Med (Zenica) Glas

Medicinski Glasnik

ISSN 1840-2445 (Online); ISSN 1840-0132 (Print)

Medical Association of Zenica-Doboj Canton

Included by: PubMed (MEDLINE), SCOPUS, EMBASE, CNKI and DOAJ.

Type of the paper:	**ORIGINAL ARTICLE**
Running title:	**Kovačević et al.** Anxiety during major abdominal surgery
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DOI:	https://doi.org/10.17392/2164-23-02

Received: 25 March 2026
Revised: 13 May 2026
Accepted: 27 May 2026

ORIGINAL RESEARCH

Perioperative anxiety in major abdominal surgery: analysis of contributing factors using the Hamilton Anxiety Rating Scale (HAM-A)

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Running title: Kovačević et al. Anxiety during major abdominal surgery

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ABSTRACT

Aim: To evaluate factors associated with perioperative anxiety in patients undergoing major abdominal surgery under general anaesthesia (GA) using the Hamilton Anxiety Rating Scale (HAM-A).

Methods: This prospective observational study included 107 adult patients scheduled for major abdominal surgery under GA. Anxiety was assessed preoperatively and postoperatively using the HAM-A. Demographic characteristics, medical history, lifestyle habits, and perioperative variables were analysed. Multivariable analysis was conducted to identify factors independently associated with pre- and postoperative anxiety.

Results: Preoperative anxiety was observed in 54 patients (50.5%), while postoperative anxiety occurred in 34 patients (31.8%). Multivariable analysis identified alcohol consumption (β=8.10, 95%CI: 0.46-14.07; p=0.037), hyperlipoproteinemia (β=1.81, 95%CI: 1.42-2.19; p<0.001), preoperative fasting duration (β=0.03, 95%CI: 0.02-0.04; p=0.005), surgery duration (β= -0.45, 95%CI: -0.74- -0.13; p=0.006), and anaesthesia duration (β=0.43, 95%CI: 0.07-0.70; p=0.015) as factors independently associated with preoperative anxiety. The type of intravenous anaesthetic showed a trend toward significance (β= -5.45, 95%CI: -10.20-0.08; p=0.054). Factors independently associated with postoperative anxiety included age (β=0.08, 95%CI: 0.01-0.17; p=0.018), previous hospitalisations (β=6.43, 95%CI: 3.69-11.86; p < 0.001), previous surgeries (β=8.13, 95%CI: 6.25-14.44; p<0.001), and preoperative fasting duration (β=2.87, 95%CI: 1.90-4.79; p<0.001).

Conclusion: Routine assessment using the HAM-A scale may help identify high-risk patients and guide targeted perioperative strategies, including preoperative counselling and optimization of fasting protocols.

Keywords: counselling, fasting, intravenous anaesthetic, patient experience

INTRODUCTION

Perioperative anxiety is a frequent psychological response among surgical patients, characterised by tension, fear, and apprehension that may occur before, during, or after surgery. This anxiety manifests both psychologically—through worry, uneasiness, or restlessness—and physically—via tachycardia, hypertension, sweating, or gastrointestinal discomfort. Its presence is clinically important as it can influence anaesthetic requirements, hemodynamic stability, postoperative recovery, and patient satisfaction (1).

The reported prevalence of preoperative anxiety varies widely, with studies indicating rates between 10% and 80 %, depending on the type of surgery, patient population, and assessment tool used (2). Major abdominal procedures, such as gastrointestinal resections or hepatobiliary surgeries, are particularly linked to elevated anxiety due to their invasiveness, potential complications, and prolonged recovery periods. Contributing factors include female sex, younger age, low or high educational level, comorbidities (e.g., cardiovascular disease, chronic pain), and prior surgical or hospitalisation experiences (3). Procedural aspects—such as the urgency of surgery, type of anaesthesia, fasting duration, and adequacy of preoperative information—also significantly affect anxiety levels (4-6).

Perioperative anxiety has both physiological and psychological consequences. Activation of the sympathetic nervous system can cause increased heart rate, blood pressure, and stress hormone secretion, potentially complicating anaesthetic management. Moreover, anxiety may impair sleep, lower pain tolerance, delay recovery, and decrease overall satisfaction (7). Recognizing and managing anxiety is therefore a key component of optimal perioperative care.

