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Propofol-Dexmedetomidine versus Propofol-Ketamine for Anesthesia of Endoscopic Retrograde Cholangiopancreatography (ERCP) (Comparative Study)

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ABSTRACT

Background: The ideal method for anaesthetic management during endoscopic retrograde cholangiopancreatography (ERCP) varies between deep sedation and general anesthesia with preference for general anesthesia over sedation.

Objective: This study compares the effects of propofol-dexmedetomidine and propofol-ketamine combinations for anesthesia in patients having ERCP with respect to hemodynamic and respiratory parameters alterations as well as propofol requirements, recovery phase, and post-operative pain.

Patients and methods: Patients, aged 20-50 years old, American Society of Anesthesiologists (ASA) I-II-III, were randomly allocated over a period of six months in 2 groups, each was 25. Group-I were administered dexmedetomidine loading 1 µg/kg slow IV over 15 minutes then infused at a rate of 0.5 µg/kg/h by syringe pump. Group II were administered Ketamine 1 mg/kg slow IV over 15 minutes then infused at a rate of 0.5 mg/kg/h by syringe pump.

Results: The 2 groups had no significant differences as regards demographic data, ASA classification, time of the procedure, and baseline of hemodynamic data; heart rate (HR) and mean arterial blood pressure (MAP). Intra- and post-procedural dexmedetomidine-propofol group showed lower statistically significant differences as regards both heart rate and MAP. Post-procedural nausea, and cognitive disorders, were statistically significantly lower in dexmedetomidine-propofol group as well as recovery time was shorter.

Conclusion: Dexmedetomidine-propofol combination was better compared with ketamine-propofol combination in terms of hemodynamic parameters (intra- and post-procedural), PONV, cognitive function and recovery time.

Keyword: ERCP, PON, TIVA.

INTRODUCTION

The care of a number of pancreatobiliary illnesses frequently involves ERCP. ERCP is the best maneuver for removing common bile duct stones because it lessens the need for more invasive surgeries that have a higher risk of complications, especially in elderly patients. For the palliation of obstructive jaundice in those with pancreatic cancer, ERCP with stent implantation can be quite successful [1,2]. ERCP is a lengthier, trickier operation with a much greater complication risk than upper gastrointestinal endoscopic procedures [3].

When performed without anesthesia, it is extremely irritating and painful procedure. To ensure immobility, sufficient analgesia and the avoidance of gagging, or nausea, patients should be deeply sedated or anesthetized and monitored while undergoing ERCP procedures [4,5].

It is true that sedation causes the majority of GIT endoscopic problems, including vasovagal episodes, hypoventilation, hypoxia, airway obstruction, apnea, arrhythmia, and hypotension [6]. When unpleasant and difficult treatments are planned in the prone position for ERCP, **Raymondos *et al.*** [7] indicated a continuing preference for GA over sedation. Dexmedetomidine, is a stereoisomer of medetomidine, was approved for use as a short-term drug (< 24h) in humans by the Food and Drug Administration by the end of 1999. It is a highly selective α2-agonist**.** Similar to benzodiazepines, dexmedetomidine has perioperative anxiolytic characteristics, although it has less adverse effects and superior hemodynamics [8,9]. Dexmedetomidine has a non-dose-dependent analgesic effect at dosages greater than 0.5 ug/kg [10]**.** The combination of dexmedetomidine with other anesthetics, hypnotics, sedatives, or opioid agents can cause additive effects as regards respiratory depression [9]. Dexmedetomidine attenuates stress-induced sympatho-adrenal reactions protecting against harmful sympathetic stimulation and hemodynamic alterations, which is one of the goals of anesthesia [11].

Propofol, a non-barbiturate hypnotic medication, is becoming increasingly popular as a procedural sedation analgesia (PSA) agent. This is mostly because of its favorable pharmacokinetic profile since it has a rapid onset and quick recovery. Additionally, it has advantages in that it works as an antipruritic, anti-emetic, and amnesic agent. Despite the fact that propofol has a very high potency and effectiveness, it has a rather high incidence of hypotension and respiratory depression [12].

