Research Square

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Association of type 2 diabetes mellitus with emergence agitation and extubation quality after vitreoretinal surgery: a prospective observational cohort study

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Research Article

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Abstract

Background

Emergence agitation and airway responses during extubation may compromise recovery after vitreoretinal surgery. Evidence regarding diabetes is limited. This study aimed to evaluate the association of type 2 diabetes mellitus with emergence agitation and extubation quality after vitreoretinal surgery.

Methods

In this single-center prospective observational cohort study conducted at a tertiary university hospital in Türkiye, we included 160 adults with American Society of Anesthesiologists (ASA) physical status I–III undergoing vitreoretinal surgery under standardized general anesthesia: 80 with type 2 diabetes and 80 without diabetes. Emergence agitation, defined as a Richmond Agitation-Sedation Scale score ≥ + 1, was assessed immediately after extubation and at 10 minutes. A blinded observer graded extubation quality from 1 (no coughing or straining) to 5 (laryngospasm with severe coughing and labored breathing).

Results

Immediately after extubation, emergence agitation occurred in 23.8% of patients with diabetes and 12.5% of those without diabetes ($p = 0.065$; risk ratio, 1.90; 95% confidence interval, 0.94–3.83). Diabetes was not independently associated with agitation after adjustment for ASA III status and smoking (adjusted odds ratio, 1.90; 95% confidence interval, 0.70–5.19; $p = 0.210$). Extubation quality was poorer in patients with diabetes (2.0 ± 1.4 versus 1.6 ± 1.1; $p = 0.040$), and heart rate was higher ($p < 0.001$). Glycated hemoglobin, fasting plasma glucose, and diabetes duration were not associated with recovery outcomes.

Conclusions

Patients with type 2 diabetes had poorer extubation quality and higher perioperative heart rate, whereas an independent association with emergence agitation was not demonstrated. These findings support careful airway and hemodynamic monitoring during emergence.

INTRODUCTION

Emergence agitation is an important neurobehavioral complication that occurs during the early recovery period after general anesthesia and may adversely affect patient safety and postoperative recovery. It is characterized by restlessness, confusion, disorientation, and potentially violent or non-purposeful physical behavior. Emergence agitation may lead to hypoxemia, airway obstruction, accidental removal of endotracheal tubes, intravenous catheters, or surgical drains, surgical-site bleeding, and injury to

patients or healthcare personnel. In addition, agitation-related sympathetic activation may increase heart rate, arterial blood pressure, and myocardial oxygen demand, with potentially serious consequences in patients at high cardiovascular risk [1–4].

Diabetes mellitus is a common comorbidity that increases perioperative risk and may complicate anesthetic management [5]. According to the 2024 International Diabetes Federation estimates, more than 589 million adults worldwide are living with diabetes [6, 7]. Approximately 15% of patients undergoing surgery have diabetes, and nearly half of all individuals with diabetes are expected to require at least one surgical procedure during their lifetime [5]. Chronic hyperglycemia may adversely affect neurocognitive recovery through several interrelated mechanisms, including neuroinflammation, cerebral microvascular injury, disruption of autonomic regulation, and diabetic neuropathy [8–10]. These mechanisms may also influence behavioral and physiological responses during emergence from anesthesia.

Vitreoretinal surgery is performed to treat disorders involving the retina and vitreous, including diabetic retinopathy, retinal detachment, intraocular hemorrhage, uveitis, and ocular trauma [11, 12]. Maintaining stable intraocular pressure throughout the perioperative period is important for preserving surgical outcomes and preventing postoperative complications. During emergence, coughing, straining, agitation, and uncontrolled movement may cause abrupt increases in intraocular pressure and potentially contribute to ocular bleeding or other adverse surgical outcomes [13]. Type 2 diabetes mellitus is common among patients undergoing vitreoretinal surgery and may further increase susceptibility to perioperative physiological and neurocognitive disturbances [5, 14]. However, the association between type 2 diabetes mellitus and emergence agitation after vitreoretinal surgery has not been adequately investigated. Therefore, the objective of this study was to evaluate the association of type 2 diabetes mellitus with emergence agitation and extubation quality in patients undergoing vitreoretinal surgery under general anesthesia. Secondary outcomes included perioperative hemodynamic variables, postoperative pain, rescue analgesic requirements, and postoperative nausea and vomiting.