Validated tools such as the Hamilton Anxiety Rating Scale (HAM-A) are commonly used to quantify anxiety severity by assessing both psychological and somatic components (8). The HAM-

A enables clinicians to identify at-risk patients and apply targeted interventions, including preoperative counselling, pharmacological anxiolysis, and supportive care measures.

Despite its clinical significance, perioperative anxiety among patients undergoing major abdominal surgery remains underexplored. Most previous studies have combined patients from various surgical specialties, limiting insights into the specific stressors associated with major abdominal procedures. Therefore, more focused research in this patient population is needed.

This study aims to evaluate preoperative and postoperative anxiety in adult patients undergoing major abdominal surgery and to identify demographic, clinical, and procedural factors associated with increased anxiety—thereby providing evidence to improve perioperative management strategies.

MATERIAL AND METHODS

Subjects and study design

This prospective observational study was conducted between January and October 2025, following approval by the institutional Ethics Committee (approval No. 00-03-18-8/25, 30 January 2025). Written informed consent was obtained from all participants.

A total of 107 adult patients (≥18 years) scheduled for major abdominal surgery under general anaesthesia (GA) were enrolled, including both elective and urgent procedures. Patients were excluded if they pregnant; had pre-existing psychiatric disorders (defined as previously diagnosed psychiatric conditions according to ICD classification); had a history of recurrent or intermittent episodes of anxiety or depression, even without formal diagnosis; were transferred from the intensive care unit (ICU) or other hospital wards during the current admission; had an American Society of Anaesthesiologists (ASA) physical status ≥ IV; or declined to participate.

Methods

During the study, preoperative, intraoperative, and postoperative variables were collected for all patients.

Preoperative variables encompassed age, gender, body weight, body mass index (BMI), ASA classification, smoking status, and alcohol consumption (any self-reported use including occasional or rare consumption), education level (primary, secondary, or tertiary), comorbidities, previous hospitalisations, prior surgeries or ICU admissions, fasting duration (recorded in hours from the last oral intake to induction of anaesthesia), and type of surgery (elective or urgent).

Intraoperative variables included surgical approach (laparoscopic or open), duration of surgery and anaesthesia, use of a nasogastric tube, urinary catheter, or central venous line, and anaesthetic medications (premedication sedatives, intravenous induction drugs such as propofol or thiopental, muscle relaxant, and opioid administration before intubation, with total dosage recorded).

Postoperative data included postoperative complications (gastrointestinal, respiratory, or bleeding).

Major abdominal surgery was defined as a surgical procedure performed within the peritoneal cavity, excluding primary thoracic involvement, and involving either the resection of a hollow organ or removal of a solid organ related to the gastrointestinal system (9).

Perioperative anxiety was defined as a spectrum of emotional responses, including tension and apprehension, that may occur at any stage of the surgical period (10). Anxiety levels were assessed at two time points using the Hamilton Anxiety Rating Scale (HAM-A): preoperatively (HAM-A 1) and two hours postoperatively (HAM-A 2).

The HAM-A is a clinician-administered instrument consisting of 14 items evaluating both psychological and somatic manifestations of anxiety. These domains include: anxious mood;

tension (e.g., startle response, fatigue, restlessness); fears (of darkness, strangers, crowds); sleep disturbances; cognitive difficulties (poor memory or concentration); depressed mood (loss of interest or pleasure); somatic complaints (pain, stiffness, bruxism); sensory symptoms (tinnitus, blurred vision); cardiovascular symptoms (palpitations, tachycardia); respiratory issues (chest tightness, choking sensations); gastrointestinal symptoms (nausea, abdominal discomfort); genitourinary symptoms (frequent urination, decreased libido); autonomic features (dry mouth, headaches); and observable behaviour during the interview (fidgeting, restlessness). Each item is rated on a scale from 0 (absent) to 4 (severe). A total score above 17 (of 56) indicates mild anxiety, while scores between 25 and 30 represent moderate to severe anxiety (11).

The study flow diagram illustrating patient selection and data collection is presented in Figure 1.