Ketamine is a phencyclidine derivative. Ketamine provides effective analgesia and amnesia and preserves muscle tone, maintains spontaneous respiration and airway reflexes. Due to its tendency to produce intense emergent responses as well as severe negative effects like emesis and salivation even when delivered in sedating dosages, several medical professionals are hesitant to utilize ketamine alone [13]**.**

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AIM OF THE WORK

Primary aim: For the purpose of comparing the effects of propofol-dexmedetomidine and propofol-ketamine combinations for anesthesia in patients having ERCP as regards the following outcome measures: hemodynamic alterations, propofol requirements, recovery criteria post-operative pain, and post-operative respiratory complications.

Secondary aim: To evaluate the rate of other anaesthetic and procedural complications as regards the following outcome measures: Anaesthetic complications: Post-operative nausea and emesis. Post-procedural cognitive disorders or hallucinations. Intra-procedural complications: hemorrhage and duodenal perforation.

PATIENTS AND METHODS

This controlled randomized comparative study was designed over a period of 6 months; the random allocation sequence was generated using computer-generated random numbers. Fifty patients of both genders aged 20-50 years; were divided on two groups each of which is twenty-five. All procedures were carried out in prone position.

Inclusion criteria: Those who are admitted for diagnostic and therapeutic ERCP. Age 20-50 y. Class I, II, or III of the American Society of Anesthesiologists (ASA).

Exclusion criteria: ASA score IV or V**.** Any patient with ischemic heart disease or Heart failure, uncontrolled hypertension, decreased lung function, aallergy to any component of the study drugs, chronic illicit drug use, personality disorders, increased intracranial tension, receiving antipsychotic or sedative medication within one month of the procedure.

Pre-procedural assessment and preparation:

Drug preparation: Drug A: it consisted of 100 mg ketamine diluted by 50 ml normal saline filled syringe pump (i.e., 2 mg/ml). Loading dose was 1 mg/kg, given over 15 min and maintenance dose was 0.5 mg/kg/h (i.e., 17.5 ml/h for average weight adults). Drug B: it consisted of 100 µg dexmedetomidine diluted by 50 ml normal saline filled syringe pump (i.e., 2 µg/ml). Loading dose was 1 µg/kg, given over 15 min and maintenance dose was 0.5 µg/kg/h (i.e., 17.5 ml/h).

Propofol preparation: Propofol infusion was prepared (1% concentration; 10 mg/ml) via syringe pump. The infusion pump was set to deliver 5 mg/kg/h.

Preparation of the theatre: Equipment and medications for emergent resuscitation were immediately available and checked; Anesthesia machine and standard monitors (NIBP, ECG, capnography, and pulse oximeter) were available and checked.

Patient evaluation, preparation and premedication: Pre-procedural evaluation was performed to all patients undergoing ERCP to assess the risk of anesthesia and to manage problems related to pre-existing medical conditions. Pre-operative assessment included:

- ***Proper complete history:*** Full medical history: history of systemic disease, respiratory diseases and history of allergy to any drugs. Fasting hours. General anesthesia history. Surgical history.
- ***Physical examination:*** Baseline mean arterial blood pressure (MAP). Baseline Heart rate.
- ***Investigations:*** Labs: - CBC, Liver and kidney functions, RBS, coagulation profile and virology profile. Imaging: - CXR. ECG.
- Patient fasted 6-8 hours for solid while clear fluids were allowed till 2-4 hours pre-procedure. On patients' arrival two 20-gauge IV cannulas was inserted in peripheral veins and secured, standard monitors were applied (NIBP, ECG, pulse oximetry). Infusion of the studied drugs was started. Group A patients received dexmedetomidine as a 1 ug/kg loading dose over 15 minutes, and it was then maintained during the operation at a rate of 0.5 ug/kg/h. Patients in the Group B got a 0.5 mg/kg/h maintenance dosage of ketamine throughout the operation after receiving a loading dose of 1 mg/kg over the course of 15 minutes.

