

Postoperative quality of recovery in older adults undergoing elective surgery (PQoRE study): a prospective cohort study protocol based on patient-reported outcome measures

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Abstract

Background Postoperative quality of recovery is a multidimensional process, particularly relevant in very old patients, where functional independence, well-being, and symptom burden are critical. Traditional clinical outcomes may not fully capture the patient's perspective. The Quality of Recovery questionnaire (QoR-15) offers a structured tool to assess patient-reported recovery. This study aimed to evaluate postoperative recovery in individuals aged 80 years and older undergoing elective surgery in tertiary hospitals in Spain, identifying factors associated with poor recovery and informing patient-centered perioperative care.

Methods We will conduct a prospective, multicenter observational study including patients aged ≥ 80 years scheduled for elective surgery requiring hospital admission. Recovery will be assessed using the Spanish version of the QoR-15 (QoR-15E) preoperatively and at multiple postoperative time points. Frailty will be assessed using the Clinical Frailty Scale (CFS), and sociodemographic, clinical, comorbidity and surgical variables will be collected. Longer-term clinical outcomes, including readmissions and survival, will be assessed during follow-up. Statistical analyses will evaluate changes in QoR-15E scores over time and associations between patient and perioperative characteristics and postoperative recovery, with multivariable analyses used to identify factors independently associated with poor recovery.

Trial registration This study was registered at ClinicalTrials.gov (NCT07505758) on 22/02/2024.

Keywords Older adult · QoR-15 / QoR-15E · frailty · Postoperative recovery · Patient-centered care

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Introduction

A satisfactory postoperative recovery is a cornerstone of high-quality perioperative care. Traditionally, the assessment of postoperative outcomes has focused on objective clinical indicators such as physiological parameters, surgical duration, postoperative morbidity and mortality, length of hospital stays and readmission rates [1]. While these indicators are essential for evaluating healthcare quality, they often overlook the patient's own perception of recovery, which is a critical component of patient-centered care [2, 3].

Over the past two decades, there has been growing interest in incorporating patient-reported outcome measures (PROMs) into perioperative evaluation. These tools aim to assess dimensions such as emotional well-being, physical comfort, pain control and the ability to return to activities of daily living. Among them, the Quality of Recovery questionnaire (QoR-40), developed by Myles et al. in 2000, represented a major advance by providing a structured method to evaluate postoperative recovery from the patient's perspective [4]. However, due to its length and complexity, its routine application in clinical practice was limited. To improve feasibility, a shorter version, the QoR-15, was later developed and validated [5]. This tool keeps the conceptual framework of the original questionnaire while offering improved usability and faster completion. The QoR-15 has been widely adopted internationally and recommended by perioperative quality initiatives due to its strong psychometric properties and clinical applicability [3, 6]. Moreover, it has been translated and culturally adapted into multiple languages, including Spanish. Recently, our research group completed the cross-cultural adaptation and validation of the Spanish version (QoR-15E), demonstrating its reliability and validity in Spanish-speaking populations [7].

Postoperative recovery in older patients

Population ageing is a global phenomenon, leading to a substantial increase in the number of elderly patients undergoing surgery. In the last decades older adults, especially those aged 80 years and above, represent the fast-growing surgical population [8]. This group is characterized by increased vulnerability due to age-related physiological decline and the presence of frailty, a multidimensional syndrome associated with reduced physiological reserve and increased susceptibility to adverse outcomes [9, 10].

Currently, prehabilitation programs have been introduced as a strategy to optimize patients' physical and psychological status before elective surgery. These interventions have demonstrated benefits in reducing postoperative complications, length of hospital stay and readmission rates, effects that are particularly relevant in elderly populations [11]. However, despite their growing implementation, the impact of such programs on patient-perceived recovery has not been adequately assessed. In this context, the systematic evaluation of postoperative recovery from the patient's perspective using validated instruments such as the QoR-15 becomes highly relevant.

