications noted among the three groups (p-value=0.284), as shown in [Table/Fig-12].

Time interval	Group D	Group C	Group P	p-value
Time zero	NA	NA	NA	-
5 min	NA	NA	NA	-
10 min	3 (3-4)	3 (3-3)	4 (4-4)	0.143
15 min	3 (3-4)	3 (3-3.75)	4 (3-4)	0.098
20 min	2 (2-3)	3 (2-4)	4 (3-4)	0.001
25 min	3 (2-3)	3 (2-3)	4 (3-4)	<0.001
30 min	2 (2-3)	2 (2-3)	3 (3-4)	<0.001
45 min	2 (2-3)	2 (2-3)	3 (3-4)	<0.001
60 min	2 (2-3)	2 (2-2.5)	3 (3-3.5)	<0.001

[Table/Fig-10]: Comparison of VAS score among three groups: Data are presented as Median (IQR1-IQR3).
Test used: Kruskal Wallis test, p<0.05 (Significant), NA: Not assessed as patient was not extubated

Clinical characteristics	Group D	Group C	Group P	p-value
Fentanyl consumption (µg)	108.57±19.72	105±6.06	137.12±13.52	<0.001
Time to extubation	19.71±5.93	19±5.11	20.57±5.39	0.490
Duration of Surgery (min.)	120.57±25.80	124.85±19.42	126.42±20.38	0.518
Duration of anaesthesia (min.)	136.42±23.05	135.57±19.39	136.71±20.68	0.973

[Table/Fig-11]: Comparison of Fentanyl consumption, time to extubation, duration of surgery and anaesthesia.
Test used: ANOVA, p-value >0.05 is non significant and p<0.05 (Significant)

Adverse outcome during emergence	Group D (n=35)	Group C (n=35)	Group P (n=35)	p-value
Hypotension	14.2% (5/35)	8.57% (3/35)	0% (0/35)	0.284
Bradycardia	14.2% (5/35)	22.8% (8/35)	0% (0/35)	

[Table/Fig-12]: Comparison of adverse outcomes during emergency.
Test used: Chi-square test, p-value >0.05 is non significant

DISCUSSION

The present study was carried out in a tertiary care teaching government hospital to assess the effect of i.v. dexmedetomidine and i.v. clonidine on the quality of emergence from General Endotracheal Anaesthesia (GETA) in patients undergoing elective laparotomy. The patients were randomly allocated into three groups, and there were no differences recorded in demographic characteristics such as age, gender, and BMI amongst the three groups. More than half of the patients in each group consisted of patients operated for lump abdomen, carcinoma colon, and Subacute Intestinal Obstruction (SAIO).

A comparison of systolic, diastolic, and mean blood pressure amongst the three groups showed that all these variables were significantly lower in patients who received dexmedetomidine and clonidine infusion compared to the placebo from 10-15 minutes after the beginning of infusion. This is consistent with the time of peak onset of action of dexmedetomidine and clonidine (15 minutes and 10 minutes, respectively). A comparison of mean HR showed that patients in the dexmedetomidine and clonidine groups had significantly lower HR than patients who received the placebo starting at 5 minutes after the beginning of the infusion. However, none of the patients in either group had clinically significant bradycardia.

The centrally acting sympatholytic activity of both dexmedetomidine and clonidine is responsible for these haemodynamic changes. The results of the present study are in agreement with those of Lee JS et al., (2015) [9], who concluded that the addition of dexmedetomidine 0.5 mcg/kg i.v. during emergence was effective in attenuating coughing and haemodynamic changes after thyroid surgery with a sample size of 142 in Gangnam hospital, Korea. Kim DJ et al., also concluded that the administration of dexmedetomidine 0.4 mcg/kg/hr decreased emergence agitation after orthopaedic surgery in

elderly patients in a study conducted in 2012 with a sample size of 115 in Chosun university, Korea [10]. Vankayalapati SD et al., however, demonstrated a statistically significant difference in HR, SBP, DBP, and MAP from three minutes of drug injection onwards in patients who received i.v. dexmedetomidine and clonidine in a study with a sample size of 90 in Mallareddy Medical College, Hyderabad [11]. This earlier onset may be due to the fact that they injected both dexmedetomidine and clonidine i.v. over two minutes, whereas in the present study, the authors injected the drug over 10 minutes. Aouad MT et al., also demonstrated a significant lower SBP at extubation and at 5 minutes after extubation in patients who received 1 mcg/kg, 0.5 mcg/kg, and 0.25 mcg/kg of dexmedetomidine when compared to control [7]. However, there was no difference in HR in patients who received 0.25 mcg/kg of dexmedetomidine.

