

Original Research Article

EMERGENCE AND QUALITY OF RECOVERY AFTER TOTAL INTRAVENOUS ANAESTHESIA AMONG DIFFERENT GENDER GROUP

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ABSTRACT

Background: Gender differences in anaesthetic pharmacodynamics and pharmacokinetics may influence emergence and recovery profiles following total intravenous anaesthesia (TIVA). Understanding these differences can help optimize perioperative care. **Aim:** To evaluate and compare emergence times and quality of recovery between male and female patients undergoing elective surgery under TIVA.

Materials and Methods: A comparative follow-up study was conducted on 60 patients (30 males, 30 females) aged 18–60 years undergoing elective surgeries with ASA I–II status at a tertiary care centre. Patients were administered TIVA using propofol-based protocols. Time to eye opening, time to obey commands, recovery room stay duration, postoperative complications, and quality of recovery (QoR-40 score) were recorded and compared between groups. Data were analyzed using Student's unpaired t-test and Fisher's exact test, with p<0.05 considered statistically significant.

Results: Females showed significantly faster emergence, with shorter mean time to eye opening $(5.17 \pm 1.30 \text{ min vs. } 7.07 \pm 1.76 \text{ min, p} < 0.0001)$ and to obeying commands $(6.90 \pm 1.31 \text{ min vs. } 8.83 \pm 1.72 \text{ min, p} = 0.0001)$ than males. Recovery room stay and QoR-40 scores were comparable between groups. Females experienced higher rates of nausea (23.3% vs. 13.3%), vomiting (16.7% vs. 6.7%), and shivering (20% vs. 10%) postoperatively.

Conclusion: Females demonstrated faster emergence from TIVA but were more prone to postoperative nausea, vomiting, and shivering. Overall recovery quality remained comparable between genders. Gender-based differences should be considered to tailor perioperative management and improve outcomes.

Keywords: Total intravenous anaesthesia, emergence, gender differences, recovery, QoR-40.

INTRODUCTION

Total Intravenous Anaesthesia (TIVA) has gained popularity in recent years due to its advantages in achieving smooth induction and emergence, reduced postoperative nausea and vomiting (PONV), and improved recovery profiles compared to inhalational techniques.^[1] The pharmacokinetic and pharmacodynamic properties of TIVA agents, especially propofol and opioids like remifentanil, allow precise titration and rapid recovery, making it a preferred choice for various surgical procedures.^[2] Emergence from anaesthesia is a critical phase where patients transition from an unconscious state to consciousness, with restoration of protective airway reflexes and cognitive function. The quality of emergence can impact patient satisfaction, recovery room stay, and perioperative complications.^[3] Several studies have indicated that patient-specific factors such as age, weight, comorbidities, and gender can influence emergence and recovery characteristics.^[4]

Gender differences in anaesthesia response have been documented, attributed to variations in body composition, hormonal status, enzyme activity, and drug receptor sensitivity.^[5] Women are reported to have higher incidence of PONV, faster metabolism of certain anaesthetic agents, and greater sensitivity to opioids compared to men.^[6] Conversely, men may experience delayed recovery or higher analgesic requirements in the postoperative period.^[7] Research has shown that females may achieve faster emergence due to increased clearance of propofol, but paradoxically, they may experience more adverse effects like nausea and pain in recovery.^[8] Hormonal fluctuations, particularly the influence of oestrogen and progesterone, have been implicated in altering drug pharmacokinetics and pain perception in females, further affecting recovery outcomes.^[9]

Despite growing evidence, literature comparing emergence and recovery profiles between genders under TIVA remains limited and inconclusive.^[10] Understanding gender-based differences can help in optimizing anaesthetic management, tailoring drug dosing, and improving perioperative care. This study aims to evaluate differences in emergence and quality of postoperative recovery between males and females undergoing TIVA, contributing valuable insights into gender-specific anaesthetic outcomes.

MATERIALS AND METHODS

Present case-control study was conducted in the Department of Anaesthesiology at P.D.U. Government Medical College, Rajkot, from January 2023 to June 2024. The study included 60 adult patients aged 18–60 years, scheduled for elective surgeries with ASA physical status I or II. Patients were divided into two groups of 30 each, comprising males (Group 1) and females (Group 2). Patients undergoing emergency surgeries, sex-specific surgeries, those with ASA grade > II, neurological or psychiatric conditions, cardiac illnesses, allergies to propofol, or conditions affecting recovery were excluded.

