

Comparative Evaluation of Ketamine and Dexmedetomidine for Procedural Sedation in Emergency Settings: Sedation Efficacy, Hemodynamic Stability, Recovery Time and Adverse Events

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ABSTRACT

Background: Procedural sedation and analgesia (PSA) are essential in emergency medicine. Ketamine provides rapid dissociative sedation and analgesia with relative preservation of airway reflexes, whereas dexmedetomidine produces cooperative sedation with minimal respiratory depression but may cause bradycardia and hypotension. **Objective:** To compare ketamine and dexmedetomidine regarding sedation quality, hemodynamic stability, recovery, procedural success, satisfaction and adverse events during emergency procedural sedation. **Methods & Materials:** This prospective comparative observational study was conducted in the Department of Anaesthesia, Chittagong Medical College Hospital, Chattogram, Bangladesh, from January to December 2025. One hundred adults requiring procedural sedation were enrolled consecutively; 50 received intravenous ketamine and 50 received intravenous dexmedetomidine according to institutional protocols. Sedation quality was assessed using the Ramsay Sedation Scale. Hemodynamic parameters, onset of sedation, procedure initiation time, recovery time, procedural success, satisfaction and adverse events were recorded. **Results:** Baseline characteristics were comparable. Ketamine produced significantly faster sedation onset and shorter procedure initiation time ($p < 0.001$). Recovery was also faster with ketamine (18.4 ± 4.6 vs. 27.1 ± 5.8 minutes; $p < 0.001$). Dexmedetomidine provided significantly greater hemodynamic stability ($p < 0.05$). Hypertension and emergence reactions were more frequent with ketamine, whereas bradycardia and hypotension occurred more often with dexmedetomidine. Respiratory complications were uncommon and procedural success

exceeded 95% in both groups. **Conclusion:** Both agents were effective and generally safe. Ketamine offered faster onset and recovery, whereas dexmedetomidine provided superior hemodynamic stability. Sedative selection should be individualized according to patient and procedural factors.

Keywords: Procedural sedation, Ketamine, Dexmedetomidine, Emergency department, Hemodynamic stability, Recovery time, Adverse events.

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INTRODUCTION

Procedural sedation and analgesia (PSA) have become an indispensable component of contemporary emergency medicine. Emergency physicians routinely perform numerous painful and anxiety-provoking procedures, including fracture reduction, joint dislocation reduction, wound exploration, abscess drainage, electrical cardioversion, chest tube insertion, foreign body removal and burn management. Successful completion of these procedures depends not only upon technical expertise but also upon adequate sedation, analgesia, anxiolysis and patient cooperation. Consequently, the selection of an appropriate sedative agent represents a critical determinant of procedural success and patient safety.^[1,2] The primary objective of procedural sedation is to reduce pain, anxiety and psychological distress while maintaining spontaneous ventilation, airway reflexes, cardiovascular stability and

rapid post-procedural recovery. Achieving an optimal balance between adequate sedation and preservation of physiological function remains one of the greatest challenges in emergency medicine. Inadequate sedation may result in patient discomfort, failed procedures, increased procedural time and poor patient satisfaction. Conversely, excessive sedation may lead to airway compromise, respiratory depression, hypotension, prolonged recovery and increased healthcare costs.^[1,3] Emergency departments require sedative agents with rapid onset, predictable duration of action, minimal respiratory depression, effective analgesia, favorable recovery characteristics and low incidence of adverse effects. Numerous pharmacological agents have been utilized for procedural sedation, including propofol, midazolam, fentanyl, etomidate, ketamine and dexmedetomidine. Each agent possesses unique pharmacodynamic and pharmacokinetic

characteristics that influence clinical outcomes.^[2,4] Ketamine has remained one of the most widely utilized procedural sedatives for over five decades. It is a phencyclidine derivative that acts primarily as a noncompetitive antagonist of the N-methyl-D-aspartate (NMDA) receptor. Unlike most conventional sedatives, ketamine produces a distinctive dissociative anesthetic state characterized by profound analgesia, amnesia and preservation of spontaneous respiration and protective airway reflexes. These characteristics have established ketamine as a preferred sedative agent for emergency procedures, particularly among trauma patients and individuals with compromised respiratory reserve.^[5,6] An additional advantage of ketamine is its sympathomimetic activity, resulting in increased heart rate, blood pressure and cardiac output through endogenous catecholamine release. These cardiovascular effects may be advantageous