METHODS

Study design and ethical considerations

This single-center prospective observational cohort study was conducted at Farabi Hospital, Karadeniz Technical University Faculty of Medicine, Trabzon, Türkiye, from July 2, 2025, to June 1, 2026. The Karadeniz Technical University Faculty of Medicine Scientific Research Ethics Committee approved the protocol on July 2, 2025 (2025/188). Written informed consent was obtained from all participants. As this was an observational study without an experimental intervention, prospective trial registration was not required. Reporting followed the STROBE recommendations.

Participants and groups

Patients aged 18–90 years with American Society of Anesthesiologists (ASA) physical status I–III who were scheduled for elective vitreoretinal surgery under general anesthesia were eligible. Exclusion criteria were ASA physical status ≥ IV; severe cardiovascular, respiratory, hepatic, renal, or metabolic disease other than type 2 diabetes mellitus; neurological or psychiatric disease; allergy to a study-protocol medication; refusal of consent; surgery lasting > 3 hours; or incomplete or unevaluable data.

Group D comprised patients with a documented pre-existing diagnosis of type 2 diabetes mellitus, whereas Group N comprised patients without a history or diagnosis of diabetes mellitus. Enrollment continued until each group contained 80 patients. Age, sex, anthropometric measurements, ASA status, medications, smoking, alcohol use, comorbidities, and surgical and anesthesia durations were recorded. Diabetes duration, glycated hemoglobin, fasting plasma glucose, and antidiabetic treatment were additionally recorded in Group D.

Anesthesia and perioperative monitoring

Electrocardiography, noninvasive arterial pressure, peripheral oxygen saturation, and end-tidal carbon dioxide were monitored using a CARESCAPE B650 or B850 monitor (GE HealthCare, Helsinki, Finland). Anesthetic depth was monitored with an integrated E-BIS module and maintained at a bispectral index of 40–60. Neuromuscular blockade was monitored by acceleromyography using a TOF-Watch SX (Organon Teknika, Dublin, Ireland).

After room-air baseline measurements and 3–5 minutes of preoxygenation with 100% oxygen at 6–8 L/min, anesthesia was induced intravenously with midazolam 2 mg, fentanyl 1–2 μg/kg, lidocaine 1–2 mg/kg, propofol 2–2.5 mg/kg, and rocuronium 1 mg/kg. Following approximately three minutes of bag-mask ventilation, an experienced anesthesiologist performed direct-laryngoscopic tracheal intubation.

Anesthesia was maintained with 5%–6% desflurane in 50% oxygen–air and remifentanil 0.1 μg/kg/min. Ventilation maintained end-tidal carbon dioxide at 30–35 mmHg. Rocuronium 0.15 mg/kg was added when the train-of-four count recovered to ≥ 2, except during the final 20–30 minutes. Paracetamol 1 g and ondansetron 4 mg were administered intravenously 20–30 minutes before surgery ended.

Desflurane and remifentanil were discontinued when surgery was completed. Neuromuscular blockade was reversed with sugammadex 2 mg/kg. Extubation followed confirmation of a train-of-four ratio ≥ 0.9, adequate spontaneous ventilation, protective airway reflexes, and responsiveness to verbal commands.

Measurements and outcomes

Heart rate, systolic, diastolic, and mean arterial pressures, peripheral oxygen saturation, and end-tidal carbon dioxide were recorded after intubation; at 15, 30, 45, 60, 90, and 120 minutes; before and after extubation; and in the post-anesthesia care unit. Baseline measurements preceded induction; baseline

oxygen saturation was measured on room air. The 90- and 120-minute values were available only while surgery remained in progress.

Emergence agitation was assessed immediately after extubation and at 10 minutes in the post-anesthesia care unit using the Richmond Agitation-Sedation Scale (RASS; −5, unarousable, to + 4, combative). Emergence agitation was defined as RASS ≥ + 1; its incidence immediately after extubation was the primary outcome.

Extubation quality was graded from 1 to 5: 1, no coughing or straining; 2, one or two mild coughs; 3, three or four moderate coughs; 4, severe coughing or labored breathing with 5–10 coughs; and 5, laryngospasm with severe coughing and labored breathing. Higher scores indicated poorer quality. Pain was assessed on an 11-point numerical rating scale after adequate cooperation (RASS ≥ − 1); intravenous meperidine 20–30 mg was given for scores ≥ 4. Postoperative nausea and vomiting and rescue analgesic requirements were recorded during the post-anesthesia care unit stay.

