



Evaluating the Role of Total Intravenous Anesthesia (TIVA) in Different Gastrointestinal Procedures

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Abstract

Background: Total Intravenous Anesthesia (TIVA) is increasingly used for gastrointestinal (GI) procedures due to its favorable pharmacokinetic profile, reduced postoperative complications, and improved patient satisfaction. However, data on its role across diverse GI interventions remain limited in developing countries.

Methods: This prospective observational study was conducted from January to December 2024 at Popular Diagnostic Centre LTD, Dhaka, Bangladesh. A total of 506 adult patients (ASA I–II) undergoing elective diagnostic or therapeutic GI procedures under TIVA were enrolled. Exclusion criteria included ASA III or above, known allergies to anesthetic agents, or need for advanced airway management. Demographic data, anesthetic practices, intraoperative observations, and post-procedural outcomes were analyzed using SPSS.

Results: Among 506 patients undergoing GI procedures under TIVA, upper GI endoscopy was the most common (60.9%), followed by colonoscopy (15.6%) and combined procedures (7.9%). Propofol was used for induction in all cases, with fentanyl (63.6%) and remifentanyl (36.4%) as opioids. Hemodynamic stability was maintained in 90.5% of patients, and desaturation occurred in 7.5%. Postoperative nausea/vomiting occurred in 8.1%, hypotension in 3.8%, and delayed recovery in 4.9%. Most patients (80.4%) had no complications. Unplanned hospital admission was needed in 3.0%, and high patient satisfaction was recorded in 92.5% of cases.

Conclusion: TIVA proved to be a safe, effective, and well-tolerated anesthetic technique for a variety of GI procedures, demonstrating high patient satisfaction and a low incidence of complications. Broader application and further comparative studies are warranted.

Keywords: TIVA, gastrointestinal procedures, propofol, patient satisfaction, anesthesia outcomes

Introduction

Total Intravenous Anesthesia (TIVA) is a widely used anesthetic technique that involves the administration of intravenous agents to achieve and maintain anesthesia without the use of inhalational gases [1]. With advances in pharmacology and infusion technology, TIVA has gained popularity due to its benefits such as reduced postoperative nausea and vomiting (PONV), smoother emergence from anesthesia, and better control over hemodynamic responses [2]. These advantages make TIVA especially suitable for short, outpatient, or minimally invasive procedures, including gastrointestinal (GI)

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endoscopic interventions [3]. Gastrointestinal procedures like upper GI endoscopy, colonoscopy, endoscopic retrograde cholangiopancreatography (ERCP), and polypectomy are commonly performed for both diagnostic and therapeutic purposes [4]. These procedures, although minimally invasive, often require patient cooperation, optimal relaxation, and hemodynamic stability for successful outcomes. In this context, the choice of anesthesia plays a crucial role in ensuring patient comfort, procedural efficacy, and safety [5]. Traditionally, moderate sedation or general anesthesia with inhalational agents has been used, but these may be associated with delayed recovery, respiratory complications, and higher incidence of PONV, particularly in ambulatory settings [6].

TIVA, particularly when based on agents like propofol and short-acting opioids such as fentanyl or remifentanyl, offers rapid onset, short duration, and favorable recovery profiles [7]. Its use in GI endoscopy is associated with reduced airway irritation, more predictable pharmacokinetics, and quicker recovery times, making it highly beneficial in busy day-care or outpatient centers [8]. Moreover, the avoidance of inhalational agents and their associated risks, such as environmental pollution and postoperative cognitive dysfunction, further supports the use of TIVA in suitable patients [9]. Despite these benefits, the use of TIVA in GI procedures remains variable across different clinical settings, often due to concerns related to safety, cost, and clinician familiarity [10]. There is limited data from Bangladesh and other low- to middle-income countries assessing the effectiveness, safety, and patient outcomes associated with TIVA in GI procedures [11]. A clearer understanding of its role in various types of GI interventions can help optimize anesthetic practices and patient care, particularly in high-volume centers [12].

Our institute is a tertiary care diagnostic center that handles a large number of diagnostic and therapeutic endoscopic procedures. Therefore, this study was undertaken to evaluate the use of Total Intravenous Anesthesia in different gastrointestinal procedures conducted at a tertiary diagnostic center in Dhaka, Bangladesh. The primary objectives were to assess the distribution of GI procedures under TIVA, describe patient characteristics, document anesthetic agents and intraoperative parameters, and evaluate post-procedure outcomes such as complications, recovery time, and patient satisfaction. By systematically analyzing 506 cases over a one year period, this study aims to provide practical insights into the feasibility, safety, and effectiveness of TIVA in routine GI anesthesia practice.

