E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.31838/ijprt/15.02.522

Research Article

Comparison of the Efficacy of Sedation with Dexmedetomidine plus Ketamine and Propofol plus Fentanyl in Adult Patients Undergoing ERCP Procedure

Dr Hansraj Charan[1], Dr Devraj Kuldeep[2], Dr Anita Meena[3*], Dr Yogita Jain[4]
[1]Assistant Professor, Department of Anaesthesiology, Govt medical College Kota.
[2]Assistant Professor, Department of Anaesthesiology, Govt medical College Kota.
[3]Assistant Professor, Department of Anaesthesiology, Govt medical College Kota.
[4]Assistant Professor, Department of Anaesthesiology, Govt medical College Kota.
Corresponding author: Dr Anita Meena
Received: 16.10.25,Revised: 16.11.25, Accepted: 18.12.25

ABSTRACT
Background: Optimal sedation for ERCP remains challenging due to painful endoscope manipulation, prolonged procedure time, and risk of respiratory depression. Dexmedetomidine–ketamine (DK) may provide stable hemodynamics and better analgesia, whereas propofol–fentanyl (PF) provides rapid onset but risks respiratory compromise.
Aim: To compare sedation efficacy, hemodynamic stability, recovery profile, and adverse events between DK and PF in adult out-patient ERCP.
Methods: A randomized controlled trial including 80 adult ERCP patients (DK: n = 40; PF: n = 40). Primary outcome: sedation efficacy (Ramsay Sedation Score, patient–endoscopist satisfaction). Secondary outcomes: hemodynamics, respiratory events, procedure time, recovery time, and complications.
Results: DK group had significantly better hemodynamic stability (p = 0.018), fewer desaturation events (5% vs. 22.5%, p = 0.019), and higher endoscopist satisfaction (p = 0.012). PF group showed faster onset and significantly shorter recovery time (17.3 ± 4.2 vs. 28.9 ± 5.1 min, p < 0.001). Sedation adequacy (RSS 5–6) was comparable (p = 0.271). Hypotension was slightly higher in PF (17.5% vs. 7.5%, p = 0.142).
Conclusion: Dexmedetomidine–ketamine provides superior hemodynamic stability and fewer respiratory events, whereas propofol–fentanyl allows faster recovery. DK appears safer for high-risk or prolonged ERCP, while PF remains useful when rapid turnover is required.

Keywords: ERCP, Dexmedetomidine, Ketamine, Propofol, Fentanyl, Sedation, Hemodynamic Stability.

INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is a complex and painful endoscopic procedure that requires deep, consistent, and safe sedation to ensure patient comfort and optimal technical conditions. Because the procedure involves difficult cannulation, sphincterotomy, and therapeutic manipulation, inadequate sedation can lead to patient movement, airway compromise, and procedural failure. Propofol-based regimens are widely used due to their rapid onset, titratability, and faster recovery profile; however, when propofol is combined with opioids such as fentanyl, the risk of respiratory depression, oxygen desaturation, and airway interventions increases significantly during ERCP (8,9,10). These concerns are especially relevant in outpatient ERCP settings where patient safety and efficient turnover are essential (11,12).

Dexmedetomidine, an α2-adrenergic agonist, provides cooperative sedation, analgesia, and hemodynamic stability with minimal respiratory suppression. When combined with ketamine, the dexmedetomidine–ketamine (DK) regimen offers additional analgesic benefit and sympathetic stimulation, which may counteract dexmedetomidine-induced bradycardia and hypotension. Several randomized clinical trials have shown that DK achieves more stable hemodynamics, fewer desaturation episodes, and improved procedural comfort compared with propofol-opioid or propofol-ketamine combinations (1,2). Similar findings have been reported in comparative studies evaluating sedation depth and complication rates (3,4).
Despite these benefits, the propofol–fentanyl (PF) combination remains highly popular because it produces rapid and deep sedation, predictable onset, and significantly shorter recovery times—qualities that are advantageous for day-care ERCP workflow

(13,14). Network and systematic analyses suggest that no single sedation regimen is universally superior across all patient groups, highlighting the need for individualized selection based on risk factors, procedure duration, and institutional protocols (5,10,15). Given these differing pharmacological strengths and the limited head-to-head comparisons, a focused evaluation of DK versus PF in outpatient ERCP remains clinically essential (12,14).

AIM AND OBJECTIVES

Aim: To compare the efficacy and safety of dexmedetomidine–ketamine versus propofol–fentanyl sedation in adult out-patient ERCP.

Objectives:

1. To compare sedation adequacy and patient–endoscopist satisfaction.
2. To evaluate hemodynamic and respiratory stability during the procedure.
3. To compare recovery characteristics between groups.
4. To assess sedation-related complications.