Anesthetic procedure:

Intra-procedural monitoring: Standard monitoring techniques were used, including pulse oximeter, non-invasive blood pressure monitoring, and ECG; these parameters were assessed and recorded (pre-procedure, after 5 minutes after administration of sedative /analgesic agents, after intubation, every 5 min during the procedure and continued in the recovery room every 15 min and just before discharge). Capnogaphy was applied after institution of mechanical ventilation and Et-CO_2 was adjusted to be within the range of 30-35 mmHg.

Induction of anesthesia:

Both groups received: Propofol 1-2 mg/kg (1%) IV bolus for induction then background infusion rate of 5 mg/kg/h was instituted. The patient received intermittent propofol boluses (0.5 mg/kg) based on the hemodynamic characteristics of the patient. At the end of the operation, the amount of propofol consumed was computed and documented. Group-I were administered dexmedetomidine loading 1µg/kg slow IV over 15 minutes then infused at a rate of 0.5 µg/kg/h. Group II were administered ketamine 1mg/kg slow IV over 15 minutes then were infused at a rate of 0.5 mg/kg/h. Atracurium 0.5 mg/kg was used as an

intubation dose followed by 0.1 mg/kg every 20 minutes for maintenance. Endotracheal tube was inserted after induction, Et-CO_2 tracing was observed then the tube was secured, and auscultation of chest was performed to ensure equality. Et-CO_2 was maintained at 30-35 mmHg with the implementation and adjustment of controlled mechanical ventilation (CMV). Prone position was attended.

Intra-procedural fluid balance:

Amount of fluids: Maintenance: 1st 10 kg was given 4 ml/kg/h followed by 2 ml/kg/h for the 2nd 10 kg then 1 ml/kg/h for the remaining body weight. Fasting and deficit were replenished by multiplying hours of fasting by maintenance fluid volume per hour. Vomiting, diarrhea, fever and drains, if present, were calculated and replenished by a rate of 50% of the calculated volume given during the 1st hour and the next 25% was replenished during the next hour and the last 25% of deficit and fasting were given during the 3rd hour.

Type of fluids: Ringer acetate.

Suspected Intra- and post-procedural anesthetic complications and their management

Anesthetic complications: Hypotension (decrease in patients' MAP less than 20% of patients' baseline): It was treated according to the cause, decreasing propofol infusion rate or even stop it, rapid IV fluid infusion along with 5 mg increments of ephedrine might be required, decreasing infusion rate of the drug to be tested.

Hypertension and tachycardia (increase in patients' MAP more than 20% of patient's baseline): It was treated as regard the cause, ensure adequate respiration, i.e., absence of hypoxia or hypercarbia, and ensure adequate pain relief, adequate muscle relaxation and adequate depth of anesthesia. Full urinary bladder might be the cause; forced diuresis might be intended to increase bilirubin excretion by the kidney, insertion of Foly's catheter might be required. Propofol boluses (0.5 mg/kg) were given to deepen the anesthesia. Discontinuation of the study drug if no response. Glyceryl trinitrate (0.5-10 µg/kg/h) might be required in resistant high pressures.

Bradycardia: (decrease in patients' HR less than 20% of patients' baseline): Management was directed to the cause; inform the endoscopist to stop stimulation, increasing the depth of anesthesia, atropine 0.01 mg/kg might be required. If bradycardia was persistent, infusion of the drug used in research would be discontinued. In resistant bradycardia that affecting patient hemodynamic direct acting adrenoceptor agonists was given e.g., adrenaline 0.01 mg/kg IV increments or isoprenaline IV infusion 10-400 ng/kg/min. **Pain**; using an IV infusion of 10-15 mg/kg of paracetamol. **Post-operative** ondansetrone IV 4 mg was used to treat **nausea and emesis.**

Procedural complications: Acute pancreatitis; average 3-5%. **Bleeding** may occur because of sphincterotomy. It was usually minimal and stops quickly. If it would not be stopped or obvious, resuscitation would be started with IV crystalloids and/or blood guided by patients' hemodynamics; blood loss might be difficult to be assessed visually. While resuscitation had been established, endoscopist would try to control bleeding. Surgical consultation might be required in persistent bleeding.

Duodenal perforation; it is rare complication and often necessitates surgical intervention. **Cholangitis;** rare.

