Review Article

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Nebulised Dexmedetomidine for Patient Comfort and Satisfaction During Diagnostic Upper Gastrointestinal Endoscopy: A Narrative Review

Anaesthesia Section

AJINKYA AKULWAR[1], NEETA CHAUDHARY[2]

ABSTRACT

Diagnostic upper gastrointestinal endoscopy often causes anxiety, gagging, coughing and procedural discomfort, which can reduce tolerance and impair procedural conditions. Nebulised dexmedetomidine has drawn interest as a non invasive premedication because it provides anxiolysis and sedation with minimal respiratory depression. The present narrative review examined the available evidence on its role in improving procedural tolerance and related outcomes during diagnostic upper gastrointestinal endoscopy. A literature search was performed across PubMed, Embase, Cochrane Library, Scopus, Web of Science and Cumulative Index to Nursing and Allied Health Literature (CINAHL). Studies involving adult and paediatric patients who received nebulised dexmedetomidine before endoscopy were reviewed, with emphasis on patient comfort, procedural ease, gag and cough suppression, sedative sparing effects and safety. The present narrative review provides a focused summary of the emerging evidence on nebulised dexmedetomidine during diagnostic upper gastrointestinal endoscopy, with emphasis on procedural tolerance, airway reflex suppression and safety in adult and paediatric populations. Larger multicentre studies with standardised outcome measures are needed to define its role more clearly.

Keywords: Child, Conscious sedation, Cough, Gagging, Inhalation, Sedation

INTRODUCTION

Upper gastrointestinal endoscopy, or Oesophagogastroduodenoscopy (EGD), is one of the most commonly performed diagnostic procedures worldwide. It allows direct visualisation of the oesophagus, stomach and duodenum for the evaluation of dyspepsia, gastrointestinal bleeding, dysphagia and suspected malignancy [1,2]. Upper Gastrointestinal Endoscopy (UGE) still causes substantial discomfort in many patients despite its diagnostic value. Passage of the endoscope through the oropharynx provokes protective reflexes such as gagging, retching and coughing, and the procedure can also produce anxiety, distress and cardiovascular responses that may reduce patient tolerance and procedural quality [3,4].

The need to improve comfort without compromising safety has led to the use of several sedation strategies during UGE [5,6]. Common approaches include topical pharyngeal anaesthesia with lignocaine spray, conscious sedation with benzodiazepines such as midazolam and deeper sedation with propofol or opioid based regimens. However, each method has limitations. Topical anaesthesia alone may not provide adequate relief in anxious patients, and intravenous sedation may cause respiratory depression, cardiovascular instability and delayed recovery, and this increases the need for monitoring and recovery support [7,8]. These concerns are especially relevant in children, where cooperation is often limited and gag reflex responses are usually more prominent [9].

Dexmedetomidine is a highly selective $\alpha 2$ adrenergic receptor agonist with a pharmacological profile that has drawn attention in procedural sedation [10,11]. It provides sedation, anxiolysis and analgesia while preserving respiratory drive and causing minimal respiratory depression [10,11]. Its central action at the locus coeruleus produces a sedative state that resembles natural sleep, and patients remain easily arousable [12]. Dexmedetomidine also has antisialagogue effects and produces haemodynamic stability through sympatholysis, which makes it suitable for procedures that involve airway instrumentation [13].

Intravenous dexmedetomidine has shown promise in endoscopy, but it requires venous access and may still cause bradycardia and hypotension, particularly with bolus administration [14,15]. Nebulised dexmedetomidine provides a non invasive alternative and uses absorption through the nasal and buccal mucosa, where bioavailability is about 65% and 82%, respectively [16,17]. This route avoids the transient nasal irritation, coughing and laryngospasm that may occur with intranasal administration, and it allows broad mucosal deposition through atomised delivery [18,19].