The same trained anesthesia technician, unaware of diabetes status, group, fasting plasma glucose, glycated hemoglobin, and other preoperative data, performed all RASS and extubation-quality assessments.

Sample size

An a priori sample-size calculation was performed using G*Power version 3.1.9. Published evidence on emergence agitation in adults and patients undergoing vitreoretinal surgery was reviewed during study planning [3, 11]. The investigators prespecified an absolute between-group difference of 25 percentage points in emergence-agitation incidence (40% in Group D versus 15% in Group N) as clinically meaningful. Using a two-sided Fisher's exact test for two independent proportions, a 1:1 allocation ratio, an α level of 0.05, and 80% power, the required sample size was 112 patients (56 per group). After increasing this number by 10% to account for potential exclusions or incomplete data, the target sample size was 124 patients (62 per group). The final analysis included 160 patients, with 80 patients in each group.

Statistical analysis

Analyses used IBM SPSS Statistics 26.0 (IBM Corp., Armonk, New York, United States); repeated-measures and sensitivity analyses were independently reproduced in Python 3.12 using SciPy. Continuous data were summarized as mean±standard deviation or median (interquartile range), and categorical data as n (%). Student's t, Welch's t, or Mann–Whitney U tests were used as appropriate. Categorical data were analyzed using Pearson's chi-square, Fisher's exact, or Fisher–Freeman–Halton exact tests.

Hemodynamic measurements were analyzed using linear mixed-effects models with a patient-specific random intercept and fixed effects for group, categorical time, and group×time. Holm-adjusted time-

specific contrasts were used when appropriate. A post-hoc logistic-regression sensitivity analysis evaluated diabetes and emergence agitation while accounting for ASA III status and smoking. Secondary and subgroup analyses (hemodynamic parameters other than heart rate, pain, nausea and vomiting, and the diabetes-related subgroup comparisons) were exploratory and were not adjusted for multiplicity beyond the Holm correction applied to hemodynamic time-point contrasts; findings from these analyses should be interpreted as hypothesis-generating. Odds ratios were reported with 95% confidence intervals. Tests were two-sided, with $p < 0.05$ considered significant.

RESULTS

Patient flow and baseline characteristics

Of 175 patients assessed for eligibility, 15 were excluded: three declined consent, seven had incomplete data, and five underwent surgery lasting longer than three hours. The final analysis included 160 patients, with 80 patients in each group. Age, sex, body mass index, and anesthesia and surgical durations were comparable between the groups. ASA III status was more frequent in Group D than in Group N (83.8% versus 28.7%; $p < 0.001$), whereas current smoking was less frequent (6.2% versus 20.0%; $p = 0.010$). Other comorbidities did not differ significantly between the groups (Table 1).

Table 1
Baseline and perioperative characteristics of patients undergoing vitreoretinal surgery, stratified by type 2 diabetes status

Age, years	**Group D (n = 80)**	**Group N (n = 80)**	**p value**
	64.5 ± 11.4	**66.4 ± 11.7**	**0.286**
Female sex, n (%)	43 (53.8)	33 (41.2)	0.113
ASA physical status, n (%)			< 0.001
I–II	13 (16.2)	57 (71.3)	
III	67 (83.8)	23 (28.7)	
Body mass index, kg/m²	28.2 ± 4.9	27.1 ± 4.2	0.127
Surgical duration, minutes	80.0 ± 25.2	77.7 ± 25.0	0.559
Anesthesia duration, minutes	90.3 ± 26.3	89.8 ± 26.5	0.893
Comorbidities, n (%)			
Hypertension	51 (63.8)	49 (61.2)	0.744
Coronary artery disease	10 (12.5)	13 (16.2)	0.499
Chronic kidney disease	9 (11.2)	3 (3.8)	0.072
Current smoking, n (%)	5 (6.2)	16 (20.0)	0.010

Data are presented as mean±standard deviation or number (percentage). Group D comprised patients with type 2 diabetes mellitus, and Group N comprised patients without diabetes mellitus. Continuous variables were compared using the independent-samples Student's *t* test, and categorical variables using Pearson's chi-square test. ASA, American Society of Anesthesiologists.