Statistical analysis

All analyses were performed using SPSS (IBM Corp., Armonk, NY, USA). Normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous variables were presented as mean ± SD, and categorical variables as counts and percentages (N, %). Univariable linear regression analyses were performed to examine associations between demographic, clinical, and perioperative variables and pre- and postoperative HAM-A scores, with results reported as mean ± SD, 95% confidence intervals (CI), and p-values. Variables showing significant associations in univariable analysis were included in multivariable linear regression models to identify independent predictors of perioperative anxiety. Model assumptions—including linearity, homoscedasticity, independence of residuals, and absence of multicollinearity—were verified. A p-value < 0.05 was considered statistically significant.

RESULTS

Preoperative anxiety was identified in 54 patients (50.5%), whereas postoperative anxiety was present in 34 patients (31.8%). The mean age of the study population was 54 ± 17 years.

HAM-A 1 scores were significantly associated with alcohol consumption (p=0.009), joint disease (p=0.002), inflammatory bowel disease (p=0.033), hyperlipoproteinemia (p=0.003), and preoperative fasting (p=0.018). Similarly, HAM-A 2 scores showed significant associations with age (p = 0.047), joint disease (p = 0.028), inflammatory bowel disease (p=0.036), previous hospitalisations (p=0.040), prior surgeries (p = 0.010), and fasting duration (p=0.002) (Table 1).

Regarding intraoperative and postoperative variables, HAM-A 1 scores were significantly correlated with the duration of surgery (p=0.005), duration of anaesthesia (p=0.010), and the type of intravenous anaesthetic used (p=0.037). In contrast, HAM-A 2 scores were significantly associated with anaesthesia duration (p=0.046) and the presence of postoperative gastrointestinal complications (p=0.048) (Table 2).

Multivariable analysis identified alcohol consumption (p=0.037), hyperlipoproteinemia (p < 0.001), preoperative fasting duration (p=0.005), duration of surgery (p=0.006), and duration of anaesthesia (p=0.015) as independent predictors of preoperative anxiety. The type of intravenous anaesthetic showed a trend toward significance (p=0.054). The strongest predictors of postoperative anxiety were age (p=0.018), previous hospitalisations (p<0.001), previous surgeries (p<0.001), and preoperative fasting (p<0.001) (Table 3).

DISCUSSION

Perioperative anxiety is a frequent and clinically relevant phenomenon in patients undergoing major abdominal surgery, with potential implications for anaesthetic management, postoperative recovery, and overall patient satisfaction. In this study, preoperative anxiety was observed in 50.5% of patients, while postoperative anxiety was present in 31.8%, which aligns with prevalence rates reported in previous surgical populations (12). The reduction in anxiety following surgery may reflect both the alleviation of anticipatory stress and the effects of perioperative interventions (13).

Our findings indicate that preoperative anxiety is significantly associated with alcohol consumption, hyperlipoproteinemia, fasting duration, surgical and anaesthesia duration, and the type of intravenous anaesthetic administered. Alcohol consumption has previously been linked to heightened anxiety through both neurochemical and psychosocial mechanisms (14). Hyperlipoproteinemia may serve as a surrogate marker for chronic metabolic stress, potentially contributing to increased anxiety levels via systemic inflammatory pathways (15). Chronic dyslipidaemia is associated with persistent low-grade inflammation, endothelial dysfunction, and oxidative stress. These processes may influence neurobiological mechanisms involved in affective and stress-related regulation, including alterations in cytokine signalling and hypothalamic–pituitary–adrenal axis activity (16). These mechanisms highlight the complex interaction between metabolic health and psychological well-being, suggesting that HLP may reflect not only cardiovascular risk but also vulnerability to anxiety-related disorders. In addition to hyperlipoproteinemia, other comorbidities observed in our cohort showed varying associations with perioperative anxiety. Joint diseases and inflammatory bowel disease were significantly associated with increased anxiety levels, likely reflecting their chronic inflammatory nature and

impact on quality of life and psychological well-being. This inflammatory milieu has been linked to alterations in neuroimmune pathways and stress regulation (17), particularly in patients with chronic inflammatory conditions.

In contrast, other common comorbidities such as cardiovascular disease, hypertension, diabetes mellitus, and chronic obstructive pulmonary disease did not show a statistically significant association with anxiety in our study. This may suggest that not all chronic conditions equally influence perioperative psychological responses, and that factors such as disease burden, symptom severity, and chronic pain may play a more prominent role in shaping anxiety levels.