The aim of this study is to evaluate postoperative quality of recovery from the perspective of patients aged 80 years and older undergoing elective surgery requiring hospital admission. By identifying factors associated with poor perceived recovery, this study aims to contribute to the optimization of perioperative care and to support more individualized, patient-centered clinical decision-making in older surgical patients.

Methods and analysis

Objectives

The primary objective of this study is to evaluate postoperative quality of recovery using the Spanish version of the Quality of Recovery questionnaire (QoR-15E) in patients aged 80 years and older undergoing elective surgery with hospital admission.

The secondary objectives are: (1) to identify factors and challenges that affect postoperative recovery in patients aged 80 years and older; and (2) to support the improvement of Enhanced Recovery After Surgery (ERAS) and multimodal prehabilitation programs specifically adapted for elderly patients.

We hypothesize that postoperative quality of recovery, as assessed by the QoR-15E, will vary over the postoperative period in patients aged 80 years and older undergoing elective surgery. We further hypothesize that greater preoperative frailty and other patient- and surgery-related characteristics will be associated with poorer postoperative quality of recovery.

Study design and setting

This is a prospective, observational, multicenter cohort study. The study will be conducted in four tertiary university hospitals in Spain: Hospital Vall d'Hebron (Barcelona), Hospital de la Santa Creu i Sant Pau (Barcelona), Hospital Clínic Barcelona (Barcelona) and Hospital del Mar (Barcelona). All these participating hospitals attend a diverse and representative population of older patients undergoing elective surgery, allowing for comprehensive assessment of postoperative recovery across multiple clinical environments in Spain. The study protocol adheres to the STROBE Statements checklist (supplemental file 1).

Study population

The study will consecutively include patients aged 80 years and older who are scheduled for elective surgery requiring hospital admission. Only those who can understand the study procedures and provide written informed consent will be approached.

Patients will be excluded if they do not speak Spanish, have pre-existing cognitive impairment, are undergoing urgent or emergency surgery, are scheduled for neurosurgical or cardiac procedures, or are undergoing outpatient surgery without hospital admission.

Participant selection and inclusion

Prior to inclusion, all participants will review, sign and date the most current Local Ethics Committee-approved written informed consent form. Informed consent forms for enrolled participants, as well as for those screened but not subsequently included, will be securely maintained at each study site in accordance with local data protection and governance regulations.

All screening assessments, including verification of eligibility criteria, will be completed and reviewed to ensure that each participant meets the study inclusion and exclusion criteria before enrollment. This process will guarantee that the study population is appropriate, representative and eligible to contribute valid data for the evaluation of postoperative recovery in elderly surgical patients.

Study procedures

At the preoperative visit, clinical frailty will be assessed using the Clinical Frailty Scale (CFS). Sociodemographic and baseline clinical data will also be collected at this stage. On the day of surgery, during the pre-admission process, included patients will be provided with the QoR-15E questionnaire to complete prior to their procedure.

During the postoperative period, the QoR-15E questionnaire will be administered 24 h, 48 h, 7 days and 30 days after surgery. Research team members will visit patients in person on the hospital wards to ensure questionnaire completion. For patients discharged home or transferred to a convalescence or rehabilitation facility, follow-up will be conducted by telephone using the contact information provided by the patient or recorded in the medical chart. When a participant is unable to complete a scheduled QoR-15E assessment, the reason for

Fig. 1 Abbreviations: Confusion Assessment Method – CAM, Spanish Quality of Recovery questionnaire – QoR-15E, T0 (preoperative baseline), T1-T2-T3-T4 (postoperatively at 24 h, 48h, 7 days and 30 days), Postoperative Morbidity Survey-POMS, Electronic medical records – EMR