Methodology & Materials

This prospective observational study was conducted at the Popular Diagnostic Centre LTD, Dhaka, Bangladesh, from January 2024 to December 2024. The aim was to

evaluate the clinical role of Total Intravenous Anesthesia (TIVA) in patients undergoing various gastrointestinal (GI) procedures. During the designated study period, a total of 5,196 endoscopic procedures were performed. Based on our selection criteria, 506 cases were included in the study. A total of 506 patients who underwent elective diagnostic or therapeutic GI procedures under TIVA were included. Eligible patients were adults (≥ 18 years), categorized as ASA physical status I to II, and scheduled for procedures such as upper GI endoscopy, colonoscopy, combined endoscopy-colonoscopy, endoscopic or colonoscopic polypectomy, and EVL. Patients with ASA class III or higher, known hypersensitivity to anesthetic agents, or those requiring airway instrumentation were excluded.

After obtaining informed written consent, standard monitoring was applied, including ECG, non-invasive blood pressure, and pulse oximetry. TIVA was induced in all patients using intravenous propofol. Short-acting opioids, such as fentanyl or remifentanyl, were administered as needed. Supplemental oxygen was provided via nasal cannula or face mask. Intraoperative parameters such as hemodynamic stability, oxygen saturation, desaturation episodes, and procedure duration were recorded. Postoperative variables included recovery time, incidence of nausea or vomiting, hypotension, delayed recovery, and patient satisfaction. Data were documented on a structured case record form. All data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics including frequencies and percentages were calculated for categorical variables. The outcomes were analyzed to assess the safety, effectiveness, and recovery profile of TIVA across different GI procedures.

Results

Table 1: Distribution of GI Procedures Performed Under TIVA (n = 506)

Procedure Type	Frequency (n)	Percentage (%)
Endoscopy	308	60.9
Colonoscopy	79	15.6
Combined Endoscopy + Colonoscopy	40	7.9
Endoscopic Polypectomy	23	4.5
Colonoscopic Polypectomy	22	4.3
EVL (Endoscopic Variceal Ligation)	18	3.6
Oesophageal stenting	3	0.6
Removal of foreign body	4	0.8
Achalasia balloon dilatation of esophagus	2	0.4
Duodenal dilatation	2	0.4
Dilatation of oesophageal stricture	3	0.6
Dilatation of colonic stricture	2	0.4
Total	506	100

Table 1 presents the distribution of gastrointestinal (GI) procedures performed under Total Intravenous Anesthesia (TIVA) among 506 patients. The majority underwent endoscopy (60.9%), followed by colonoscopy (15.6%) and combined endoscopy with colonoscopy (7.9%). Therapeutic procedures such as endoscopic polypectomy (4.5%), colonoscopic polypectomy (4.3%), and endoscopic variceal ligation (3.6%) were also common. Less frequent interventions included oesophageal stenting (0.6%), foreign body removal (0.8%), and various GI dilatations (each ranging from 0.4% to 0.6%).

Table 2 summarizes the demographic characteristics of the 506 patients who underwent GI procedures under TIVA. Most patients were between 31–50 years old (43.9%), followed by those aged 51–70 years (32.0%). The cohort had a nearly balanced gender distribution, with males comprising 53.8% and females 46.2%. Regarding ASA physical status, the majority were classified as ASA II (63.4%), indicating patients with mild to moderate systemic disease.

Table 2: Demographic Characteristics (n = 506)

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
18–30	81	16
31–50	222	43.9
51–70	162	32
>70	41	8.1
Sex		
Male	272	53.8
Female	234	46.2
ASA Physical Status		
ASA I	185	36.6
ASA II	321	63.4

Table 3 presents the anesthetic agents used and intraoperative observations among the 506 patients. Propofol was used universally (100%) for induction. Fentanyl (63.6%) was the more commonly used opioid compared to remifentanyl (36.4%). Hemodynamic stability was maintained in 90.5% of patients, with desaturation episodes occurring in 7.5%. Additionally, 24.3% of procedures lasted longer than 30 minutes.

Table 4 summarizes the post-procedure outcomes of patients undergoing GI procedures under TIVA. The majority experienced no complications (80.4%), while 8.1% reported postoperative nausea or vomiting. Hypotension occurred in 3.8% of cases, and 4.9% had delayed recovery. Unplanned hospital admission was required in 3.0% of patients. Notably, patient satisfaction was high (92.5%), and the mortality rate was 0.4%.