Emergence and early postoperative outcomes

Immediately after extubation, emergence agitation occurred in 19 patients (23.8%) in Group D and 10 patients (12.5%) in Group N ($p = 0.065$). The corresponding risk ratio was 1.90 (95% confidence interval [CI], 0.94–3.83), and the odds ratio was 2.18 (95% CI, 0.94–5.05). After adjustment for ASA III status and current smoking, type 2 diabetes mellitus was not independently associated with emergence agitation (adjusted odds ratio, 1.90; 95% CI, 0.70–5.19; $p = 0.210$).

At 10 minutes, emergence agitation was observed in no patient in Group D and three patients (3.8%) in Group N ($p = 0.245$). RASS scores did not differ between the groups immediately after extubation (− 0.71 ± 1.49 versus − 0.99 ± 1.39; $p = 0.162$) or at 10 minutes (− 0.07 ± 0.27 versus − 0.09 ± 0.40; $p = 0.768$).

Extubation quality was poorer in Group D than in Group N (2.0 ± 1.4 versus 1.6 ± 1.1; $p = 0.040$). Rescue analgesia was required by four patients (5.0%) in Group D and five patients (6.2%) in Group N ($p = 1.000$). Postoperative nausea and vomiting occurred in one patient (1.2%) in each group ($p = 1.000$) (Table 2).

Table 2
Emergence and early postoperative recovery outcomes after vitreoretinal surgery, stratified by type 2 diabetes status

RASS score immediately after extubation	**Group D (n = 80)**	**Group N (n = 80)**	**p value**
	−0.71 ± 1.49	**−0.99 ± 1.39**	**0.162**
Emergence agitation immediately after extubation, n (%)	19 (23.8)	10 (12.5)	0.065
RASS score at 10 minutes	−0.07 ± 0.27	−0.09 ± 0.40	0.768
Emergence agitation at 10 minutes, n (%)	0 (0.0)	3 (3.8)	0.245
Extubation quality score	2.0 ± 1.4	1.6 ± 1.1	0.040
Rescue analgesic requirement, n (%)	4 (5.0)	5 (6.2)	1.000
Postoperative nausea and vomiting, n (%)	1 (1.2)	1 (1.2)	1.000

Data are presented as mean±standard deviation or number (percentage). RASS and extubation quality scores were compared using the Mann–Whitney U test; categorical outcomes were compared using Pearson's chi-square or Fisher's exact test, as appropriate. Emergence agitation was defined as RASS ≥ + 1. Group D comprised patients with type 2 diabetes mellitus, and Group N comprised patients without diabetes mellitus. RASS, Richmond Agitation-Sedation Scale.

Perioperative hemodynamics

Heart rate was higher overall in Group D (group effect, $p < 0.001$), without a significant group-by-time interaction ($p = 0.972$); after Holm adjustment, between-group differences remained significant at baseline (adjusted $p = 0.002$), after intubation, after extubation, and in the post-anesthesia care unit (each adjusted $p = 0.045$). Mean arterial pressure showed no overall group difference ($p = 0.126$), but a significant group-by-time interaction was observed ($p = 0.027$); only the post-anesthesia care unit difference remained significant after Holm adjustment ($p = 0.041$). Heart rate and mean arterial pressure trajectories are shown in Fig. 1.

Systolic arterial pressure was marginally higher overall in Group D ($p = 0.048$), without a significant group-by-time interaction ($p = 0.057$); after Holm adjustment, differences remained significant at baseline ($p = 0.008$) and in the post-anesthesia care unit ($p = 0.025$). No significant group effects or group-by-time interactions were observed for diastolic arterial pressure, peripheral oxygen saturation, or end-tidal carbon dioxide.

Diabetes-related analyses

In Group D, mean HbA1c was 7.5%±1.3%, fasting plasma glucose was 145.3 ± 53.2 mg/dL, and diabetes duration was 16.9 ± 10.6 years. Treatment comprised diet alone in 13 patients, oral antidiabetic medication alone in 36, insulin alone in 17, and combined oral antidiabetic medication and insulin in 14.