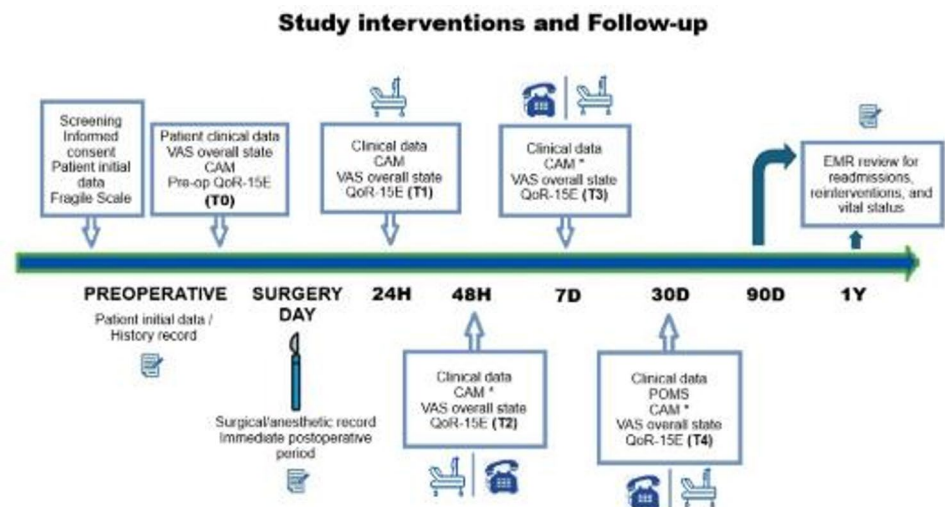


Table 1 Scheduled visits and activities

Study Activity	Pre-op visit	Day of surgery	24 h post-op	48 h post-op	Day 7 post-op	Day 30 post-op	Day 90 post-op	1 year post-op
Sociodemographic data	X							
Clinical frailty (CFS)	X							
Clinical data	X	X	X	X	X	X	X	X
Multimodal prehabilitation	X							
QoR-15E questionnaire		X	X	X	X	X		
Confusion Assessment Method (CAM)		X	X	X*	X*	X*		
Postoperative Morbidity Survey (POMS)						X		
Laboratory results	X						X	X
Pain assessment		X	X	X	X	X		
Medication	X				X	X		
Follow-up outcomes							X	X

* CAM assessment is performed only if the patient remains hospitalized at the corresponding time point

non-completion will be recorded whenever possible, including postoperative delirium or cognitive impairment, clinical deterioration, inability to communicate, refusal, or other reasons.

Acute postoperative confusion or delirium will be assessed using the Confusion Assessment Method (CAM) starting at the preoperative visit and throughout the postoperative hospitalization until discharge. Postoperative complications will be systematically recorded using the Postoperative Morbidity Survey (POMS), covering respiratory, infectious, renal, gastrointestinal, cardiovascular, neurological, hematological complications, surgical wound complications and postoperative pain. Other clinical data, including vital signs, medications, and laboratory results, will also be recorded as part of routine care. Study interventions and follow-up are graphically presented at Fig. 1.

Long-term follow-up at 90 days and 1 year will focus on vital status, hospital re-admissions and any surgical reinterventions, collected exclusively from medical records, without direct contact with patients or relatives at these time points. A summary of scheduled visits and study activities is presented in Table 1

Variables

Preoperative variables

- Demographics: Age, sex, weight, height, and body mass index (BMI).
- Lifestyle habits: Active smoking, previous smoking, current or prior alcohol consumption.
- Medical history: Hypertension, diabetes mellitus, hyperlipidemia, chronic obstructive pulmonary disease, asthma, ischemic heart disease, atrial fibrillation, stroke, peripheral vascular disease, renal insufficiency, anemia, hypothyroidism, anxiety syndrome and depressive syndrome.
- Chronic treatments: Benzodiazepines, antidepressants, antihypertensives, lipid-lowering agents, anticoagulants, antiplatelets, oral antidiabetics, insulin, thyroid hormone replacement, analgesic and inhaled respiratory medications.
- Preoperative assessment: American Society of Anesthesiology (ASA) classification, Clinical Frailty Scale (CFS), visual analog scale (VAS) for global perceived health.
- Laboratory tests: Hemoglobin, creatinine, estimated glomerular filtration rate (eGFR), hemoglobin A1c.
- Prehabilitation interventions: Optimization of anemia, functional status, nutrition, and psychological preparation.
- Patient-reported recovery baseline: QoR-15E questionnaire.
- Surgical indication and characteristics: Current diagnosis, surgical specialty, oncologic diagnosis.