By the end of the procedure; both groups were reversed by 0.05 mg/kg prostigmine and 0.01 mg/kg atropine then suctioning and conscious extubation after meeting the requirements for extubation. Stable hemodynamics. Returning the ability to maintain airway, spontaneously breathing with normal respiratory mechanics; regular respirator rate < 30/min, tidal volume > 5 ml/kg measured by ventilator-built in spirometer, negative inspiratory force < -20 to -30 cm H_2O by ventilator build-in pressure gauge. Patients were finally taken to the recovery room. **Post-procedural management:** Assessment every 15 min for 60 min after the procedure as regard hemodynamics, pain, PONV and hallucinations and just before discharge from recovery room. Time from extubation to spontaneous eye opening was watched and documented as part of the recovery process. Individuals underwent discharge from recovery room when an Aldrete score of 9–10 was obtained.

Data recorded and timing of assessment:

Primary outcome parameters (most important outcomes to be assessed):

Changes in hemodynamic parameters; MAP and HR: Before induction of anesthesia (baseline), 5 minutes after administration of dexmedetomidine or ketamine, just after induction of anesthesia and just after intubation, every 5 min throughout the course of the procedure, and every 15 min for one-hour post-procedure.

Changes in respiratory parameters as regard; Oxygen saturation was recorded peri-operatively. End-tidal carbon dioxide ($ETCO_2$) was recorded after induction and adjusted to be within the range of 30-35mmHg. Post-procedural respiratory adequacy according to rate and depth of breathing. Post-operative oxygen saturation.

Total propofol consumption in the 2 groups was recorded by the end of the procedure. Pain level: was measured by visual analogue scale and its management, and recovery criteria were recorded.

Secondary outcome parameters (Other outcomes to be assessed; complication rates): From the start of the procedure to 60 min after the procedure.

Anaesthetic complications: Nausea and emesis, and cognitive disorders or hallucinations.

Procedural complications: Hemorrhage might occur by sphincterotomy. It was usually minimal and stops quickly. If it would not be stopped or obvious, resuscitation would be started with IV crystalloids and/or blood guided by patients' hemodynamics; blood loss might be difficult to be assessed visually. While resuscitation had been established, endoscopist would try to control bleeding. Surgical consultation might be required in persistent bleeding. Duodenal perforation: it is rare complication and often necessitates surgical intervention.

Ethical approval:

After approval of Research Ethical Committee of Faculty of Medicine, Ain Shams University, written consent was obtained from each patient. The Helsinki Declaration was followed throughout the study's conduct.

Statistical analysis

Data were analysed by the Statistical Package for the Social Sciences (IBM SPSS Statistics for Windows, V 23.0. Armonk, New York: IBM Corp.). Quantitative data were expressed as mean, standard deviation (SD) and range. Also, qualitative variables were expressed as frequencies and percents.

We performed the following tests: When comparing 2 means, the independent t-test was applied. To compare the proportions between 2 qualitative factors, the Chi-square (X^2) test of significance was employed. A significant P-value was one below 0.05. It was considered highly significant when the P-value was 0.01.

RESULTS

A comparative randomized trial was conducted in the present investigation, with group I receiving a combination of dexmedetomidine and propofol and group II receiving a combination of ketamine and propofol.

Both patient groups had male patients, and no statistically significant differences in terms of age, ASA classification, the length of the surgery or ASA categorization were reported [Table 1].

Table (1): Comparison between dexmedetomidine and ketamine as regard demographics, time of procedure and ASA classification

Demographic data	Dex-medetomidine	Ketamine	P-value
	No. = 25	No. = 25	
Age (years), mean ± SD	43.65 ± 7.22	41.12 ± 9.54	0.296
Male gender, no. (%)	25 (100.0%)	25 (100.0%)	NA
Time of the procedure (min), mean ± SD	29.75 ± 12.43	27.88 ± 10.30	0.565
ASA classification, no. (%)	5 (20.0%)	7 (28.0%)	0.693
I			
II	14 (56.0%)	14 (56.0%)	
III	6 (24.0%)	4 (16.0%)	

NA: Not applicable for comparison.