Nebulised dexmedetomidine may improve comfort during UGE because it can reduce anxiety and suppress airway reflexes before endoscope insertion [13,16-19]. These effects may improve procedural conditions and may do so without the respiratory concerns associated with deeper sedation [7,10,11]. The present narrative review examines the available evidence on nebulised dexmedetomidine for patient comfort and satisfaction during diagnostic upper gastrointestinal endoscopy in adult and paediatric populations, and it outlines priorities for future research.

Search strategy: A comprehensive literature search was conducted across multiple electronic databases including PubMed, Embase, Cochrane Library, Scopus, Web of Science, and CINAHL from inception to February 2026. The search strategy made use of combinations of the following terms: "dexmedetomidine", "nebulised" OR "nebulised", "upper gastrointestinal endoscopy", "oesophagogastroduodenoscopy" OR "esophagogastroduodenoscopy", "EGD", "gastroscopy", "sedation", and "anxiolysis". Boolean operators were used to combine search terms appropriately. Reference lists of included studies and relevant reviews were manually searched to identify additional eligible publications.

Overview of Dexmedetomidine Pharmacology

Dexmedetomidine is a highly selective alpha 2 adrenergic receptor agonist that produces its principal effects through central actions in the

locus coeruleus and spinal cord [10-12]. Activation of these receptors reduces sympathetic outflow and lowers noradrenaline release, which produces sedation, anxiolysis and modest analgesic effects [10-12]. The sedative state resembles natural sleep, and patients usually remain calm and easily arousable [11,12]. This profile is relevant in endoscopic practice, where excessive sedation may compromise airway safety and delay recovery [7,14]. Dexmedetomidine also reduces salivary secretions and blunts stress responses, which may improve tolerance during upper airway and upper gastrointestinal instrumentation [10,13].

Respiratory safety remains one of its main advantages. Dexmedetomidine causes minimal respiratory depression at clinically used doses and usually preserves spontaneous ventilation, unlike many benzodiazepine, opioid and propofol based regimens [10,11,14]. This characteristic has supported its use in procedural sedation and endoscopic settings where maintenance of respiratory drive is important [7,11,14].

The nebulised route provides a non invasive method of administration and allows absorption across the nasal, buccal and respiratory mucosa [16-19]. Reported extravascular bioavailability through nasal and buccal surfaces is substantial, with values of about 65% and 82%, respectively [17]. Clinical onset after nebulisation generally occurs within 20 to 30 minutes, which supports its use as a preprocedural medication [16-18]. This route avoids venous cannulation and may reduce abrupt haemodynamic effects associated with rapid intravenous administration [16-23]. These pharmacological features make nebulised dexmedetomidine a plausible option for improving comfort and procedural tolerance during upper gastrointestinal endoscopy [20-23].

Study selection: The literature search identified relevant records evaluating nebulised dexmedetomidine in upper gastrointestinal endoscopy settings. Three randomised controlled trials directly evaluating nebulised dexmedetomidine during upper gastrointestinal endoscopy were identified and included in the primary synthesis [20-22]. Additionally, supporting evidence was drawn from trials of nebulised dexmedetomidine in related airway instrumentation contexts and from studies establishing the pharmacological basis for the nebulised route [23-26].

Characteristics of included studies: The characteristics of the three primary studies directly evaluating nebulised dexmedetomidine in UGE is summarised in [Table/Fig-1] [20-22].

EFFICACY OUTCOMES

Effects on Procedural Outcomes

Patient satisfaction and comfort: Patient satisfaction showed mixed results across the two adult studies. Sriramka B et al., found no significant difference in satisfaction scores between nebulised dexmedetomidine and saline despite better procedural ease and tolerance in the intervention group [20]. Shah B and Salim R reported a more favourable result, with all patients in the dexmedetomidine group rated as very satisfied compared with 68.8% in the control group [22]. These findings indicate that patient reported satisfaction may not improve consistently at a dose of 1 µg/kg in adults, although procedural comfort appears to improve across studies [20,22].

Gag reflex suppression: Gag reflex suppression was assessed most clearly in the paediatric trial by Turunc E et al., [21]. In that study, 88.3% of children in the dexmedetomidine group had no gag reflex compared with 30% in the control group, and this difference was statistically significant [21]. The magnitude of this effect indicates that nebulised dexmedetomidine can markedly improve tolerance of endoscope passage in children when used as premedication before standard intravenous sedation [21].