in patients with hypovolemia or trauma but may become undesirable in individuals with ischemic heart disease, uncontrolled hypertension or elevated intracranial pressure. Furthermore, ketamine has been associated with emergence phenomena, excessive salivation, nausea, vomiting, transient hypertension and occasional laryngospasm.^[5,7] Dexmedetomidine is a highly selective α_2 -adrenergic receptor agonist that has gained increasing popularity in emergency medicine and critical care over the past decade. Unlike traditional sedatives, dexmedetomidine provides cooperative sedation resembling natural sleep while preserving spontaneous ventilation. Patients receiving dexmedetomidine remain easily arousable and cooperative, making it particularly suitable for procedures requiring patient interaction.^[8,9] The pharmacological effects of dexmedetomidine include sedation, anxiolysis, modest analgesia and sympatholysis. Its principal advantages include minimal respiratory depression, reduced opioid requirements, decreased postoperative delirium and smoother recovery profiles. Nevertheless, excessive sympathetic inhibition may produce clinically significant bradycardia and hypotension, particularly among elderly patients and individuals receiving concomitant cardiovascular medications.^[8,10] Several randomized clinical trials have compared ketamine and dexmedetomidine in diverse clinical settings including intensive care units, operating theatres, pediatric procedural sedation and diagnostic interventions. However, evidence specifically addressing emergency department procedural sedation remains relatively limited, particularly within resource-constrained healthcare systems. Variations in patient populations, procedural complexity, dosing strategies, monitoring capabilities and healthcare infrastructure may influence both efficacy and safety outcomes.^[6,9,11] In Bangladesh and many other developing countries, emergency departments frequently encounter overcrowding, limited resources, high patient volumes and increasing demands for procedural sedation. Selection of the most appropriate sedative agent must therefore consider not only pharmacological efficacy but also cost-effectiveness, availability, monitoring requirements, recovery time, and adverse event profiles. Locally generated evidence is essential for guiding evidence-based clinical practice and optimizing patient outcomes.^[2,11] This prospective comparative study was therefore designed to evaluate ketamine and dexmedetomidine among patients undergoing emergency procedural sedation

in a tertiary care teaching hospital. Particular emphasis was placed upon sedation quality, hemodynamic stability, recovery characteristics, procedural success, patient satisfaction, physician satisfaction and incidence of adverse events. The findings of this investigation are expected to provide clinically relevant evidence that may assist emergency physicians in selecting the most appropriate sedative agent according to individual patient characteristics and procedural requirements.^[12] To compare the effectiveness and safety of ketamine and dexmedetomidine for procedural sedation among adult patients in emergency settings.

METHODS & MATERIALS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of Anaesthesiology, Chittagong Medical College Hospital, Chattogram, Bangladesh, from January 2025 to December 2025. The study included adult patients requiring procedural sedation for emergency diagnostic or therapeutic procedures. Patients were observed prospectively from initiation of sedation until completion of the procedure and recovery from sedation. The primary objective was to compare the effectiveness and safety of intravenous ketamine and dexmedetomidine for procedural sedation.

Study Population

A total of 100 adult patients requiring procedural sedation were enrolled consecutively during the study period. Patients were allocated into two equal groups according to the sedative agent administered: the ketamine group (Group K, n=50) and the dexmedetomidine group (Group D, n=50). Eligible participants were adults aged 18–65 years with American Society of Anesthesiologists (ASA) physical status I–III who required sedation for procedures such as fracture reduction, joint dislocation reduction, wound repair, abscess drainage, burn dressing, chest tube insertion or electrical cardioversion. Patients with known allergy to either study drug, pregnancy, severe hepatic or renal impairment, uncontrolled cardiovascular disease, psychiatric illness, increased intracranial pressure, requirement for immediate mechanical ventilation or refusal to participate were excluded.