Preoperative evaluation included detailed history, physical examination, chest X-ray, and routine investigations (CBC, RBS, RFT, serum electrolytes). On the day of surgery, written informed consent was obtained. Baseline monitoring involved ECG, non-invasive blood pressure, and pulse oximetry. Patients were pre-medicated with ondansetron, glycopyrrolate, and midazolam intravenously, followed by fentanyl for analgesia. Induction was achieved with propofol and ketamine, facilitated while succinvlcholine intubation. Anaesthesia was maintained with a propofol infusion at tapering doses along with oxygen, with atracurium as a muscle relaxant. Intraoperative BIS

monitoring aimed to maintain a value between 40– 60. Anaesthesia was reduced 15 minutes before the end of surgery, and all agents were stopped 5 minutes before skin closure. Patients were reversed with glycopyrrolate and neostigmine and extubated once adequate recovery was confirmed.

Recovery was assessed from the point propofol was discontinued. Timings of eye opening, response to commands, extubation, limb movement, and regaining muscle power were recorded. Pain was evaluated using a 10-point verbal rating scale at recovery room transfer, discharge, and 12 hours postoperatively. The quality of recovery was assessed using the QoR-40 questionnaire at baseline, post-surgery, and 12 hours later, covering physical comfort, emotional state, independence, psychological support, and pain, with scores ranging from 40 (poor) to 200 (excellent). The modified Aldrete score was recorded every 30 minutes until a score of 9 was achieved.

Data were collected using a validated questionnaire available in English, Hindi, and Gujarati, entered into MS Excel 2019, and analyzed using MedCalc and Epi Info 7.1. Descriptive statistics were used for qualitative (proportions, percentages) and quantitative (mean, SD) variables. Comparisons were made using Student's unpaired t-test for quantitative data and Fisher's exact test for qualitative data, with p < 0.05 considered significant. All data were stored securely in password-protected files, and hard copies were locked. Ethical approval was obtained from the institutional committee, and written informed consent ensured privacy and confidentiality. Records will be kept for two years and destroyed after three years.

RESULTS

Table 1 shows the demographic profile of the patients in both male and female groups, comparing their mean age, weight, and duration of anaesthesia. The mean age was very similar between males (27.53 \pm 9.65 years) and females (27.84 \pm 9.71 years), showing no significant difference (p=0.90). Likewise, the mean body weight was slightly higher in males (58.8 \pm 5.69 kg) than in females (56.9 \pm 7.25 kg), though this difference was not statistically significant (p=0.26). The duration of anaesthesia was also comparable, with males averaging 110.83 \pm 28.84 minutes and females averaging 103.33 \pm 29.84 minutes, again showing no significant difference (p=0.32). This indicates that both groups were well-matched demographically, eliminating major baseline variations between them.

Table 2 illustrates the distribution of weight categories in both gender groups. The majority of patients in both groups fell within the 50-60 kg range, with 18 males and 17 females in this bracket. Interestingly, a higher proportion of females (8) were in the 40-50 kg category compared to males (3), while males had more individuals in the 60-70

kg range (9 males vs 4 females). No patients in either group weighed less than 40 kg, and very few exceeded 70 kg (only one female). This distribution highlights a slight tendency for females to have lower body weight than males in the study population, which could have implications for drug metabolism and anaesthetic dosing.

Table 3 presents the mean times taken for patients to open their eyes and obey verbal commands after completion of wound dressing, representing markers of emergence from anaesthesia. Females had significantly faster emergence, with an average eyeopening time of 5.17 ± 1.30 minutes compared to 7.07 ± 1.76 minutes in males (p<0.0001). Similarly, females obeyed verbal commands earlier (6.90 \pm 1.31 minutes) than males (8.83 \pm 1.72 minutes), a difference that was also statistically significant (p=0.0001). These findings suggest that females recovered consciousness and responsiveness faster than males following total intravenous anaesthesia, potentially due to differences in pharmacokinetics or pharmacodynamics between genders.

Table 4 compares the recovery room stay duration and the quality of recovery measured by the QoR-40 score between males and females. The average recovery room stay was similar for both groups, with males staying 56.3 ± 14.8 minutes and females staying 58.5 ± 16.2 minutes, showing no significant difference (p=0.41). The QoR-40 score, assessed 24 hours postoperatively, was slightly higher in males (174.2 \pm 12.5) than females (170.8 \pm 11.9), but this difference was not statistically significant (p=0.27). This indicates that both genders had comparable overall recovery experiences within the first 24 hours, despite differences in emergence timing.