Cough Reduction

Cough reduction was a consistent finding across the included studies. Sriramka B et al., reported fewer coughing episodes in adults who received nebulised dexmedetomidine than in those who received saline [20]. Shah B and Salim R also showed lower coughing in the dexmedetomidine group, with coughing reported in 9.4% of patients compared with 46.9% in controls [22]. Turunc E et al., found a similar pattern in children, where 95% of patients in the dexmedetomidine group had no cough compared with 55% in the control group [21]. These findings show a consistent effect on airway reflex suppression across age groups [20-22].

Sedative sparing effects: Sedative sparing effects were demonstrated most clearly in the paediatric study. Turunc E et al., found that children who received nebulised dexmedetomidine required less additional propofol to maintain adequate sedation during the procedure [21]. This finding suggests that nebulised dexmedetomidine may reduce the total anaesthetic burden when used as an adjunct. Comparable data were not shown in the adult studies because one trial used no intravenous sedation and the other focused primarily on satisfaction, tolerance and haemodynamic measures [20,22].

Safety Profile of Nebulised Dexmedetomidine

Haemodynamic effects: Nebulised dexmedetomidine showed better haemodynamic findings in the adult studies. Sriramka B et al., reported lower postprocedure systolic and diastolic blood pressure values in the dexmedetomidine group than in the saline group, without clinically significant bradycardia or hypotension [20]. Shah B and Salim R also found better haemodynamic parameters in patients who received dexmedetomidine, which indicates

Author and year	Country	Design	Population	N (Dex/Ctrl)	Group details	Conclusion of the study
Sriramka B et al., 2023 [20]	Bhubaneswar, Odisha, India	Double blind randomised controlled trial	Adults aged 18 to 65 years with American Society of Anaesthesiologists (ASA) physical status I or II undergoing diagnostic UGE	45/45	Group D: Nebulised dexmedetomidine 1 µg/kg diluted with normal saline to a total volume of 5 mL. Group C: nebulised normal saline 5 mL. Nebulisation was administered for 15 minutes before the procedure.	Nebulised dexmedetomidine improved procedural ease and patient tolerance and reduced coughing, but it did not significantly improve patient satisfaction compared with control.
Turunc E et al., 2025 [21]	Turkey	Single centre prospective randomised controlled trial	Children aged 2 to 17 years undergoing upper GI endoscopy	60/60	Dexmedetomidine group: Nebulised dexmedetomidine 2 µg/kg as premedication. Control group: no premedication.	Nebulised dexmedetomidine was safe and effective as premedication; it significantly reduced gag and cough reflexes, decreased anaesthetic requirements and improved endoscopist satisfaction.
Shah B and Salim R 2026 [22]	Pimpri, Pune, Maharashtra, India	Randomised controlled trial	Adults aged 18 to 70 years with ASA physical status I or II undergoing elective diagnostic upper GI endoscopy	32/32	Group-D: Nebulised dexmedetomidine 1 µg /kg in 5 mL normal saline (0.9%). Group C:5 mL normal saline (0.9%). Both groups underwent 15 minute preprocedure nebulisation with the respective drugs.	Nebulised dexmedetomidine improved patient satisfaction, patient tolerance and endoscopist reported procedural ease, and it reduced coughing with a more favourable haemodynamic profile than control.

[Table/Fig-1]: Characteristics of included studies evaluating nebulised dexmedetomidine in upper gastrointestinal endoscopy [20-22].
ASA: American Society of Anesthesiologists; RCT: Randomised controlled trial; Dex: Dexmedetomidine; Ctrl: Control; NR: Not reported

attenuation of procedural stress responses [22]. These findings support the view that nebulised dexmedetomidine can improve procedural conditions without causing major haemodynamic instability in the studied populations [20,22].