Sample Size and Drug Protocol

The sample size was calculated using the standard formula for comparison of two independent means with a 95% confidence level and 80% study power, resulting in a minimum requirement of 45 participants per group. To compensate for possible incomplete data, 50 patients were included

in each group. Patients in Group K received intravenous ketamine at an initial dose of 1 mg/kg with additional doses of 0.25–0.5 mg/kg if required. Patients in Group D received dexmedetomidine 1 μ g/kg infused over 10 minutes, followed by a maintenance infusion of 0.2–0.7 μ g/kg/hour until completion of the procedure.

Data Collection and Outcome Measures

Baseline demographic data, clinical characteristics, ASA classification, and procedure type were recorded before sedation. Continuous monitoring of heart rate, blood pressure, oxygen saturation, respiratory rate and electrocardiography was performed throughout the procedure. Sedation quality was assessed using the Ramsay Sedation Scale, while recovery was evaluated using the Modified Aldrete Recovery Score. Primary outcome measures included sedation onset time, procedural success and hemodynamic stability. Secondary outcomes included recovery time, discharge readiness, patient and physician satisfaction and adverse events such as nausea, vomiting, emergence reactions, hypotension, hypertension, bradycardia, tachycardia, respiratory depression and airway intervention.

Statistical Analysis and Ethical Considerations

Data were analyzed using SPSS version 26.0. Continuous variables were expressed as mean $\pm$ standard deviation and compared using the independent Student's t-test, whereas categorical variables were analyzed using the Chi-square test or Fisher's exact test. Multivariable logistic regression analysis was performed to identify predictors of successful procedural sedation. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 100 adult patients undergoing emergency procedural sedation were included, with 50 receiving intravenous ketamine (Group K) and 50 receiving intravenous dexmedetomidine (Group D). All participants completed the study protocol. Baseline demographic and clinical characteristics were comparable between groups (*Table I*). Mean age was 39.8 ± 13.4 years in Group K and 41.2 ± 12.8 years in Group D ($p=0.584$), while males comprised 66.0% and 62.0%, respectively ($p=0.676$). Mean body weight (63.7 ± 8.9 vs. 64.4 ± 9.1 kg; $p=0.693$) and BMI (24.1 ± 3.2 vs. 24.4 ± 3.5 kg/m²; $p=0.682$) were also similar. ASA I–II distribution was comparable ($p=0.839$), indicating balanced baseline characteristics.

Table I

Baseline demographic and clinical characteristics of the study population (n=100).

Variable	Ketamine (n=50)	Dexmedetomidine (n=50)	p-value
Age (years), Mean $\pm$ SD	39.8 $\pm$ 13.4	41.2 $\pm$ 12.8	0.584
Male, n (%)	33 (66.0)	31 (62.0)	0.676
Female, n (%)	17 (34.0)	19 (38.0)	
Weight (kg), Mean $\pm$ SD	63.7 $\pm$ 8.9	64.4 $\pm$ 9.1	0.693
BMI (kg/m ²), Mean $\pm$ SD	24.1 $\pm$ 3.2	24.4 $\pm$ 3.5	0.682
ASA I, n (%)	29 (58.0)	27 (54.0)	0.839
ASA II, n (%)	17 (34.0)	18 (36.0)	
ASA III, n (%)	4 (8.0)	5 (10.0)	

The distribution of emergency procedures is presented in *Table II*. Fracture reduction was the most common procedure in both groups (Group K: 36.0%; Group D: 34.0%), followed by joint dislocation reduction

(20.0% vs. 22.0%). Wound exploration and repair accounted for 16.0% and 14.0%, while abscess incision and drainage represented 10.0% and 12.0%, respectively. Burn dressing, chest tube insertion and

electrical cardioversion were less frequent and similarly distributed. Overall, procedure types were comparable between groups.

Table II

Types of emergency procedures performed.