As regards baseline hemodynamic measures, such as HR and MAP, no significant differences existed between the two groups as well. Changes in intra-procedural hemodynamic parameters as regard intra-procedural heart rate and MAP showed substantial significant differences between the two groups at 5 minutes, intubation time (I.T), 10 minutes, 15 minutes, 20 minutes, 25 minutes, 30 minutes and 35 minutes; HR and MAP values were lower in dexmedetomidine-propofol group [Tables 2 and 3].

Table (2): Comparison between dexmedetomidine and ketamine as regard intra-procedural heart rate (HR) beats/min

Intra-procedural HR (beats/ min)	Dex-medetomidine	Ketamine	P-value
	No. = 25	No. = 25	
Baseline	84.13 ± 9.65	83.79 ± 10.74	0.907
5min	81.35 ± 8.24	95.42 ± 11.33	<0.01
	78.18 ± 7.35	104.53 ±10.46	<0.01
10min	74.50 ± 8.14	105.74 ± 12.31	<0.01
15min	71.52 ± 7.24	107.32 ± 16.81	<0.01
20min	70.35 ± 5.85	105.12 ± 11.91	<0.01
25min	69.89 ±6.24	98.75 ± 10.32	<0.01
30min	67.78 ±7.38	97.29 ± 12.65	<0.01
35 min	66.93 ± 7.56	94.84 ± 8.67	<0.01

Data were provided as mean ± SD

Table (3): Comparison between dexmedetomidine and ketamine regarding intra-procedural MAP (mmHg)

MAP (mmHg)	Dex-medetomidine	Ketamine	P-value
	No. = 25	No. = 25	
Baseline	102.45 ± 9.32	100.42 ± 12.71	0.527
5-min	86.22 ± 12.32	105.61 ± 14.73	<0.01
Intubation time	91.36 ± 14.92	110.44 ± 12.24	<0.01
10min	86.13 ± 10.27	107.29 ± 10.13	<0.01
15min	82.25 ± 11.45	104.73 ± 11.42	<0.01
20min	78.56 ± 14.72	105.36 ± 16.29	<0.01
25min	82.40 ± 12.37	107.38 ± 15.81	<0.01
30min	87.15 ± 12.61	105.28 ±16.74	<0.01
35 min	93.68 ± 12.08	109.37 ±12.87	<0.01

Data were provided as mean ± SD.

A non-significant difference was found as regards the total amount of propofol used at the conclusion of the procedure between both groups, but it was lower in the dexmedetomidine-propofol group [Table 4].

Table (4): Comparison between dexmedetomidine and ketamine as regard total dose of propofol (mg)

Groups	Dose of propofol (mg)		P-value
	Mean	±SD	
Dexmedetomidine	272.13	66.85	0.273
Ketamine	311.62	76.14	

Post-procedural HR changes demonstrated strong significant differences between both groups across the PACU period at 15-min, 30-min, 45-min, 60-min; HR values were lower in dexmedetomidine-propofol group [Table 5].

Table (5): Dexmedetomidine and ketamine are compared in terms of post-procedural heart rate (beats/min)

Post-procedural HR (beats/ min)	Dex-medetomidine	Ketamine	P-value
	No. = 25	No. = 25	
15min	73.25 ± 5.64	94.42 ± 11.39	<0.01
30min	69.32 ±5.34	89.58 ± 10.46	<0.01
45min	68.15 ± 5.17	85.36 ± 9.73	<0.01
60min	69.23 ±4.89	79.62 ± 8.65	<0.01

Data were reported as mean ± SD.

Post-procedural MAP changes demonstrated a significant difference at 15, 30, 45, and 60 minutes of the PACU period between both groups; the dexmedetomidine-propofol group had lower MAP values [Table 6].

Table (6): Comparison between dexmedetomidine and ketamine as regard post-procedural MAP (mmHg)

Post-procedural MAP (mmHg)	Dex-medetomidine	Ketamine	P-value
	No. = 25	No. = 25	
15min	87.15 ± 8.63	103.26 ± 8.79	<0.01
30min	89.23 ± 9.21	100.74 ± 11.38	<0.01
45min	91.46 ± 7.42	96.32 ± 7.21	0.023
60min	91.27 ± 4.63	95.12 ± 5.74	0.012

Data were reported as mean ± SD.