Longer preoperative fasting duration emerged as a modifiable procedural factor; previous studies have similarly shown that extended fasting can exacerbate preoperative stress and discomfort, suggesting that optimization of fasting protocols may help mitigate anxiety (18). Greater anticipated surgical and anaesthetic duration has been linked with higher levels of preoperative anxiety, likely because patients perceive longer procedures as more complex and riskier (19). Additionally, the type of intravenous induction agent showed a trend toward affecting preoperative anxiety, supporting the notion that anaesthetic regimens may influence anxiety levels, consistent with prior reports demonstrating modulation of perioperative stress responses by different anaesthetic approaches (20).

In addition to anaesthetic technique, the pharmacological properties of specific anaesthetic agents may also play an important role in shaping perioperative anxiety responses. Propofol, a widely used intravenous anaesthetic in abdominal surgery, exerts its effects primarily through potentiation of gamma-aminobutyric acid (GABA) receptors, resulting not only in sedation but also in anxiolytic effects (21). Furthermore, preoperative anxiety has been shown to influence anaesthetic requirements, with more anxious patients requiring higher doses of propofol to achieve adequate

anaesthesia (22). However, the overall relationship between anaesthetic agents and anxiety remains complex and may depend on individual patient characteristics, dosing strategies, and perioperative context. Therefore, the associations observed in our study should also be interpreted in light of the anaesthetic regimen used, even though this was not the primary focus of our analysis.

Beyond the primary predictors, several other factors have been consistently identified in the literature as being significantly associated with postoperative anxiety, highlighting the multifactorial nature of patients' emotional responses following surgery (23). Older age has been variably reported as a protective or risk factor for perioperative anxiety, and our findings suggest that in this cohort, advanced age was linked to greater postoperative anxiety, potentially reflecting increased vulnerability to surgical stress and slower physiological recovery (24). Preoperative anxiety was particularly pronounced in patients without prior experience with anaesthesia or surgery, who tended to exhibit higher levels of anxiety, likely due to unfamiliarity with the perioperative environment and uncertainty regarding the procedure (25). Longer preoperative fasting duration has been associated with increased postoperative anxiety, emphasizing how cumulative procedural stressors can adversely affect patients' emotional states (26).

The physiological and psychological consequences of perioperative anxiety are well documented. Anxiety can activate the sympathetic nervous system, increasing heart rate, blood pressure, and stress hormone levels, potentially complicating anaesthetic management and recovery (27). Furthermore, anxiety may impair sleep, reduce pain tolerance, prolong recovery, and decrease overall patient satisfaction, underscoring the need for early recognition and targeted interventions (28). Routine assessment using validated instruments such as the HAM-A enables clinicians to quantify anxiety and address both psychological and somatic components (29). In the perioperative

context, HAM-A has been successfully applied to identify at-risk patients and guide interventions, including preoperative counselling and enhanced perioperative support (30).

Our findings support a multifactorial model of perioperative anxiety, encompassing demographic, clinical, and procedural factors. Modifiable elements such as preoperative fasting duration, adequacy of preoperative information, and patient counselling represent actionable targets for intervention. Incorporating systematic anxiety screening into preoperative protocols may improve patient-centred outcomes and optimize perioperative care.

Limitations of this study include the single-country setting and relatively modest sample size of 107 patients, which may limit the generalisability of the findings. A smaller sample size may also reduce the statistical power to detect certain associations, particularly for less frequent variables. Additionally, we did not systematically assess intraoperative anaesthetic depth or postoperative pain scores, which could also influence anxiety levels. Future studies should consider larger, multicentre cohorts and include both physiological and psychosocial correlates of perioperative anxiety.

CONCLUSION

In conclusion, perioperative anxiety is common among patients undergoing major abdominal surgery and is influenced by a combination of demographic, clinical, and procedural factors. Early identification and targeted management strategies, informed by tools such as HAM-A, have the potential to improve perioperative experience and outcomes.

Funding: No specific funding was received for this study.

Conflicts of interest: None to declare.

Author contributions (CRediT): Conceptualization—M.K.; Methodology—M.K., A.A.B.; Formal analysis—J.S.; Investigation—M.K., A.A.B.; Data curation—A.O.; Writing – original draft—M.K.; Writing – review & editing—M.K., J.S., F.K.; Supervision—M.K.; Project administration—F.K.; Funding acquisition—M.K.