Respiratory Safety

Respiratory safety remained favourable across all three studies. Sriramka B et al., found no oxygen desaturation attributable to nebulised dexmedetomidine in adults [20]. Turunc E et al., reported that hypoxia occurred in both groups at the same frequency and there was no significant between group difference [21]. The available evidence therefore indicates that nebulised dexmedetomidine preserves respiratory stability when used before diagnostic upper gastrointestinal endoscopy [20,21].

Adverse Events

No major adverse events directly attributable to nebulised dexmedetomidine were reported in the included studies. Sriramka B et al., observed no episodes of bradycardia, hypotension or other complications in either group [20]. Turunc E et al., recorded a small number of transient adverse events, including hypoxia and bradycardia. Shah B and Salim R reported fewer adverse effects in the dexmedetomidine group compared with controls, and the difference between groups was statistically significant. Taken together, the available studies indicate that nebulised dexmedetomidine has an acceptable short term safety profile in both adults and children undergoing diagnostic upper gastrointestinal endoscopy [20-22].

The parameters evaluated across the studies and their findings and interpretations is summarised in [Table/Fig-2] [20-22].

Parameters assessed	Study or studies	Main finding	Interpretation
Patient satisfaction	Sriramka B et al., [20]; Shah B and Salim R [22]	No significant improvement in one adult study, but significant improvement in the later adult study	Satisfaction benefit in adults remains inconsistent and may depend on study design, patient population or outcome assessment
Patient tolerance	Sriramka B et al., [20]; Shah B and Salim R [22]	Better tolerance with dexmedetomidine in both adult studies	Nebulised dexmedetomidine appears to improve overall procedural comfort
Endoscopist rated ease of procedure	Sriramka B et al., [20]; Shah B and Salim R [22]; Turunc E et al., [21]	Procedural ease and endoscopist satisfaction improved with dexmedetomidine	Better airway reflex control and calmer patient behaviour may improve technical conditions
Gag reflex suppression	Turunc E et al., [21]	Marked reduction in gag reflex severity	Strong evidence of benefit in paediatric patients
Cough reduction	Sriramka B et al., [20]; Turunc E et al., [21]; Shah B and Salim R [22]	Coughing was lower in the dexmedetomidine groups across all three studies	This is the most consistent efficacy signal across the available evidence
Additional propofol requirement	Turunc E et al., [21]	Lower additional propofol requirement in the dexmedetomidine group	Indicates a sedative sparing effect when used as premedication
Separation anxiety	Turunc E et al., [21]	Easier parental separation in children who received dexmedetomidine	Shows added anxiolytic benefit in paediatric practice
Haemodynamic parameters	Sriramka B et al., [20]; Shah B and Salim R [22]	More stable blood pressure profile with dexmedetomidine	Indicates attenuation of procedural sympathetic response
Respiratory events	Sriramka B et al., [20]; Turunc E et al., [21]	No meaningful increase in hypoxia or desaturation	Supports respiratory safety of the nebulised route
Adverse events	Sriramka B et al., [20]; Turunc E et al., [21]; Shah B and Salim R [22]	Fewer adverse effects were reported in dexmedetomidine groups, with no major safety concerns identified	Current evidence suggests acceptable short term tolerability

[Table/Fig-2]: Parameters assessed and their interpretation [20-22].

DISCUSSION

Supporting Evidence from Related Contexts

Direct evidence in upper gastrointestinal endoscopy remains limited to three trials, but findings from related procedural settings support the rationale for nebulised dexmedetomidine in airway and mucosal instrumentation [20-22]. Gaikawad J et al., studied dexmedetomidine added to lignocaine nebulisation for awake videoendoscopic guided nasal intubation and found better suppression of airway reflexes with improved patient comfort [24]. Elsaid A et al., compared nebulised dexmedetomidine with nebulised ketamine and topical lidocaine in paediatric flexible bronchoscopy and reported less cough, less bronchospasm and less airway trauma with dexmedetomidine [25].