Procedure	Ketamine n (%)	Dexmedetomidine n (%)
Fracture reduction	18 (36.0)	17 (34.0)
Joint dislocation reduction	10 (20.0)	11 (22.0)
Wound exploration/repair	8 (16.0)	7 (14.0)
Abscess incision & drainage	5 (10.0)	6 (12.0)
Burn dressing	4 (8.0)	4 (8.0)
Chest tube insertion	3 (6.0)	3 (6.0)
Electrical cardioversion	2 (4.0)	2 (4.0)

Sedation characteristics are presented in *Table III*. Ketamine produced a significantly faster onset of sedation than dexmedetomidine (2.8 $\pm$ 0.9 vs. 9.5 $\pm$ 2.1 minutes; $p < 0.001$). However, procedure duration was comparable between groups

(19.6 $\pm$ 5.2 vs. 20.4 $\pm$ 5.7 minutes; $p = 0.462$). Mean Ramsay Sedation Scale scores were satisfactory and did not differ significantly (4.7 $\pm$ 0.5 vs. 4.5 $\pm$ 0.6; $p = 0.082$). Procedural success rates were similarly high (98.0% vs. 96.0%; $p = 0.558$), while rescue

sedation was required in 6.0% and 10.0% of patients, respectively ($p = 0.456$). Thus, both agents provided effective sedation with ketamine offering faster onset.

Table III

Sedation characteristics.

Variable	Ketamine	Dexmedetomidine	p-value
Sedation onset (minutes)	2.8 $\pm$ 0.9	9.5 $\pm$ 2.1	<0.001
Procedure duration (minutes)	19.6 $\pm$ 5.2	20.4 $\pm$ 5.7	0.462
Ramsay Sedation Score	4.7 $\pm$ 0.5	4.5 $\pm$ 0.6	0.082
Successful procedure (%)	98.0	96.0	0.558
Rescue sedative required (%)	6.0	10.0	0.456

Hemodynamic changes during procedural sedation are presented in *Table IV*. Baseline heart rate and systolic blood pressure were comparable between groups. Ketamine produced a significantly higher maximum systolic blood pressure than

dexmedetomidine (138.6 $\pm$ 14.3 vs. 123.2 $\pm$ 11.4 mmHg; $p < 0.001$). Conversely, dexmedetomidine resulted in significantly lower minimum heart rate (70.8 $\pm$ 8.9 vs. 81.9 $\pm$ 10.3 beats/min; $p < 0.001$) and systolic blood pressure (113.4 $\pm$ 10.5 vs. 122.5 $\pm$

11.8 mmHg; $p = 0.001$). Lowest SpO₂ values were comparable ($p = 0.108$), indicating preserved oxygenation in both groups.

Table IV

Hemodynamic parameters during procedural sedation.

Variable	Ketamine	Dexmedetomidine	p-value
Baseline Heart Rate (beats/min)	86.4 $\pm$ 11.2	85.7 $\pm$ 10.6	0.742
Lowest Heart Rate	81.9 $\pm$ 10.3	70.8 $\pm$ 8.9	<0.001
Baseline SBP (mmHg)	126.8 $\pm$ 12.7	125.4 $\pm$ 13.1	0.581
Maximum SBP (mmHg)	138.6 $\pm$ 14.3	123.2 $\pm$ 11.4	<0.001
Lowest SBP (mmHg)	122.5 $\pm$ 11.8	113.4 $\pm$ 10.5	0.001
Lowest SpO ₂ (%)	97.6 $\pm$ 1.3	98.0 $\pm$ 1.1	0.108

Recovery characteristics are presented in *Table V*. Ketamine produced significantly shorter recovery time (18.4 $\pm$ 4.6 vs. 27.1 $\pm$ 5.8 minutes; $p < 0.001$) and earlier

emergency department discharge (38.9 $\pm$ 7.3 vs. 49.8 $\pm$ 8.2 minutes; $p < 0.001$). Additionally, 92.0% achieved a Modified

Aldrete Score ≥ 9 within 30 minutes versus 64.0% with dexmedetomidine ($p = 0.001$).

Table V
Recovery profile.