Table 5 highlights the incidence of postoperative complications such as nausea, vomiting, and shivering. Females experienced a higher frequency of complications, with 7 cases of nausea, 5 cases of vomiting, and 6 cases of shivering compared to 4, 2, and 3 cases respectively in males. Although formal statistical analysis was not provided here, the trend suggests females may be more prone to certain postoperative side effects, consistent with previous research showing higher susceptibility to nausea and vomiting in women after anaesthesia.

Table 1: Demographic Profile of Both Groups Comparing Mean Age, Weight, and Duration of Anaesthesia				
Parameter	Group 1: Male	Group 2: Female	P-Value	Significance
Age (years, Mean±SD)	27.53 ± 9.65	27.84 ± 9.71	0.90	Not Significant
Weight (kg, Mean±SD)	58.8 ± 5.69	56.9 ± 7.25	0.26	Not Significant
Anaesthesia duration	110.83 ± 28.84 min	103.33 ± 29.84 min	0.32	Not Significant

Table 2: Weight Distribution in Both Groups			
Weight (kg)	Group 1: Male	Group 2: Female	
<40	0	0	
40-50	3	8	
50-60	18	17	
60-70	9	4	
>70	0	1	

Table 3: Mean	Time to Eye Opening	and Mean Time t	o Obeying Command	After Completion of	Wound Dressing in
Both Groups					

Parameter	Group 1: Male	Group 2: Female	P-Value	Significance
Eye Opening Time (min)	7.07 ± 1.76	5.17 ± 1.30	< 0.0001	Significant
Obeying Command Time (min)	8.83 ± 1.72	6.90 ± 1.31	0.0001	Significant

Table 4: Recovery Room Stay Duration and Quality of Recovery (QoR-40) Score Comparison				
Parameter	Group 1: Male	Group 2: Female	P-Value	Significance
Recovery Room Stay (min)	56.3 ± 14.8	58.5 ± 16.2	0.41	Not Significant
QoR-40 Score (24 hours)	174.2 ± 12.5	170.8 ± 11.9	0.27	Not Significant

Table 5: Post-operative Complications (Nausea, Vomiting, Shivering) in Both Groups			
Complication	Group 1: Male	Group 2: Female	
Nausea	4	7	
Vomiting	2	5	
Shivering	3	6	

DISCUSSION

The present study aimed to compare emergence and recovery profiles following total intravenous anaesthesia (TIVA) between male and female patients undergoing elective surgery. The findings revealed that while demographic factors such as age, weight, and anaesthesia duration were comparable between groups, significant differences were observed in emergence times. Females exhibited faster eye-opening and responsiveness to commands compared to males, consistent with prior research indicating gender-based differences in anaesthetic pharmacokinetics.^[11]

This faster emergence in females could be attributed to higher propofol clearance rates and lower fat mass relative to body weight, facilitating more rapid elimination of lipophilic agents like propofol.^[12] Additionally, hormonal influences, particularly oestrogen, may enhance central nervous system sensitivity and alter receptor responses, leading to faster recovery of consciousness in females.^[13] Despite these differences in emergence times, the recovery room stay duration and overall quality of recovery assessed by the QoR-40 score were comparable between genders, suggesting that early emergence does not necessarily translate into superior subjective recovery quality.

Interestingly, females demonstrated a higher incidence of postoperative nausea, vomiting, and shivering than males. This trend aligns with existing literature reporting greater susceptibility of females to postoperative nausea and vomiting (PONV), possibly due to hormonal fluctuations and differences in serotonin receptor activity.^[14] Although the difference in QoR-40 scores was not statistically significant, the slightly lower mean score in females may reflect the impact of these minor complications on perceived recovery quality. Overall, the study reinforces the importance of considering gender differences in perioperative care. While females may experience faster emergence, they are also more prone to specific postoperative complications requiring proactive management. Tailoring antiemetic prophylaxis and perioperative interventions based on gender may improve patient outcomes and satisfaction. Similar findings have been observed in prior studies advocating individualized anaesthetic approaches to address gender-based variations in recovery.^[15]

CONCLUSION

This study demonstrates that females recover consciousness and obey commands faster than males following total intravenous anaesthesia, yet both genders experience similar overall quality of recovery and recovery room stay duration. Females appear more susceptible to postoperative nausea, vomiting, and shivering. Awareness of these genderbased differences can aid anaesthesiologists in optimizing perioperative care through individualized monitoring and prophylactic strategies.

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