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Peri-Procedural Adverse Events in Non-Operating Room Anaesthesia: A Retrospective Case Series from a Tertiary Centre in Eastern India

Running Title: *Adverse Events in NORA*

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Abstract: ***Background**: Non-operating room anaesthesia (NORA) is increasingly used for endoscopic, bronchoscopic, interventional radiology and imaging procedures, where remote locations and limited airway access may increase peri-procedural risk. This study describes the pattern, management and immediate outcomes of clinically significant adverse events during NORA at a tertiary centre in Eastern India. **Methods**: This retrospective review screened all NORA procedures from June to October 2025. Anaesthesia, procedure and recovery records were assessed to identify cases with predefined respiratory, haemodynamic or sedation-related adverse events. Procedures without events and those conducted under general anaesthesia in operating theatres were excluded. Data on demographics, comorbidities, procedure type, anaesthetic technique, adverse events, interventions and outcomes were collected and summarised descriptively. **Results**: Nine patients met inclusion criteria (mean age 49.7 years; five males, four females; ASA II = 5, ASA III = 4). Procedures included ERCP (n = 4), bronchoscopy (n = 2), interventional radiology (n = 2) and paediatric MRI sedation (n = 1). Eleven adverse events were documented. Respiratory events occurred in six patients (hypoxaemia, bronchospasm, difficult mask ventilation). Haemodynamic events occurred in three (propofol-related hypotension, transient ventricular bigeminy), and sedation-related events in two (paradoxical agitation, delayed recovery). All events were promptly recognised and managed without unplanned intubation, conversion to general anaesthesia, intensive care transfer or mortality. **Conclusion**: Respiratory and haemodynamic instability were the predominant complications during NORA, but all were reversible with timely intervention. Vigilant monitoring, cautious sedation titration and immediate access to airway and cardiovascular rescue measures are essential for safe NORA practice.*

Keywords: Non-Operating Room Anaesthesia; Conscious Sedation; Remote Anaesthesia; Adverse Events; Airway Management

1. Introduction

Non-operating room anaesthesia (NORA) accounts for an increasing proportion of anaesthetic workload as complex procedures expand beyond operating theatres.[1,2] These remote environments may involve constraints such as restricted space, limited airway access, safety hazards and variable equipment availability. Previous analyses suggest a disproportionate burden of respiratory and cardiovascular complications in NORA compared with traditional operating room settings.[1,3]

Procedures such as endoscopic retrograde cholangiopancreatography (ERCP), flexible bronchoscopy and paediatric MRI sedation represent particular anaesthetic challenges due to shared airways, non-supine positioning and the need for deep and immobile sedation.[2,4] Despite the increasing utilisation of NORA in India, reports describing real-world complications and their bedside management remain limited. Small retrospective analyses can provide useful insights into local patterns of adverse events and inform quality improvement.

This study describes clinically significant peri-procedural adverse events encountered during NORA at a tertiary centre in Eastern India and outlines immediate management strategies and outcomes.

2. Methods

This retrospective descriptive case series was conducted at a tertiary care teaching hospital performing NORA for endoscopic, bronchoscopic, interventional radiology and MRI procedures. All NORA lists were supervised by consultant anaesthesiologists, and standard ASA monitoring was used in remote areas.

All NORA procedures performed between June and October 2025 were reviewed. Anaesthesia charts, procedure records and recovery documentation were screened to identify cases with predefined clinically significant adverse events. Procedures without adverse events, incomplete records and cases conducted under general anaesthesia in the main operating theatre were excluded.

Data collected included demographics, ASA physical status, comorbidities, procedure type and position, anaesthetic technique, oxygen delivery method, airway adjunct use, type and timing of adverse events, interventions administered and immediate outcomes.

Adverse events were defined a priori. Hypoxaemia was SpO_2 < 90% for ≥30 s despite supplemental oxygen; bronchospasm referred to new-onset wheeze or increased airway resistance requiring bronchodilators; difficult mask ventilation was defined as the need for two-handed technique, airway adjuncts or rescue supraglottic airway; hypotension as systolic blood pressure < 90 mmHg or >20% fall from baseline requiring fluid or vasoactive support; arrhythmia as a new clinically significant ECG abnormality; paradoxical agitation as agitation requiring a change in sedation strategy; delayed recovery as failure to achieve a Modified Aldrete score ≥9 within 60 min requiring reversal or extended monitoring.

The study adhered to the Declaration of Helsinki (2013). As a retrospective descriptive series including all eligible cases, no sample size calculation was required. Continuous variables are summarised as mean (SD) or median (IQR) and categorical variables as counts and percentages.