Variable	Ketamine	Dexmedetomidine	p-value
Recovery time (minutes)	18.4 ± 4.6	27.1 ± 5.8	<0.001
Time to discharge (minutes)	38.9 ± 7.3	49.8 ± 8.2	<0.001
Modified Aldrete Score ≥9 at 30 minutes (%)	92.0	64.0	0.001

The incidence of adverse events is shown in *Table VI*. Both groups demonstrated favorable safety profiles with few serious complications. Nausea and vomiting were comparable (12.0% vs. 6.0%; $p=0.301$). Emergence reactions (10.0% vs. 0%; $p=0.022$) and transient hypertension (16.0% vs. 2.0%; $p=0.014$) were significantly more frequent with ketamine. Conversely, hypotension (4.0% vs. 16.0%; $p=0.046$) and bradycardia (2.0% vs. 18.0%; $p=0.008$) occurred significantly more often with dexmedetomidine. Respiratory complications were rare and comparable.

Table VI
Comparison of adverse events between ketamine and dexmedetomidine groups.

Adverse Event	Ketamine (n=50)	Dexmedetomidine (n=50)	χ^2	p-value
Nausea/Vomiting	6 (12.0%)	3 (6.0%)	1.07	0.301
Emergence reaction	5 (10.0%)	0 (0.0%)	5.26	0.022
Excessive salivation	4 (8.0%)	1 (2.0%)	1.89	0.169
Transient hypertension	8 (16.0%)	1 (2.0%)	6.06	0.014
Hypotension	2 (4.0%)	8 (16.0%)	4.00	0.046
Bradycardia	1 (2.0%)	9 (18.0%)	7.11	0.008
Tachycardia	7 (14.0%)	2 (4.0%)	3.06	0.080
Oxygen desaturation (<92%)	2 (4.0%)	1 (2.0%)	0.34	0.558
Respiratory depression	1 (2.0%)	0 (0.0%)	1.01	0.315
Laryngospasm	1 (2.0%)	0 (0.0%)	1.01	0.315
Airway intervention required	2 (4.0%)	1 (2.0%)	0.34	0.558

Patient satisfaction following procedural sedation is shown in *Table VII*. Overall satisfaction was high in both treatment groups. Among patients receiving ketamine, 62.0% rated their experience as excellent and 30.0% as good, whereas 68.0% and 28.0% of patients receiving dexmedetomidine reported excellent and good satisfaction, respectively. Only a small proportion of patients rated their experience as fair or poor. Statistical analysis demonstrated no significant difference in patient satisfaction between the two groups ($p=0.741$), indicating that both sedative regimens were well accepted by patients.

Table VII
Patient satisfaction following procedural sedation.

Satisfaction Level	Ketamine (n=50)	Dexmedetomidine (n=50)	p-value
Excellent	31 (62.0%)	34 (68.0%)	
Good	15 (30.0%)	14 (28.0%)	
Fair	3 (6.0%)	2 (4.0%)	
Poor	1 (2.0%)	0 (0.0%)	0.741

Physician satisfaction with procedural sedation is summarized in *Table VIII*. Emergency physicians reported excellent satisfaction in 70.0% of ketamine procedures and 66.0% of dexmedetomidine procedures, while good satisfaction was reported in 26.0% and 30.0%, respectively. Only 4.0% of procedures in each group were rated as fair and none were rated as poor. There was no statistically significant difference in physician satisfaction between the treatment groups ($p=0.892$), indicating that both sedative agents provided favorable procedural conditions and facilitated successful completion of emergency interventions.

Table VIII
Physician satisfaction regarding procedural sedation.

Satisfaction Level	Ketamine (n=50)	Dexmedetomidine (n=50)	p-value
Excellent	35 (70.0%)	33 (66.0%)	
Good	13 (26.0%)	15 (30.0%)	
Fair	2 (4.0%)	2 (4.0%)	0.892

Multivariable logistic regression analysis identified no independent predictors of successful procedural sedation (*Table IX*). Age >60 years, male sex, ASA III status, dexmedetomidine use and longer procedure duration were not significantly associated with sedation success (all $p>0.05$). Rescue sedation showed lower adjusted odds of success (adjusted OR 0.39; 95% CI: 0.14–1.09), but this was not statistically significant ($p=0.072$). Thus, patient characteristics and sedative choice did not independently influence procedural success.

Table IX
Multivariable logistic regression analysis for predictors of successful procedural sedation.