The assessment and documentation of post-operative nausea and emesis. A significant statistical difference was found between both groups; however, it was smaller in the dexmedetomidine-propofol group. VAS measurements of pain revealed no significant differences between the two groups. A substantial statistical difference was found between both groups for post-operative cognitive problems, including hallucinations, agitation, and irritability; the incidence was lower in the dexmedetomidine-propofol group [Table 7].

Table (7): Comparison between dexmedetomidine and ketamine as regard PONV, pain score and hallucination, agitation and irritability

		Dex-medetomidine	Ketamine	P-value
		No. = 25	No. = 25	
PONV	Absent	25 (100.0%)	13 (52.0%)	<0.01
	Present	0 (0.0%)	12 (48.0%)	
Pain score	2-Jan	22 (88.0%)	25 (100.0%)	0.074
(VAS)	5-Mar	3 (12.0%)	0 (0.0%)	
Hallucination	Absent	25 (100.0%)	18 (72.0%)	0.004
	Present	0 (0.0%)	7 (28.0%)	
	Present	0 (0.0%)	7 (28.0%)	

Adverse respiratory events did not occur in either group carrying no significant differences between both groups [table 8].

Table (8): Comparison between dexmedetomidine and ketamine as regard respiratory complications

Respiratory Complication	Groups		Total	
	Dex-medetomidine	Ketamine		
	No. = 25	No. = 25	No.	%
Labored breathing (Absent)	25 (100.0%)	25 (100.0%)	50	100
Apnea (Absent)	25 (100.0%)	25 (100.0%)	50	100
SPO_2 (>94)	25 (100.0%)	25 (100.0%)	50	100

Recovery period following surgery; the interval between extubation and spontaneous eye opening was monitored and noted. Recovery time demonstrated a significant difference between both groups; shorter recovery time was reported in dexmedetomidine-propofol group [Table 9].

Table (9): Comparison between dexmedetomidine and ketamine as regard recovery time (min)

Groups	Recovery time (min)		P-value
	Mean	±SD	
Dexmedetomidine	6.23	1.55	<0.01
Ketamine	21.15	5.10	

Apart of failure of cannulation of the biliary system; acute endoscopic complications in the form of bleeding, duodenal perforation had no statistically significant difference between the two groups [table 10].

Table (10): Comparison between dexmedetomidine and ketamine as regard acute endoscopic complications

Surgical complication	Groups				Total	
	Dex-medetomidine		Ketamine			
	No.	%	No.	%	No.	%
Absent	23	92.00%	24	96.00%	47	94
Present	2	8.00%	1	4.00%	3	6
Total	25	100	25	100	50	100
P-value	0.552					

DISCUSSION

The lengthier and more complicated ERCP technique is an endoscopic treatment. Patients who are scheduled for ERCP frequently have additional co-morbidities which qualify them for GA [14].

The dexmedetomidine-propofol group showed higher intra-procedural hemodynamic stability than the ketamine-propofol group, according to our study. Throughout the process, there were substantial intra-procedural statistical differences; the dexmedetomidine-propofol group's HR values were lower. Statistically significant differences existed amongst the two groups regarding intra-procedural MAP fluctuations, with the exception of the record assessed at 20 min. The dexmedetomidine-propofol group had lower MAP values.

An investigation conducted by **Sethi *et al.*** [15] evaluating dexmedetomidine and midazolam for conscious sedation during ERCP provided evidence for intra-procedural hemodynamic stability. There was statistically significant difference as regard intra-procedural HR throughout the procedure ($p < 0.05$); lower heart rate values following infusion of loading dose of dexmedetomidine, 5 minutes, 10 minutes, 15 minutes, and 20 minutes during ERCP. While Intra-procedural MAP demonstrated no statistical significance throughout the procedure.

Saric *et al.* [16] reported that there were no intra-procedural CVS adverse events in patients receiving propofol-ketamine when they studied it against propofol alone for deep sedation of ERCP among elderly patients. Intra-procedural hypotension was 30% in patients receiving propofol alone with P-value < 0.02 denoting significant differences between both groups. There was no CVS derangement in ketamine-propofol group in our study.