Diabetes duration, HbA1c, and fasting plasma glucose did not differ significantly between patients with and without emergence agitation. Insulin use was not associated with the incidence of emergence agitation (29.0% versus 20.4%; $p = 0.540$) or extubation quality (2.1 ± 1.4 versus 1.9 ± 1.5; $p = 0.376$). However, the immediate postoperative RASS score was higher among insulin-treated patients than among those not receiving insulin (− 0.29 ± 1.27 versus − 0.98 ± 1.57; $p = 0.042$). Emergence and extubation outcomes did not differ according to the prespecified HbA1c and fasting plasma glucose thresholds or among the four treatment categories (all $p > 0.05$) (Table 3).

Table 3
Diabetes-related characteristics and emergence outcomes in patients with type 2 diabetes mellitus

Panel A. Characteristics according to emergence agitation status			
Characteristic	**Emergence agitation (n = 19)**	**No emergence agitation (n = 61)**	**p value**
Diabetes duration, years	19.2 ± 11.2	16.2 ± 10.4	0.306
HbA1c, %	7.6 ± 1.5	7.4 ± 1.2	0.563
Fasting plasma glucose, mg/dL	155.4 ± 56.9	142.1 ± 52.1	0.375
Panel B. Outcomes according to insulin use			
Outcome	**No insulin (n = 49)**	**Insulin use (n = 31)**	**p value**
Emergence agitation, n (%)	10 (20.4)	9 (29.0)	0.540
Immediate postoperative RASS score	−0.98 ± 1.57	−0.29 ± 1.27	0.042
Extubation quality score	1.9 ± 1.5	2.1 ± 1.4	0.376

Data are presented as mean±standard deviation unless otherwise indicated. *p* values were obtained using Welch's t test for Panel A; the continuity-corrected Pearson chi-square test for emergence agitation in Panel B; and the Mann–Whitney U test for RASS and extubation-quality scores. Emergence agitation was defined as RASS ≥ + 1. HbA1c, glycated hemoglobin; RASS, Richmond Agitation-Sedation Scale.

DISCUSSION

The principal finding of this prospective observational study was that emergence agitation occurred more frequently in patients with type 2 diabetes mellitus than in those without diabetes, although the difference did not reach statistical significance. After adjustment for ASA III status and smoking, diabetes was not independently associated with emergence agitation. In contrast, patients with diabetes had poorer extubation quality and a higher perioperative heart rate. Glycated hemoglobin, fasting plasma glucose, and diabetes duration were not associated with emergence agitation or extubation quality.

Emergence agitation is particularly relevant in ophthalmic surgery because coughing, straining, and uncontrolled movement may abruptly increase intraocular pressure and compromise surgical conditions [13]. Most available evidence is derived from nasal, maxillofacial, orthopedic, and other non-ophthalmic procedures [3, 15]. A recent vitreoretinal study from our group examined the influence of anesthetic technique on emergence agitation [11], whereas prospective evidence focusing on diabetes remains scarce. The standardized anesthetic protocol used in both groups in the present study reduced potential confounding related to anesthetic technique.

Emergence agitation occurred in 23.8% of patients with diabetes and 12.5% of those without diabetes. The estimated risk was approximately 1.9-fold higher, but the confidence interval included no effect, and adjustment for ASA status and smoking attenuated the association. Diabetes may therefore contribute as part of a broader clinical-risk profile rather than act as an independent determinant. This interpretation is consistent with the meta-analysis by Wei et al., in which diabetes was not conclusively identified as an independent risk factor [3], and with Fields et al., who reported that an association observed in univariable analysis did not persist after multivariable adjustment [15].

Nevertheless, biological plausibility exists for a relationship between diabetes and disturbed emergence. Chronic hyperglycemia may promote neuroinflammation, cerebral microvascular injury, blood–brain barrier disruption, and central cholinergic dysfunction [8, 10]. Autonomic neuropathy may also alter sympathetic responses and the physiological response to emergence from anesthesia [16]. Interactions among these mechanisms, comorbidities, anesthetic exposure, pain, and surgical factors may explain the numerical difference observed without a statistically independent association.