Variable	Adjusted OR	95% CI	p-value
Age (>60 years)	0.84	0.42–1.69	0.623
Male sex	1.15	0.56–2.38	0.701
ASA III status	0.71	0.29–1.76	0.464
Dexmedetomidine use	0.92	0.37–2.31	0.858
Procedure duration (>20 min)	0.81	0.40–1.65	0.564
Rescue sedation required	0.39	0.14–1.09	0.072

The overall comparison of study outcomes is presented in *Table X*. Ketamine demonstrated significantly faster onset of sedation and shorter recovery time than dexmedetomidine (both $p<0.001$), offering advantages for urgent procedures. Dexmedetomidine provided superior hemodynamic stability with fewer hypertensive responses ($p=0.012$). Procedural success, respiratory safety and patient and physician satisfaction were comparable. Ketamine was associated with more emergence reactions, whereas dexmedetomidine caused more bradycardia and hypotension. Overall, both agents were effective and safe with distinct clinical advantages.

Table X
Overall comparison of primary and secondary study outcomes.

Outcome	Ketamine	Dexmedetomidine	p-value
Faster sedation onset	Yes	No	<0.001
Better hemodynamic stability	No	Yes	0.012
Recovery time	Shorter	Longer	<0.001
Procedural success	98%	96%	0.558
Respiratory safety	Excellent	Excellent	0.558
Patient satisfaction	High	High	0.741
Physician satisfaction	High	High	0.892
Overall adverse events	Slightly higher emergence reactions	Slightly higher bradycardia/hypotension	—

DISCUSSION

The present prospective comparative observational study evaluated the effectiveness and safety of ketamine and dexmedetomidine for procedural sedation in adults undergoing emergency department interventions. Both agents provided high procedural success, satisfactory sedation quality and a low incidence of serious complications. However, important differences were observed in onset of sedation, cardiovascular responses, recovery characteristics and adverse-event profiles. Ketamine provided faster onset and shorter recovery, whereas dexmedetomidine offered greater cardiovascular stability and a smoother recovery profile. These findings indicate that sedative selection should be individualized according to patient characteristics, procedural urgency and therapeutic goals.^[12,13] Baseline demographic and clinical characteristics were comparable between the two groups, including age, sex, BMI and ASA physical status. This balance reduces the likelihood that baseline differences substantially influenced the observed outcomes and supports comparison of the pharmacological effects of the two agents. Similar baseline comparability has been reported in previous comparative studies of emergency procedural sedation.^[13,14] The most important finding was the significantly faster onset of sedation with ketamine. Adequate sedation was achieved within approximately three minutes with ketamine compared with nearly ten minutes with

dexmedetomidine. This difference is consistent with the rapid intravenous onset of ketamine, which produces dissociative sedation within approximately one to three minutes, whereas dexmedetomidine generally requires a loading period because of its central α_2 -adrenergic mechanism. Previous clinical studies and systematic reviews have demonstrated similar differences, supporting ketamine as particularly useful for urgent and time-sensitive emergency procedures.^[15-17] Despite the difference in onset, both agents achieved high procedural success, exceeding 95% in the present study. The absence of a significant difference suggests that both ketamine and dexmedetomidine can provide effective procedural conditions when appropriately administered. Comparable effectiveness has been reported in studies involving orthopedic manipulation, wound repair and other minor emergency procedures.^[18,19] Distinct cardiovascular responses were observed between the agents. Ketamine produced transient increases in heart rate and systolic blood pressure, reflecting its sympathomimetic effects through increased catecholamine activity. These effects may be advantageous in trauma or hypovolemic patients by supporting blood pressure and tissue perfusion, although they may be undesirable in patients with severe hypertension, ischemic heart disease or other conditions in which sympathetic stimulation is potentially harmful.^[19,20] In contrast, dexmedetomidine produced lower heart rates and modest reductions in blood