Table 3: Anesthetic Agents and Intraoperative Observations (n = 506)

Parameter	Frequency (n)	Percentage (%)
Induction Agent		
Propofol	506	100
Opioid Used		
Fentanyl	322	63.6
Remifentanyl	184	36.4
Hemodynamic Stability		
Stable	458	90.5
Unstable	48	9.5
Desaturation Episodes (< 90%)	38	7.5
Procedure Duration > 30 minutes	123	24.3

Table 4: Post-Procedure Outcomes (n = 506)

Outcome	Frequency (n)	Percentage (%)
Postoperative Nausea/Vomiting	41	8.1
Hypotension (SBP <90 mmHg)	19	3.8
Delayed Recovery (>30 mins)	25	4.9
No Complications	407	80.4
Unplanned Hospital Admission	15	3
Patient Satisfaction (High)	468	92.5
Death	2	0.4

Discussion

This prospective observational study evaluated the efficacy, safety, and intraoperative/postoperative outcomes of Total Intravenous Anesthesia (TIVA) in a cohort of 506 patients undergoing various gastrointestinal (GI) procedures. The results demonstrated that TIVA, primarily using propofol in combination with either fentanyl or remifentanyl, provided effective anesthetic management with a high level of patient satisfaction and a low rate of adverse events. TIVA has become increasingly popular in GI endoscopy and related interventions due to its favorable pharmacokinetic profile, predictable recovery, and reduced postoperative complications compared to inhalational anesthesia, as demonstrated by Rudner et al., and Amornyotin et al [13, 14]. Our findings are consistent with those of Rudner et al., who observed smoother sedation and faster recovery in patients receiving propofol-based TIVA during outpatient colonoscopy [13]. Similarly, Amornyotin et al., emphasized the safety and efficiency of intravenous sedation techniques in GI endoscopy, highlighting reduced procedural discomfort and better control over anesthetic depth [14].

In our study, the majority of procedures (60.9%) were upper GI endoscopies, followed by colonoscopies and combined diagnostic and therapeutic interventions. Regardless of the procedure type, propofol was universally used for induction. The choice of opioid was based on procedural duration and depth of analgesia required—fentanyl being more common in shorter procedures, and remifentanyl in longer or more painful interventions. These combinations align with best practices reported in the similar studies, including those by Amornyotin et al., and Chan WH et al. [14, 15]. Our intraoperative observations showed that 90.5% of patients maintained hemodynamic stability, while desaturation events were relatively infrequent (7.5%) which was managed successfully. These results are encouraging and reflect findings from studies like those by Chan WH et al., who reported reduced anesthesia-controlled operating room time and improved physiological parameters with TIVA compared to volatile anesthetics in colorectal surgery [15]. Furthermore, the incidence of hypotension (3.8%) and delayed recovery (4.9%) in our population were comparable or lower than rates reported in previous investigations by Wu WW et al., Kim DH et al., and Riedel B et al. [16, 17, 18]. The overall complication profile in our cohort was favorable, with 80.4% experiencing no postoperative issues and only 3.0% requiring unplanned hospital admission. Notably, patient satisfaction was high (92.5%), reinforcing TIVA's role in enhancing the patient experience during GI procedures. Liao R et al., and Kim GH et al., similarly found TIVA to be associated with lower rates of postoperative nausea and vomiting (PONV) and improved overall comfort [19, 20].

Beyond immediate clinical outcomes, there is growing interest in the long-term implications of anesthetic choice, particularly in oncologic surgeries. Studies such as those by Konstantis G et al., Wu WW et al., and Wigmore TJ et al., have proposed that TIVA might confer immunomodulatory benefits and potentially improve cancer-related outcomes [16, 21, 22]. Konstantis et al., in their meta-analysis, suggested that IV anesthetic techniques could favorably influence perioperative immune responses in patients undergoing gastric or colorectal cancer surgery [21]. Wu et al., also reported improved long-term survival in gastric cancer patients receiving TIVA compared to inhalational agents [16]. It is also important to consider the practical advantages of TIVA, including precise titration, minimal environmental pollution, and suitability for outpatient procedures. These benefits have been emphasized in the Enhanced Recovery After Surgery (ERAS) guidelines by Feldheiser A et al., which support the use of short-acting agents like propofol and remifentanyl in GI surgery to facilitate rapid recovery and early discharge [23]. Our findings of low rates of delayed recovery and unplanned admissions align well with this enhanced recovery framework.

Limitations of the study

Limitations include its single-center design, lack of a comparator group (e.g., inhalational anesthesia), and absence of long-term follow-up, particularly regarding oncological and functional outcomes. Future randomized trials comparing TIVA with other anesthetic techniques in GI procedures both diagnostic and therapeutic are warranted.

Conclusion

This prospective observational study demonstrates that Total Intravenous Anesthesia (TIVA), primarily using propofol with adjunct opioids like fentanyl or remifentanyl, is a safe, effective, and well-tolerated anesthetic technique for various gastrointestinal (GI) procedures. TIVA provided excellent hemodynamic stability, minimal postoperative complications, and high patient satisfaction, making it particularly suitable for day-care endoscopy and therapeutic interventions. The low incidence of adverse events, combined with efficient recovery profiles, supports its broader adoption in clinical practice, especially where rapid turnover and enhanced recovery are priorities. Further comparative and long-term studies are recommended to evaluate TIVA's potential advantages over inhalational techniques, particularly in high-risk or oncologic GI populations.

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Conflicts of interest

There are no conflicts of interest.

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