Extubation quality was significantly poorer in patients with diabetes. This finding is not contradictory to the nonsignificant difference in RASS-defined agitation. RASS reflects overall behavioral arousal, whereas the extubation-quality score emphasizes coughing, straining, and airway responses. These responses may be clinically relevant after vitreoretinal surgery because they can increase intraocular pressure [13]. Diabetes-related autonomic dysfunction could plausibly modify airway reflexes and the physiological response to tracheal stimulation [17, 18]. However, the available evidence is predominantly derived from children and adolescents with type 1 diabetes; therefore, this mechanism has not been directly established in adults with type 2 diabetes mellitus. Prospective studies specifically linking type 2 diabetes to extubation quality are scarce, making this finding potentially important for hypothesis generation. Because intraocular pressure and ocular complications were not measured, poorer extubation scores indicate an association with airway recovery rather than demonstrated ocular injury.

Heart rate was higher overall in patients with diabetes, although its temporal pattern was similar between the groups. Systolic arterial pressure was marginally higher overall, and mean arterial pressure differences were primarily evident during recovery. Cardiovascular autonomic neuropathy is characterized by altered sympathovagal balance, impaired baroreflex sensitivity, and reduced heart-rate variability [16]. Nevertheless, the higher proportion of ASA III patients and baseline hemodynamic differences prevent these findings from being attributed solely to diabetes.

Glycated hemoglobin, fasting plasma glucose, and diabetes duration were not associated with recovery outcomes. Insulin-treated patients had higher immediate RASS scores but not a higher incidence of emergence agitation. Insulin use may have served as a marker of treatment intensity or greater disease burden rather than exerting a direct effect on emergence [19]. Acute hypoglycemia can activate sympathoadrenal stress responses [20], but serial glucose measurements and hypoglycemic events were unavailable; therefore, this mechanism could not be evaluated. Previous studies have linked acute or chronic dysglycemia with postoperative delirium and longer-term neurocognitive outcomes [21, 22], but these conditions differ from agitation during immediate emergence. A single preoperative glucose or glycated hemoglobin measurement may therefore be insufficient to characterize the dynamic metabolic influences on early recovery. Given the small subgroups and multiple exploratory comparisons, the insulin-related finding requires confirmation.

Rescue analgesia and postoperative nausea and vomiting were uncommon and comparable between the groups. Standardized administration of paracetamol and ondansetron may have limited the effects of pain and nausea, both of which are recognized contributors to emergence agitation [3, 23]. The use of standardized anesthesia, objective neuromuscular monitoring, and blinded assessment by a single trained observer were additional strengths. From a clinical perspective, the results do not support classifying diabetes alone as an independent predictor of emergence agitation. They do, however, support careful attention to extubation quality and cardiovascular responses in this population, particularly because coughing and straining are undesirable after vitreoretinal procedures. Risk assessment should integrate diabetes with ASA status, comorbidity burden, airway responses, pain, and other perioperative factors.

LIMITATIONS

This study has several limitations. First, its single-center design may limit the generalizability of the findings. Although the final sample exceeded the prespecified minimum sample size, the observed difference in emergence-agitation incidence was smaller than anticipated in the sample-size calculation; therefore, the study may have been underpowered to detect a more modest association. Second, emergence agitation and extubation quality were assessed over a relatively short postoperative period. Third, the potential effects of unmeasured factors, including the severity of diabetic autonomic neuropathy and perioperative glucose variability, could not be evaluated. Fourth, although outcome assessment was performed by an observer blinded to diabetes status and other preoperative data, the treating anesthesia team could not be blinded to each patient's diabetes status, as is inherent to this observational design, which may have influenced intraoperative management decisions. Finally, the observational design precludes causal inference.

CONCLUSION

Type 2 diabetes mellitus was associated with poorer extubation quality and a higher perioperative heart rate after vitreoretinal surgery. Emergence agitation was more frequent in patients with diabetes, but an

independent association was not demonstrated. Careful monitoring during emergence is warranted, while larger multicenter studies incorporating autonomic, serial glycemic, and ocular outcome measurements are needed.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Karadeniz Technical University Faculty of Medicine Scientific Research Ethics Committee on July 2, 2025 (approval no. 2025/188). Written informed consent to participate was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Author Contribution

A.B.: conceptualization, investigation, data curation, visualization, and writing – original draft. A.A.: conceptualization, methodology, project administration, supervision, validation, and writing – review and editing. E.N.D.: conceptualization, methodology, resources, supervision, and writing – review and editing. All authors read and approved the final manuscript.

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Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request, subject to institutional and ethical restrictions.