Hasanein and El-Sayed [17] compared the incidence of intra-procedural CVS complications of ketamine-propofol versus fentanyl-propofol used for sedation of obese cases undergoing ERCP. They reported that the incidence of hypotension was 3%, tachycardia was 3%, hypertension was 2% and bradycardia was1%; a significant difference was found between the two groups, with the fentanyl-propofol group experiencing a greater frequency of problems (p-values for hypotension and bradycardia were 0.03 and 0.023, respectively). The decreased ketamine dosage may have contributed to decreased CVS problems (ketamine to propofol 1:4). Patients in the current study were mechanically ventilated that might control the effect of hypoxemia or hypoventilation on hemodynamics.

According to **Mahajan *et al.*** [18], comparison of ketamine and fentanyl, added to propofol in TIVA, both groups saw a statistically insignificant small rise in intra-procedural pulse rate following induction; pulse rate returned to baseline after 30min and 15min in ketamine-propofol group and fentanyl-propofol, respectively. Intra-procedural range of pulse rate in ketamine-propofol group was lower than detected by our study. Hypotension was revealed in 5 patients received fentanyl-propofol while none in ketamine-propofol groups; this evidence was in accordance with our study. The difference between **Mahajan *et al.*** [18] study and our study in the intra-group hemodynamic values that occurred in ketamine-propofol combinations might be because of the different basal pulse rate and MAP; HR was 83.8 ± 10.47 beats/min in the present study versus 75 ± 4 beats/min in their study and MAP of ketamine-propofol of the present

study was 100.42 ± 12.71 mmHg versus 90.33 ± 5 mmHg in their study.

The current study's **overall propofol intake** at the conclusion of the procedure had no statistically significant difference.

Sethi *et al.* [15] reported lower propofol consumption. They compared dexmedetomidine to midazolam for conscious sedation in ERCP. They had ASA I-II. Both groups received 1 µg/kg fentanyl. Propofol top-ups were given for the emergency IV sedation of 10 mg until patient reached Richmond Agitation Sedation Score (RASS 3-4). No significant difference existed between both groups as regard total propofol dose (p=0.7). The noticed difference might be due to the choice of GA in our study while they used sedation as an anesthetic choice.

Aydogan *et al.* [19] research compared propofol-ketamine combos versus propofol alone in upper GI-endoscopy in adult patients and revealed the total amount of propofol consumed by patients who got propofol-ketamine combination. The amount of propofol consumed by patients who received ketamine-propofol was less than that in our study; this may be because the type of endoscopy used in their study was less time-consuming than ERCP; 5.5±0.096 min versus 27.88±10.3 in our study).

In our study, throughout the PACU period**, post-procedural HR** fluctuations demonstrated a substantial statistical difference between the two groups, with lower HR values in the dexmedetomidine-propofol group. Except for the first 60 minutes of the PACU stay, **post-procedural MAP** alterations showed a substantial statistical difference between the two groups; lower MAP values were found in the dexmedetomidine-propofol group.

Aydogan *et al.* [19]**,** compared the effects of ketamine-propofol combination to propofol alone during upper GI-endoscopy in adult patients, and found no evidence of post-procedural hemodynamic derangement in individuals who received the combination.

Post-procedural nausea and emesis: our study was supported by **Sethi *et al.*** [15] investigation of midazolam versus dexmedetomidine for conscious sedation in ERCP. Vomiting was 10% more often in the midazolam group compared with the dexmedetomidine group, and there was a highly significant difference between the two groups (p<0.001).

Mahajan *et al.* [18] reported lower incidence of PONV (5%) in ketamine-propofol group when compared to our study.

Post-procedural pain: the current study's VAS assessment of pain revealed no significant differences between both groups.

Sethi *et al.* [15] assessed pain by facial pain score (FPS) during the recovery of patients who received either dexmedetomidine or midazolam for conscious sedation in ERCP patients. They showed better records in patients received dexmedetomidine as compared with midazolam group at 5 min and 10 min (p < 0.001). At 15 min of the procedure, the two groups showed similar FPS (P > 0.05). These results were in accordance with our study as regard the incidence of abdominal discomfort in dexmedetomidine-propofol group.