Evidence from non endoscopic premedication settings also supports its sedative and anxiolytic value. Abdel-Ghaffar HS et al., compared nebulised dexmedetomidine, ketamine and midazolam in preschool children undergoing bone marrow biopsy and found more satisfactory sedation, shorter recovery time and less postoperative agitation with dexmedetomidine [26]. These observations indicate that nebulised dexmedetomidine can suppress reflex responses, reduce anxiety and improve procedural cooperation in settings that involve mucosal or airway manipulation [24-26].

Indirect Evidence from Intravenous Dexmedetomidine in Endoscopy

Direct evidence for nebulised dexmedetomidine in upper gastrointestinal endoscopy remains limited, but studies using intravenous dexmedetomidine support its role in endoscopic sedation [14,27-29]. Available evidence suggests that dexmedetomidine provides effective sedation with preserved respiratory safety and acceptable haemodynamic stability during upper gastrointestinal endoscopy and related procedures [14,28,29].

Wu Y et al., demonstrated that intravenous dexmedetomidine was a feasible option for conscious sedation during elective upper gastrointestinal endoscopy, while Ghomeishi A et al., reported reduced additional sedative requirement and improved proceduralist satisfaction compared with midazolam [14,28]. In paediatric upper gastrointestinal endoscopy, Mogahed MM and Salama ER found favourable respiratory safety and higher satisfaction scores with dexmedetomidine-based sedation [29]. These findings support further evaluation of nebulised dexmedetomidine as a non invasive alternative for improving procedural tolerance during endoscopy [14,28,29].

Indirect Evidence from Airway Instrumentation Procedures

The rationale for nebulised dexmedetomidine in diagnostic upper gastrointestinal endoscopy is further supported by evidence from airway instrumentation procedures, including awake fibreoptic intubation, flexible bronchoscopy and paediatric dental sedation, where suppression of gagging, coughing and patient movement is essential [18,24,25]. These related procedural settings demonstrate the potential of nebulised dexmedetomidine to improve airway reflex control, procedural tolerance and patient cooperation during mucosal instrumentation.

Additional evidence comes from paediatric dental sedation. Zanaty OM and El Metainy SA found that nebulised dexmedetomidine, particularly when combined with ketamine, produced smoother induction, improved sedation quality and faster recovery in

Author and year	Context	Groups and dose	Parameters assessed	Key data	Conclusion
Wu Y et al., 2015 [14]	Adult diagnostic EGD	Dexmedetomidine group: 1 µg/kg I.v over 10 min, then 0.5 µg/kg/h infusion, plus fentanyl 1 µg/kg. Propofol group: 0.6 mg/kg I.v, then 10 to 20 mg boluses to OAA/S 2 to 4, plus fentanyl 1 µg/kg	MAP, HR, SpO2, RR, OAA/S, recovery, patient and endoscopist satisfaction, adverse events	Patient satisfaction: 8.9±1.4 vs 9.6±0.8. Endoscopist satisfaction: 8.2±1.1 vs 8.2±0.9. Gagging: 60.6% vs 20.6%. Respiratory depression: 0% vs 5.9%. Bradycardia: 18.2% vs 2.9%	Both regimens provided satisfactory sedation. Propofol produced higher patient satisfaction and deeper early sedation, whereas dexmedetomidine showed better respiratory safety and more stable blood pressure
Ghomeishi A et al., 2023 [28]	Gastrointestinal endosonography outside the operating room	Dexmedetomidine group: dexmedetomidine 1 µg/kg over 20 min plus propofol 0.5 mg/kg and fentanyl 1 µg/kg. Midazolam group: midazolam 0.03 mg/kg plus propofol 0.5 mg/kg and fentanyl 1 µg/kg	MAP, HR, SpO2, RSS, rescue propofol, pain, nausea and vomiting, satisfaction, recovery	Rescue propofol: 8/63 vs 34/63. SpO2 was significantly higher with dexmedetomidine during sedation. RSS was also significantly higher. No clinically significant difference in pain score or nausea and vomiting frequencies. Specialist satisfaction was higher with dexmedetomidine	Dexmedetomidine was more effective than midazolam for sedation during gastrointestinal endosonography and reduced the need for additional propofol
Mogahed MM and Salama ER 2017 [29]	Paediatric upper GI endoscopy	KD group: ketamine 1 mg/kg i.v. plus dexmedetomidine 1 µg/kg i.v. bolus over 10 min. KP group: ketamine 1 mg/kg i.v. plus propofol 1 mg/kg i.v. Top up doses were given to target RSS ≥5	HR, MAP, RR, SpO2, total ketamine dose, time to RSS ≥5, time to PADSS ≥9, apnea, desaturation, nausea and vomiting, parent and endoscopist satisfaction	Total ketamine dose: 34.6±2.9 vs 29.2±1.9 mg. Time to PADSS ≥9: 17.2±4.8 vs 15.5±3.9 min. Apnea: 0% vs 10%. Desaturation: 0% vs 6.7%. Endoscopist satisfaction: 96.7% vs 80.0%. Parent satisfaction: 93.3% vs 73.3%	Ketamine dexmedetomidine was an effective and safe alternative to ketamine propofol, with higher satisfaction and no respiratory drawback, although ketamine requirement was greater