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Figures

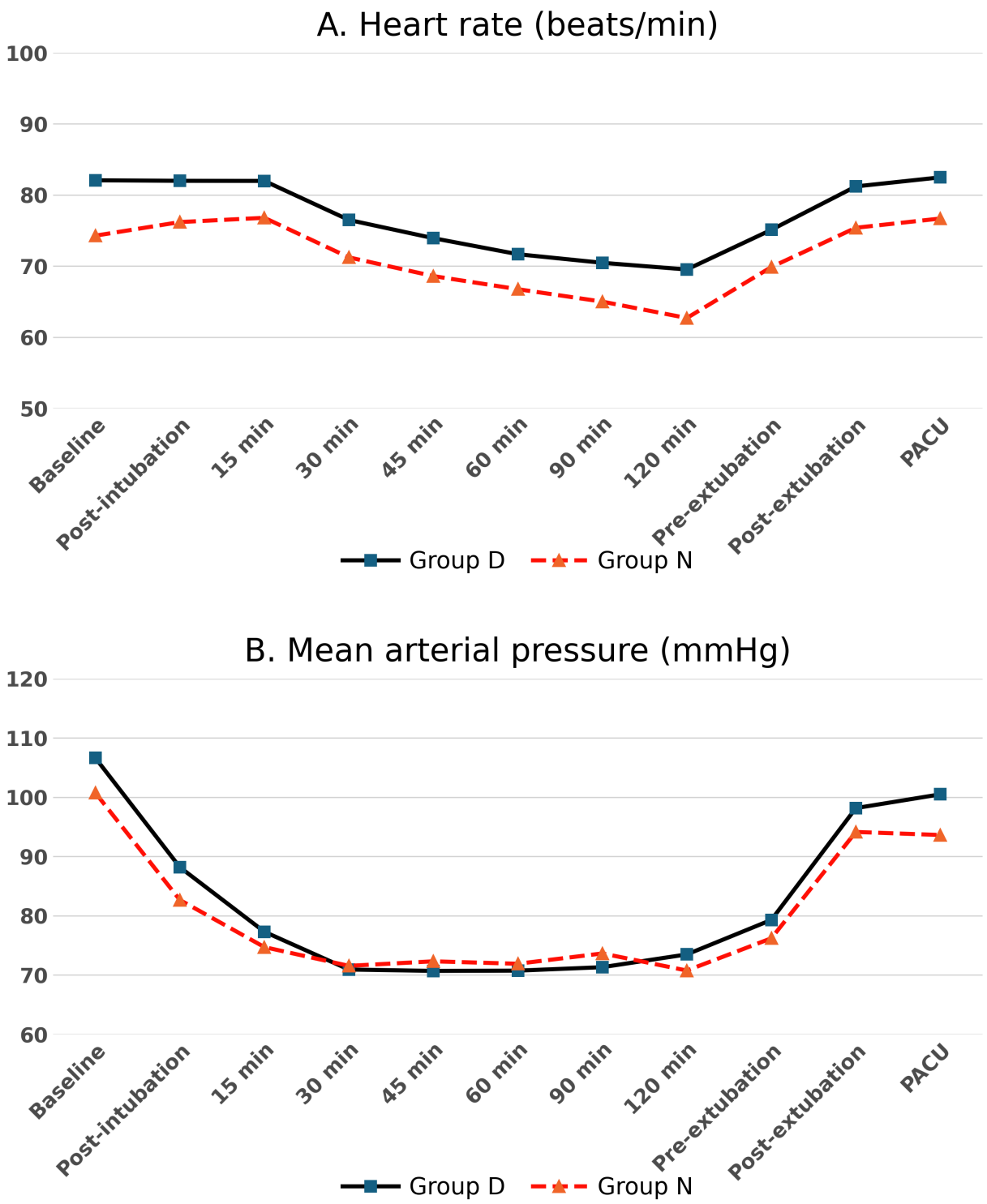


Figure 1

Perioperative trajectories of heart rate and mean arterial pressure, stratified by type 2 diabetes status. (A) Heart rate and (B) mean arterial pressure. Lines represent estimated marginal means derived from linear mixed-effects models. Group D comprised patients with type 2 diabetes mellitus, and Group N comprised patients without diabetes mellitus. PACU, post-anesthesia care unit.

Supplementary Files

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- STROBEcohortchecklist.docx