Ethics statement: The study was approved by the institutional Ethics Committee (approval No. 00-03-18-8/25; January 30, 2025). Written informed consent was obtained from all participants.

Data availability statement: The data supporting the findings of this study are available from the corresponding author upon reasonable request and with permission of the institution.

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TABLES AND FIGURES

Table 1. Univariable analysis of preoperative contributing variables

Variable			HAM-A 1	HAM-A 2
		N (%) or Mean ± SD	β (95% CI); p-value	β (95% CI); p-value
Age (per 10 years)		54 ± 17	0.17 (-0.01-0.48); 0.066	0.17 (0.04-0.26); 0.047
Gender	Female	64 (59.8)	ref.	ref.
	Male	43 (40.2)	1.88 (-1.28-3.66); 0.210	2.89 (-4.10-6.45); 0.655
BW (per 10 kg)		79.4 ± 12	0.87 (-0.40-2.09); 0.457	0.88 (-0.20-1.06); 0.296
BMI (per 1 kg/m²)		32 ± 4.3	0.11 (-0.06-0.20); 0.229	1.07 (-0.18-1.90); 0.159
ASA status	I	19 (17.8)	ref.	ref.
	II	76 (71.0)	-1.87 (-5.58-1.17); 0.090	-2.76 (-7.82-1.04); 0.131
	III	12 (11.2)	-2.10 (-6.21-3.01); 0.471	0.89 (-2.12-2.04); 0.433
Education	Primary	8 (7.5)	ref.	ref.
	Secondary	63 (58.9)	2.10 (-3.42-4.15); 0.848	-1.73 (-2.52-1.48); 0.603
	Tertiary	36 (33.6)	2.02 (-1.89-3.22); 0.321	2.23 (-1.07-3.87); 0.421
Smoking		43 (40.2)	1.87 (-1.46-2.26); 0.201	-1.54 (-4.63-2.10); 0.453
Alcohol consumption		12 (11.2)	5.11 (2.56-9.71); 0.009	3.27 (-3.94-9.36); 0.417
Comorbidities	COPD	3 (2.8)	2.36 (-1.94-5.44); 0.808	2.33 (-1.02-3.98); 0.742
	CVD	7 (6.5)	3.22 (-2.84-7.35); 0.858	2.65 (-1.92-4.63); 0.838
	HTN	104 (97.2)	0.66 (-1.31-1.54); 0.757	-1.88 (-3.57-2.33); 0.758
	DM	14 (13.1)	-1.32 (-7.99-2.05); 0.318	4.55 (-5.32-11.63); 0.458
	JD	6 (5.6)	2.72 (1.71-3.36); 0.002	4.47 (1.62-8.92); 0.028
	IBD	6 (5.6)	5.21 (3.53-8.58); 0.033	3.22 (1.52-4.29); 0.036
	HLP	8 (7.5)	2.87 (1.78-3.57); 0.003	0.36 (-1.99-2.45); 0.970
Previous hospitalisation		55 (51.4)	1.98 (-1.55-2.21); 0.456	2.72 (0.89-4.32); 0.040
Previous operation		46 (43.0)	0.65 (-1.13-3.68); 0.664	6.87 (0.87-12.27); 0.010
Previous ICU stay		19 (17.7)	-1.44 (-3.78-1.57); 0.243	5.32 (-0.44-9.26); 0.074
Fasting (hours)		10.5 ± 3.2	2.01 (1.00-4.67); 0.018	2.66 (1.21-3.09); 0.002
Emergency		44 (41.1)	2.87 (-5.07-8.39); 0.621	1.18 (-4.28-2.84); 0.686

HAM-A 1, Hamilton Anxiety Rating Scale score preoperatively; HAM-A 2, Hamilton Anxiety Rating Scale score postoperatively; CI, confidence interval; BW, body weight; BMI, body mass index; ASA status, American Society of Anaesthesiologists physical status; COPD, chronic obstructive pulmonary disease; CVD, cardiovascular disease; HTN, hypertension; DM, diabetes mellitus; JD, joint disease; IBD, inflammatory bowel disease; HLP, hyperlipoproteinemia; NGT presence, nasogastric tube presence; CVL presence, central venous line presence; Opioid before ETI, opioid before endotracheal intubation