3. Results

Nine patients met the inclusion criteria. The mean age was 49.7 years (range 6–72 years), and there were five males and four females. Five patients were ASA II and four were ASA III. Comorbidities included hypertension (n = 3), chronic airway disease (n = 3), diabetes mellitus (n = 2) and obesity (n = 2). Two patients had no significant comorbidity. Summary characteristics and adverse event distribution are shown in Table 1.

Procedures comprised ERCP (n = 4), flexible bronchoscopy (n = 2), interventional radiology procedures (n = 2) and paediatric MRI sedation (n = 1). Propofol-based sedation was used in five patients, midazolam–fentanyl in two and dexmedetomidine in one paediatric case; one patient received a mixed dexmedetomidine–ketamine technique. Oxygen was administered via nasal cannula in seven patients and via face mask in two. Rescue supraglottic airway insertion was required in one patient with difficult mask ventilation.

Across nine patients, eleven clinically significant adverse events were recorded, with three patients experiencing more than one event category. Respiratory events occurred in six patients (66.7%). Hypoxaemia occurred in three patients, mainly during ERCP, and responded to airway manoeuvres and optimisation of oxygen delivery. Bronchospasm occurred in two patients with reactive airway disease undergoing bronchoscopy. Difficult mask ventilation developed in one patient and required supraglottic airway rescue.

Haemodynamic events occurred in three patients (33.3%), including two cases of propofol-induced hypotension requiring fluid boluses and intermittent vasoactive support. One patient undergoing an interventional radiology procedure developed transient ventricular bigeminy that resolved spontaneously with brief procedural pause and haemodynamic optimisation.

Sedation-related complications occurred in two patients (22.2%). One paediatric patient sedated with dexmedetomidine developed paradoxical agitation requiring conversion to ketamine. One elderly obese patient receiving midazolam–fentanyl experienced delayed recovery requiring flumazenil.

All procedures were completed successfully. No patient required unplanned intubation, conversion to general anaesthesia, intensive care transfer or experienced peri-procedural mortality. All met recovery room discharge criteria without further immediate complications.

4. Discussion

This retrospective case series describes the nature and management of clinically significant peri-procedural adverse events in patients undergoing NORA at a tertiary centre. Respiratory complications were the most frequent, consistent with previous closed-claims analyses highlighting the predominance of respiratory events in NORA.[1-3]Hypoxaemia during ERCP and bronchoscopy reflects the challenges of airway access, positional constraints and the need for deep sedation.[1,3,4] In all cases, airway manoeuvres and increased oxygen supplementation restored oxygenation.

Bronchospasm occurred exclusively in patients with underlying airway hyperreactivity undergoing bronchoscopy, supporting existing guidance regarding pre-procedural optimisation and availability of bronchodilators.[4] Supraglottic airway rescue was required in one case, underscoring the importance of immediate access to advanced airway devices in remote locations.

Haemodynamic instability, mainly due to propofol, was self-limiting and manageable with fluids and intermittent vasoactive boluses. These findings align with literature emphasising the need for cautious titration and haemodynamic vigilance during propofol sedation.[3,5] The transient arrhythmia encountered during interventional radiology reinforces the importance of continuous ECG monitoring in remote sites.

Sedation-related events included paradoxical agitation and delayed recovery—both recognised complications of dexmedetomidine and benzodiazepine–opioid sedation.[4,6] Flexibility in modifying sedation plans facilitated procedural completion without escalation.

The absence of major morbidity or mortality likely reflects consultant-led NORA lists, adherence to monitoring standards and readiness with airway and cardiovascular rescue equipment. These systems-level factors are central to NORA safety frameworks.[1-3]

Limitations include small sample size, retrospective design and the inclusion of only patients with adverse events, precluding incidence estimation. Documentation variability may have led to under-reporting of minor events. Nevertheless, the findings offer practical insights relevant to NORA practice in Indian tertiary settings and highlight opportunities for future multicentre NORA registries and structured NORA safety interventions.

5. Conclusion

Respiratory compromise, haemodynamic instability and sedation-related variability were the predominant adverse events observed during NORA. All events were reversible with timely management, and no patient required invasive ventilation, conversion to general anaesthesia or intensive care transfer. These findings underscore the importance of vigilant monitoring, incremental sedation techniques, anticipation of airway difficulties and immediate availability of rescue devices and vasoactive drugs in remote anaesthetising environments.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Table 1: Baseline characteristics and adverse events in nine NORA cases

Parameter	Value
Mean age	49.7 years
Male : Female	5: 4
ASA II / III	5/ 4
Procedures performed	ERCP (4), Bronchoscopy (2), Interventional radiology (2), MRI (1)
Sedation techniques	Propofol (5), Midazolam–Fentanyl (2), Dexmedetomidine (1), Mixed (1)
Respiratory events	6
Haemodynamic events	3
Sedation-related events	2
Rescue LMA used	1
Unplanned intubation	0
ICU transfer	0
Mortality	0