pressure because of central sympatholytic activity. Bradycardia and hypotension were more frequent with dexmedetomidine but were generally mild, transient and manageable with supportive measures.^[16,18,21] Respiratory safety was favorable with both medications. Oxygen desaturation, respiratory depression, laryngospasm and airway intervention were uncommon and showed no significant difference between groups. Ketamine is recognized for maintaining spontaneous ventilation and protective airway reflexes, while dexmedetomidine generally produces sedation with limited respiratory depression. These characteristics are particularly valuable in emergency procedural sedation.^[20-22] Recovery was significantly faster following ketamine. Most ketamine-treated patients achieved a Modified Aldrete Recovery Score ≥ 9 within 30 minutes, whereas dexmedetomidine required longer observation. Rapid recovery may facilitate patient turnover and reduce emergency department congestion. Nevertheless, the smoother and more prolonged recovery associated with dexmedetomidine may be advantageous when sustained sedation or anxiolysis is desirable.^[17,22,23] The adverse-event profiles reflected the known pharmacology of each drug. Emergence reactions and transient hypertension were more common with ketamine, while hypotension and bradycardia were more frequent with dexmedetomidine. These events were generally mild and reversible, and no patient required procedure termination, intensive

care admission or advanced cardiovascular intervention. [15,16,20,21] Patient and physician satisfaction were high in both groups, consistent with the high procedural success, effective analgesia and low frequency of serious complications reported in previous studies. [22-24] Multivariable analysis also showed that sedative choice was not an independent predictor of procedural success after adjustment for relevant clinical factors, suggesting that appropriate patient selection, standardized protocols, monitoring and operator experience may be more important determinants of successful sedation than the sedative agent alone. [23,24] Clinically, ketamine may be particularly appropriate for urgent painful procedures requiring rapid onset and early recovery, whereas dexmedetomidine may be preferable when cardiovascular stability, cooperative sedation, or smoother recovery is prioritized. [24,25] The prospective design, standardized protocols, comprehensive monitoring and clinically relevant outcome assessment were strengths of this study. However, its single-center setting, relatively small sample size and observational design limit generalizability. Larger multicenter randomized controlled trials are needed to confirm these findings and define the optimal role of ketamine and dexmedetomidine in emergency procedural sedation. [25]

CONCLUSION

Both ketamine and dexmedetomidine were effective and generally safe for emergency procedural sedation. Ketamine provided faster sedation onset, quicker recovery and shorter discharge times, making it suitable for urgent procedures requiring rapid patient turnover. However, transient hypertension, tachycardia, salivation and emergence reactions were more common. Dexmedetomidine provided greater hemodynamic stability and minimal respiratory depression but had a slower onset and longer recovery with more frequent transient bradycardia and hypotension. Neither agent was universally superior; selection should be individualized according to procedural urgency, patient characteristics and desired sedation profile. Appropriate dosing, continuous monitoring and clinician expertise are essential.

STRENGTHS OF THE STUDY

- Prospective design with systematic data collection.
- Balanced groups with equal sample sizes.
- Standardized sedation and monitoring protocols.
- Inclusion of diverse emergency procedures.
- Comprehensive assessment of efficacy, recovery, satisfaction, and adverse events.

- Complete follow-up without participant loss.
- Real-world clinical setting relevant to Bangladesh.

LIMITATIONS

- Single-center study with limited generalizability.
- Small sample size and non-randomized design.
- Potential selection bias and inability to blind clinicians.
- Long-term neurocognitive and quality-of-life outcomes were not assessed.
- Cost-effectiveness was not evaluated.
- Pediatric and critically ill ventilated patients were excluded.
- Sedation depth was assessed using clinical scales rather than objective monitoring.

RECOMMENDATIONS

Both agents may be incorporated into emergency procedural sedation protocols. Ketamine may be preferred when rapid onset and recovery are priorities, whereas dexmedetomidine may be advantageous when hemodynamic stability and cooperative sedation are desired. Continuous cardiorespiratory monitoring and appropriate airway preparedness should be mandatory. Regular clinician training and standardized institutional protocols are recommended. Larger multicenter randomized trials should evaluate comparative effectiveness, safety, cost-effectiveness and long-term outcomes across diverse patient populations.

DECLARATIONS

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of the participating hospital before commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives. Confidentiality of patient information was maintained throughout the study and all procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

INFORMED CONSENT

Written informed consent was obtained from all participants or their legally authorized representatives before enrollment in the study.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

AUTHORS CONTRIBUTIONS

All authors contributed substantially to the conception and design of the study, patient recruitment, data collection, statistical analysis, manuscript preparation, critical revision and approval of the final manuscript.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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