Table 2. Univariable analysis of intraoperative and postoperative contributing variables

Variable			HAM-A 1	HAM-A 2
		N (%) or Mean ± SD	β (95% CI); p-value	β (95% CI); p-value
Laparoscopic		61 (57.0)	0.64 (-1.33-1.75); 0.783	-0.33 (-1.16-0.46); 0.396
NGT presence		19 (17.8)	-1.71 (-4.46-4.24); 0.399	-2.65 (-3.63-4.15); 0.893
Urinary catheter		7 (6.5)	-4.22 (-8.92-7.41); 0.384	-8.62 (-13.12-2.81); 0.413
CVL presence		5 (4.6)	2.18 (-5.84-3.43); 0.354	3.01 (-2.54-5.82); 0.082
Surgery length (min)		57.13 ± 26.83	-0.88 (-1.59--0.30); 0.005	-0.37 (-0.66-0.02); 0.066
Anaesthesia length (min)		66.53 ± 26.75	0.84 (0.21-1.48); 0.010	0.31 (0.03-0.67); **0.046**
Anaesthesia medication				
Preoperative sedation		68 (63.6)	2.38 (-4.89-7.37); 0.686	-2.77 (-4.50-1.97); 0.436
Intravenous anaesthetic	Propofol	91 (85.0)	ref.	ref.
	Thiopental	10 (9.3)	3.81 (-2.35-6.77); 0.233	2.73 (-1.81-4.29); 0.320
	Etomidate	4 (3.7)	-7.10 (-16.21--0.51); 0.037	1.89 (-4.54-3.76); 0.851
	Other	2 (1.9)	-2.71 (-4.86-1.55); 0.236	-1.90 (-2.81-1.31); 0.281
Relaxant	Atracurium	19 (17.5)	ref.	ref.
	Pancuronium	35 (32.7)	-2.39 (-4.88-2.10); 0.211	2.87 (-1.76-3.89); 0.420
	Vecuronium	38 (35.5)	-1.88 (-5.42-4.20); 0.801	1.03 (-3.06-2.03); 0.686
	Rocuronium	15 (14.0)	4.35 (-1.22-6.55); 0.441	3.89 (-2.07-5.48); 0.338
Opioid before ETI		68 (63.5)	0.09 (-0.02-0.17); 0.051	0.02 (-0.02-0.06); 0.344
Total dose of opioid (μg)		650 ± 50	-0.02 (-0.04-0.05); 0.810	0.01 (-0.04-0.04); 0.178
Complications				
Gastrointestinal		15 (14.0)	-1.81 (-4.96-2.51); 0.158	-3.10 (-9.28--0.03); 0.048
Respiratory		3 (2.8)	3.44 (-4.55-9.66); 0.686	-1.41 (-7.51-5.30); 0.730
Bleeding		3 (2.8)	-2.39 (-9.89-6.77); 0.768	1.03 (-3.28-2.41); 0.146

HAM-A 1, Hamilton Anxiety Rating Scale score preoperatively; HAM-A 2, Hamilton Anxiety Rating Scale score postoperatively; CI, confidence interval; NGT presence, nasogastric tube presence; CVL presence, central venous line presence; Opioid before ETI, opioid before endotracheal intubation;

Table 3. Multivariable analysis of factors contributing to perioperative anxiety

Variable / scale	HAM-A 1
	β (95% CI); p-value
Alcohol consumption	8.10 (0.464-14.07); 0.037
HLP	1.81 (1.42-2.19); <0.001
Fasting	0.03 (0.02-0.04); 0.005
Surgery length	-0.45 (-0.74--0.13); 0.006
Anaesthesia length	0.43 (0.07-0.70); 0.015
Intravenous anaesthetic	-5.45 (-10.20-0.08); 0.054
Variable / scale	**HAM-A 2**
	β (95% CI); p-value
Age	0.08 (0.01-0.17); 0.018
Previous hospitalisation	6.43 (3.69-11.86); <0.001
Previous operation	8.13 (6.25-14.44); <0.001
Fasting	2.87 (1.90-4.79); <0.001

HAM-A 1, Hamilton Anxiety Rating Scale score preoperatively; HAM-A 2, Hamilton Anxiety Rating Scale score postoperatively; CI, confidence interval; HLP, hyperlipoproteinemia;