Several outcomes can be used to assess the quality of recovery of patients who received GETA. The most tumultuous period of recovery from GETA is often the periextubation period. The presence of an endotracheal tube in situ in a patient who is awakening from GA predisposes the patient to periextubation cough. This may be of major concern in patients who are at an increased risk of increased ICP, IOP, and the chances of wound dehiscence/surgical site bleeding [7]. Therefore, the assessment of postoperative cough may be one of the most clinically relevant markers of the quality of recovery. Furthermore, the ease of assessing periextubation cough makes it less vulnerable to interobserver variation. Hence, the authors decided to assess postoperative cough as the primary outcome measure of the present study.

Although dexmedetomidine has been extensively studied for its effect on the recovery profile of patients undergoing surgery under GETA, there is a lack of studies that have evaluated clonidine for the same purpose. The cost of clonidine is about one-sixth of the cost of dexmedetomidine, and their pharmacological actions are essentially the same [11]. Hence, the authors decided to include a clonidine arm in the present trial. Furthermore, while i.v. dexmedetomidine has been studied in patients undergoing various surgeries such as intracranial surgery [12], thyroidectomy [13,14], middle ear surgery [15], nasal surgery [16], craniotomy [17], oral and maxillofacial surgery [18], and laryngeal microsurgery [19], no study has evaluated any centrally acting α-2 agonist in patients undergoing laparotomies under GETA. Laparotomies under GETA constitute a vast majority of the general surgical case load in almost all Indian hospitals. Additionally, due to the incisions used for laparotomies, postextubation cough predisposes patients to postoperative pain and wound dehiscence. Therefore, the authors decided to recruit patients undergoing elective laparotomies for our study. Kulka PJ et al., found in their study that i.v. clonidine attenuates the stress response to the induction of anaesthesia in doses of up to 4 µg/kg [20]. Various studies have also examined the anaesthetic effect of i.v. clonidine in doses of 1-3 µg/kg [21]. Since periextubation cough is the result of significant noxious stimuli, we decided to examine the effect of clonidine in a dose of 3 µg/kg.

The present study found that patients who received either clonidine or dexmedetomidine had significantly lower median cough scores at 20-25 minutes after starting the infusion compared to patients who received placebo. This time period corresponded to the time of extubation, when maximum cough was expected. Therefore, it can be advocated that both dexmedetomidine and clonidine infusion are effective in controlling periextubation cough.

Dexmedetomidine 0.5 mcg/kg administered as a single dose was found to lower the incidence of coughing in patients undergoing thyroidectomy when compared to remifentanil [9]. The incidence of cough was also found to be reduced in patients who underwent laparoscopic cholecystectomy and received 0.6 mcg/kg and 0.8 mcg/kg of dexmedetomidine at the time of induction of anaesthesia [9]. Aouad MT et al., showed a dose-dependent decrease in the incidence of cough in patients undergoing various surgeries under GETA who received three different doses of dexmedetomidine [7].

Furthermore, they also found that patients who received 1 mcg/kg of dexmedetomidine had a significantly lower incidence of cough compared to the control (placebo). However, since the patient population consisted of mixed surgeries, wherein patients would be expected to have different surgical stimuli, the possibility of confounding factors cannot be ruled out. The present study therefore recruited only patients undergoing laparotomies to address this issue.

To the best of the authors' knowledge, this study is the first study that has compared both clonidine and dexmedetomidine in the evaluation of periextubation cough. The present study also showed a significant reduction in postoperative pain as measured by VAS score and an increase in sedation score in patients who received dexmedetomidine/clonidine. There was no difference in agitation score, shivering score, and the incidence of PONV amongst the three groups. Patients who received either dexmedetomidine or clonidine also demonstrated a significantly reduced consumption of fentanyl, which is a direct result of the analgesic and antinociceptive properties of both these centrally acting α-2 agonists.

Limitation(s)

Firstly, the authors could have included patients undergoing the same surgery to better validate our findings. Secondly, further research using a non-inferiority trial design may help in determining the cost advantage of clonidine over dexmedetomidine.

CONCLUSION(S)

The present study concluded that dexmedetomidine (1 µg/kg) and clonidine (3 µg/kg) administered over 10 minutes before extubation are equally effective in improving the quality of emergence from GA without delaying recovery and with stable haemodynamics in patients undergoing elective laparotomies.

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