[Table/Fig-3]: Indirect evidence supporting dexmedetomidine use in upper GI endoscopy.
Indirect evidence from intravenous dexmedetomidine studies and related endoscopic settings indicates favourable sedation quality and respiratory safety, although patient satisfaction was not consistently superior to comparator regimens [14,28,29]; OAA: Observer's assessment of alertness; RSS: Ramsay sedation scale; MAP: Mean arterial pressure; HR: Heart rate, SpO_2: Peripheral oxygen saturation; RR: Respiratory rate; PADSS: Post-anesthetic discharge scoring system

outpatient dental procedures [18]. Although these procedures differ from gastrointestinal endoscopy, they similarly require suppression of protective airway and oral reflexes together with adequate patient cooperation. Collectively, these findings support the potential utility of nebulised dexmedetomidine for improving procedural tolerance during upper gastrointestinal endoscopy [18,24,25].

The indirect evidence from intravenous dexmedetomidine endoscopy trials and nebulised dexmedetomidine airway instrumentation studies is summarised in [Table/Fig-3] [14,28,29].

Future Research Directions

Large multicentre trials are needed, especially in adults, where the evidence is sparse and satisfaction findings remain inconsistent. Dose-finding studies should determine whether higher nebulised doses improve efficacy without weakening safety. Comparative trials against standard sedation regimens, and adjunct studies with low dose intravenous sedation, are needed to define clinical use more clearly. Future studies should also use uniform measures of comfort, reflex suppression, recovery and adverse events so results can be compared across studies. High-risk groups such as older adults and patients with respiratory disease should be studied directly rather than inferred from general sedation literature.

CONCLUSION(S)

Nebulised dexmedetomidine demonstrates potential to improve procedural conditions during diagnostic upper gastrointestinal endoscopy, primarily through suppression of gag and cough reflexes, enhanced procedural tolerance, and reduced anaesthetic requirements. The effect appears more pronounced in paediatric populations and with higher doses (2 µg/kg). While patient-reported satisfaction improvements remain inconclusive in adults at 1 µg/kg, the consistently favourable safety profile, haemodynamic stability, and absence of respiratory depression make nebulised dexmedetomidine an attractive option for further investigation. Current evidence supports consideration of nebulised dexmedetomidine as an adjunct premedication in paediatric endoscopy, where it significantly reduces reflex responses and separation anxiety while decreasing sedative requirements. Larger multicentre trials with standardised outcomes and dose-ranging designs are needed to establish optimal protocols and define the role of nebulised dexmedetomidine in routine endoscopy practice.

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PARTICULARS OF CONTRIBUTORS:
1. Junior Resident, Department of Anaesthesia, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.
2. Professor, Department of Anaesthesia, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Ajinkya Akulwar,
Junior Resident, Department of Anaesthesiology, Jawaharlal Nehru Medical College, Datta Meghe Institute of Higher Education and Research, Wardha-442107, Maharashtra, India.
E-mail: ajinkya.akulwar@gmail.com

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