Figure:

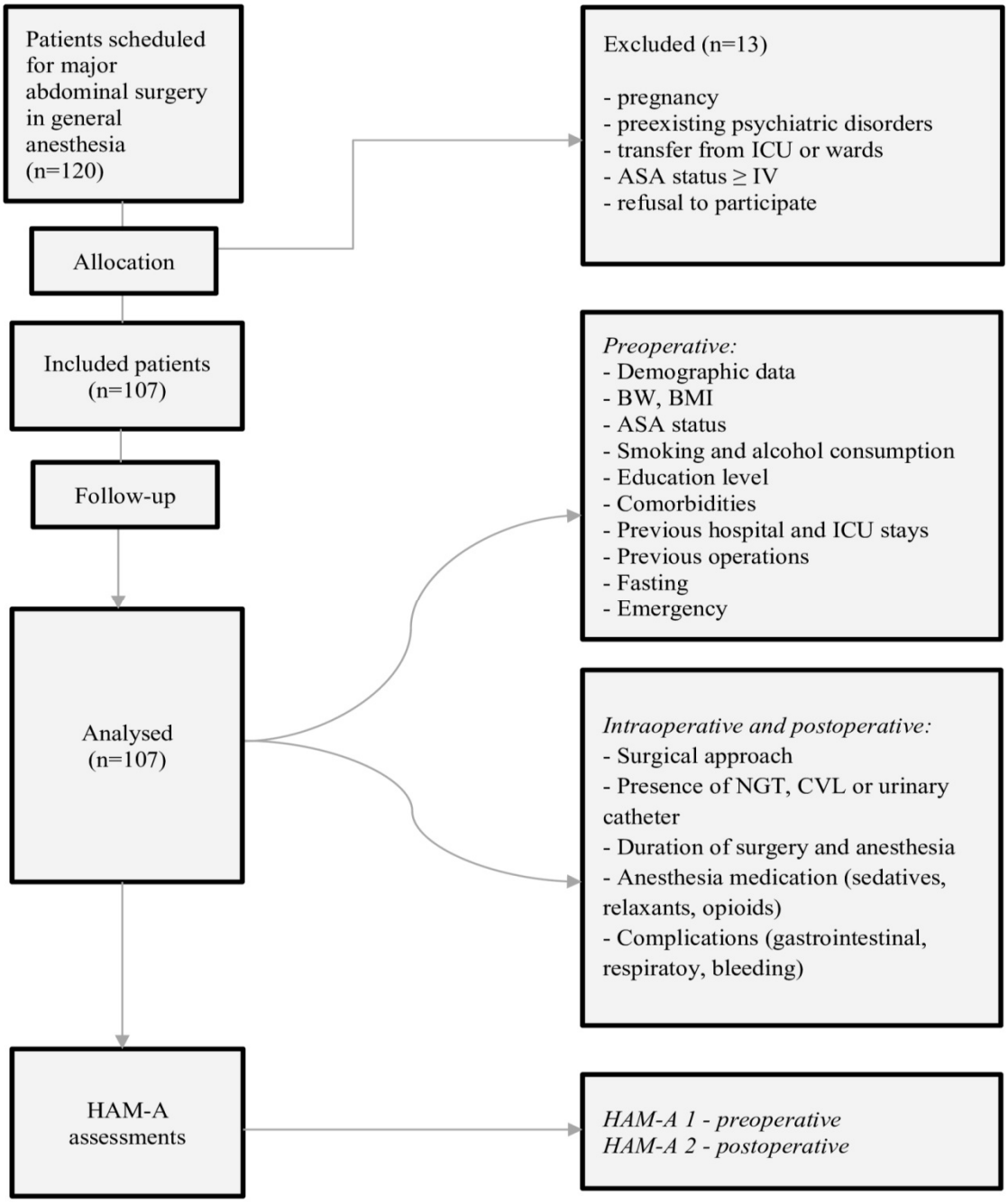

Figure 1. Flow diagram of the study design

ICU, intensive care unit; ASA status, American Society of Anaesthesiologists physical status; BW, body weight; BMI, body mass index; NGT, nasogastric tube; CVL, central venous line; HAM-A, Hamilton Anxiety Rating Scale score