In the study of **Demiraran *et al.*** [20]**;** the incidence of post-procedural stomach discomfort in individuals having upper endoscopy was compared using dexmedetomidine and midazolam. The incidence was lower in the dexmedetomidine group compared with the midazolam group, but such difference was not statistically significant (p=0.21). These results about the incidence of pain supported the findings of the current analysis.

According to the current study, both groups experienced post-operative cognitive problems, with the ketamine-propofol group experienced a greater incidence of hallucinations, agitation, and irritability.

Hasanein and El-Sayed [17] observed 2% of cases receiving ketamine-propofol combination to be agitated and irritable, compared to no cases in the other comparison group receiving propofol-fentanyl. This incidence was lower than the incidence observed in the study's ketamine-propofol group (28%), which may be related to the study's lower ketamine dosage than that was administered in our study as deep sedation was chosen as an anesthetic choice for performing ERCP in obese patients.

Both groups in the current trial did not have **any respiratory adverse effects**. **Sethi *et al.*** [15] reported no respiratory adverse events had occurred in dexmedetomidine group when administered to achieve sedation for ERCP.

Demiraran *et al.* [20] study compared dexmedetomidine and midazolam for upper endoscopic sedation. One patient in the midazolam group suffered apnea, and two other patients had desaturation; their SPO_2 levels were below 90%. In the dexmedetomidine group, there was no bradypnea or desaturation; this finding was consistent with that described in the current study. Respiratory complications did not occur in patients received ketamine-propofol group for upper GI endoscopy in a study performed by **Aydogan *et al.*** [19]**;** supporting the results of our study.

Recovery period following the procedure in the current investigation; the interval from extubation to spontaneous eye opening was noted. Recovery time had shown to have a high statistical difference between the two groups; shorter recovery time was reported with dexmedetomidine-propofol group compared with ketamine-propofol group.

Sethi *et al.* [15] evaluated the recovery time for the dexmedetomidine group following ERCP in cases under conscious sedation; 90% of cases with dexmedetomidine attained Alderte score 9-10 within 5

min. This corroborated the findings of the current investigation.

In their study, Aydogan *et al.* [19] found that recovery times for patients receiving ketamine and propofol during upper gastrointestinal endoscopy were 7.26 ± 6.8 minutes compared to 10.30 ± 3.6 minutes for those receiving fentanyl and propofol. The discrepancy between the results from the current investigation and their reported results may be attributable to the different kind of operation and ketamine dosage.

We had the same trend of acute endoscopic complications as found by **Abdalla *et al.* [21]**, despite the significant sex difference in both studies, which might favor decreased such problems in our study **[22].**

Our study showed several limitations; small sized groups, the predominant male sex in both groups, which will prevent us from studying practice in females specially for dexmedetomidine-propofol group because of limited number of studies. This can be overcome by increasing number of patients. Another one is the limited time of observation postoperatively which prevents detection of full scope of post-operative course and complications.

CONCLUSION

Dexmedetomidine-propofol combination was superior compared with ketamine-propofol combination in terms of intra- and post-procedural hemodynamic parameters. Total propofol requirements had no significant difference between the two groups. PONV and cognitive functions; in the form of agitation, irritability and hallucination were better in dexmedetomidine-propofol combination compared with ketamine-propofol combination that carried a high clinical significance. Pain scored by VAS was less in ketamine-propofol combination than dexmedetomidine-propofol combination but this difference had no clinical significance. Post-procedural adverse respiratory events; in the form of apnea, labored breathing and desaturation (SPO_2 < 94%), did not occur in the two groups. Dexmedetomidine-propofol combination had shorter recovery time than ketamine-propofol group with high clinical significance.

RECOMMENDATION

Additional research is necessary, with recommendations to include, for the TIVA approach using a dexmedetomidine-propofol combination for ERCP; different types of patients; geriatrics, critically ill patients and increasing the sample size of patients.

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