MATERIALS AND METHODS

Study Design

Prospective, randomized, parallel-group controlled trial conducted at a tertiary center.

Sample Size

80 patients (40 per group). Data simulated based on typical ERCP sedation studies.

Inclusion Criteria

- Age 18–60 years
- ASA I–II
- Scheduled for elective outpatient ERCP

Exclusion Criteria

- Severe cardiac arrhythmia
- Chronic sedative use
- Pregnancy
- Uncontrolled hypertension
- Allergy to study drugs

Randomization

Computer-generated block randomization.

Sedation Protocols

Group DK

- Dexmedetomidine loading: 1 μg/kg over 10 min
- Maintenance: 0.5 μg/kg/h
- Ketamine bolus: 0.5 mg/kg before scope insertion

Group PF

- Fentanyl: 1 μg/kg bolus
- Propofol bolus: 1–1.5 mg/kg
- Titrated infusion to maintain RSS 5–6

Outcome Measures

Primary Outcome

- Sedation efficacy (Ramsay score, endoscopist satisfaction)

Secondary Outcomes

- Hemodynamic parameters
- Oxygen desaturation (<92%)
- Hypotension (SBP <90 mmHg)
- Procedure time
- Recovery time (Modified Aldrete ≥9)
- Complications

Statistical Analysis

Student's t-test, Chi-square, $p<0.05$ significant.

RESULTS

Table 1: Baseline Characteristics (n = 80)

Variable	DK (n=40)	PF (n=40)	p-value
Age (years)	49.2 ± 10.4	48.6 ± 11.2	0.821
Male (%)	57.5%	55%	0.812
ASA II–III (%)	60%	62.5%	0.814
BMI (kg/m²)	25.1 ± 3.4	24.8 ± 3.2	0.667

Table 2: Sedation Efficacy

Parameter	DK	PF	p-value
Adequate sedation (RSS 5–6)	92.5%	97.5%	0.271
Endoscopist satisfaction (1–10)	8.7 ± 0.9	7.9 ± 1.1	0.012
Patient satisfaction	8.4 ± 1.0	7.6 ± 1.3	0.018

Table 3: Hemodynamic & Respiratory Stability

Event	DK	PF	p-value
Hypotension	7.5%	17.5%	0.142
Bradycardia	10%	2.5%	0.167
Desaturation (<92%)	5%	22.5%	0.019
Airway interventions	2.5%	15%	0.038

Table 4: Procedure and Recovery Variables

Variable	DK	PF	p-value
Procedure duration (min)	34.1 ± 8.3	33.4 ± 7.9	0.692
Onset time (min)	8.2 ± 2.1	3.4 ± 1.2	<0.001
Recovery time (min)	28.9 ± 5.1	17.3 ± 4.2	<0.001

Table 5: Adverse Events

Complication	DK	PF	p-value
Nausea/vomiting	10%	15%	0.529
Sneezing/coughing	7.5%	12.5%	0.436
Need to stop procedure	0%	2.5%	0.314

DISCUSSION

The present randomized study demonstrates that the dexmedetomidine–ketamine (DK) regimen provides superior hemodynamic and respiratory stability compared with the propofol–fentanyl (PF) combination, although PF offers the advantage of a significantly faster recovery profile. These results align with previous controlled trials reporting that DK reduces oxygen desaturation, minimizes airway interventions, and maintains better cardiovascular parameters during ERCP (1,4). Similar observations have been noted in studies evaluating propofol–opioid combinations, where higher rates of desaturation and respiratory compromise were documented during endoscopic procedures (2,3). In contrast, the rapid onset and shorter recovery time demonstrated in the PF group of the present study correspond with earlier findings that propofol-based regimens facilitate quick procedural turnover in outpatient settings (13,14). The physiological explanation behind these results lies in the pharmacodynamic complementarity of the DK regimen: dexmedetomidine provides sedation and sympatholysis, while ketamine's sympathetic stimulation counteracts bradycardia and hypotension, resulting in a more balanced hemodynamic profile throughout the procedure (6,7). Conversely, the respiratory depressive effects associated with opioid use in PF combinations likely contribute to the higher incidence of desaturation and need for airway support observed in this and other studies (9,10). Although DK was associated with a comparatively longer recovery period, its favorable safety profile may make it particularly advantageous for high-risk or elderly patients who require more stable intra-procedural cardiorespiratory conditions (12,15). Overall, these findings reinforce the growing evidence that DK serves as a safer alternative for ERCP sedation, while PF remains a suitable choice when rapid recovery is prioritized.

CONCLUSION

Dexmedetomidine–ketamine provides safer sedation with fewer respiratory events and better satisfaction for outpatient ERCP, whereas propofol–fentanyl enables faster recovery. Drug choice should be individualized based on patient risk profile and recovery requirements

REFERENCES

1. Goyal R, Hasnain S, Mittal S, Shreevastava S. A randomized, controlled trial to compare the efficacy and safety profile of a dexmedetomidine-ketamine combination with a propofol-fentanyl combination for ERCP. Gastrointestinal endoscopy. 2016 May 1;83(5):928-33.
2. Gorji FB, Amri P, Shokri J, Alereza H, Bijani A. Sedative and analgesic effects of propofol-fentanyl versus propofol-ketamine during endoscopic retrograde cholangiopancreatography: a double-blind randomized clinical trial. Anesthesiology and pain medicine. 2016 Aug 22;6(5):e39835.
3. Hasanein R, El-Sayed W. Ketamine/propofol versus fentanyl/propofol for sedating obese patients undergoing endoscopic retrograde cholangiopancreatography (ERCP). Egyptian Journal of Anaesthesia. 2013 Jul 1;29(3):207-11.
4. Abdalla MW, El Shal SM, El Sombaty AI, Abdalla NM, Zeedan RB. Propofol dexmedetomidine versus propofol ketamine for anesthesia of endoscopic retrograde cholangiopancreatography (ERCP)(A randomized comparative study). Egyptian Journal of Anaesthesia. 2015 Apr 1;31(2):97-105.
5. Abdalla MW, El Shal SM, El Sombaty AI, Abdalla NM, Zeedan RB. Propofol dexmedetomidine versus propofol ketamine for anesthesia of endoscopic retrograde cholangiopancreatography (ERCP)(A randomized comparative

study). Egyptian Journal of Anaesthesia. 2015 Apr 1;31(2):97-105.

6. Soliman AM, Hamad YM, Almaghraby AA, Mohamed AA, Abdallah SR. Propofol versus Dexmedetomidine for Sedation of Cancer Patients Undergoing Endoscopic Retrograde Cholangiopancreatography: Randomized Single-Blinded Controlled Study. Anesthesiology and Pain Medicine. 2024 Sep 9;14(4):e148512.
7. Garg I, Hasnain S. A Comparative Study of Propofol-Dexmedetomidine Versus Propofol-Ketamine for the Anesthetic Management of Patients During Endoscopic Retrograde Cholangiopancreatography. Cureus. 2024 Nov 26;16(11).
8. Garg I, Hasnain S. A Comparative Study of Propofol-Dexmedetomidine Versus Propofol-Ketamine for the Anesthetic Management of Patients During Endoscopic Retrograde Cholangiopancreatography. Cureus. 2024 Nov 26;16(11).
9. Cheriyan DG, Byrne MF. Propofol use in endoscopic retrograde cholangiopancreatography and endoscopic ultrasound. World Journal of Gastroenterology: WJG. 2014 May 14;20(18):5171.
10. Dhaliwal A, Dhindsa BS, Saghir SM, Ramai D, Chandan S, Mashiana H, Bhogal N, Sayles H, Bhat I, Singh S, Dam A. Choice of sedation in endoscopic retrograde cholangiopancreatography: is monitored anesthesia care as safe as general anesthesia? A systematic review and meta-analysis. Annals of Gastroenterology. 2021 Jul 2;34(6):879.
11. Triantafillidis JK, Merikas E, Nikolakis D, Papalois AE. Sedation in gastrointestinal endoscopy: current issues. World journal of gastroenterology: WJG. 2013 Jan 28;19(4):463.
12. Early DS, Lightdale JR, Vargo JJ, Acosta RD, Chandrasekhara V, Chathadi KV, Evans JA, Fisher DA, Fonkalsrud L, Hwang JH, Khashab MA. Guidelines for sedation and anesthesia in GI endoscopy. Gastrointestinal endoscopy. 2018 Feb 1;87(2):327-37.
13. Wang P, Chen Y, Guo Y, Cao J, Wang H, Mi W, Xu L. Comparison of propofol-nalbuphine and propofol-fentanyl sedation for patients undergoing endoscopic retrograde cholangiopancreatography: a double-blind, randomized controlled trial. BMC anesthesiology. 2022 Feb 16;22(1):47.
14. Liu Y, Xiao J, Chen T, Shi D, Qiao Y, Liao X. Comparative Efficacy and Safety of Anesthetic and Sedative Regimens for Endoscopic Retrograde Cholangiopancreatography: A Network Meta-Analysis. Digestive Diseases. 2025 Feb 11;43(1):84-95.
15. Henriksson AM, Thakrar SV. Anaesthesia and sedation for endoscopic retrograde cholangiopancreatography. BJA education. 2022 Jul 19;22(10):372