Intraoperative variables

- Surgical extension: Minor-intermediate, or major.
- Type of anesthesia: Sedation, sedation + local anesthesia, general anesthesia, central regional anesthesia, peripheral regional anesthesia, combined general anesthesia.
- Epidural catheter placement: Yes/No.
- Surgical duration: Minutes.
- Surgical technique: Open, laparoscopic, robot-assisted laparoscopic, endoscopic, endovascular, arthroscopic.
- Anesthesia duration: Minutes.
- Prophylactic antiemetic administration: Yes/No.
- Intraoperative medication use: Opioids (Yes/No), benzodiazepines (Yes/No).

Postoperative variables

- Pain assessment prior to discharge to the hospital ward following surgery.
- Global perceived recovery: at 24h, 48h, day 7, and day 30 postoperatively.
- QoR-15E questionnaire: at 24h, 48h, day 7, and day 30 postoperatively.
- Recovery milestones: Time to oral intake tolerance, duration of post-anesthesia care unit (PACU) stay (hours), total hospital stay (days).
- Postoperative complications (POMS): Pulmonary, infectious, renal, gastrointestinal, cardiovascular, neurological, hematological, pain, surgical wound dehiscence, surgical site infection.
- Blood transfusion requirements: Yes/No; number of packed red blood cell units.
- Surgical reintervention: Yes/No.
- Hospital readmission: Yes/No, up to 90 days post-surgery.

- Mortality: In-hospital mortality (cause of death), mortality at 30 days, 90 days, and 1 year; cause of death recorded for each time point.
- Long-term follow-up (90 days and 1 year): Vital status, surgical reinterventions, and hospital readmissions collected from medical records and patient contact.

Outcome measures

Participants will be assessed at hospital discharge for mortality; length of hospital stay and postoperative complications. Following discharge, they will be contacted by the research team by telephone to complete the QoR-15E questionnaire at the predefined postoperative time points: 24 h, 48 h, day 7, or day 30 depending on the study schedule and patient's discharge timing. For longer-term follow-up (for 90 days or 1 year), no direct contact with patients or their relatives will be made. At these points, follow-up will be conducted through review of electronic medical records to verify readmissions, reinterventions, and vital status.

Data collection and management

Data collection will be performed by the investigators at each participating center. Data will be collected using Case Report Form (CRF) designed exclusively for this study. Variables will be obtained from the electronic medical record, including clinical observations, medication records, physician and nursing notes, routine laboratory results and information gathered through direct patient interviews and observation. Once collected, all data will be entered into a secure electronic database (www.clinapsis.com) created specifically for this study. Before study initiation, all investigators and support staff will undergo training to standardize data acquisition and ensure uniform application of study procedures. Throughout the study, monitoring will be conducted to maintain adherence to the protocol and ensure data quality.

To maintain confidentiality, all identifiable patient information will be pseudonymized, with each participant assigned a unique study number. Access to the database will be restricted to research personnel with personal usernames and passwords and only the principal investigator will have full access to the entire dataset.

Statistical considerations

Sample size calculation and recruitment feasibility

The sample size was determined considering both the statistical requirements for the primary outcome and recruitment feasibility across the participating centers. Based on previously reported QoR-15 distributions [12–14], an expected standard deviation of approximately 16 points was considered. Assuming a clinically relevant difference of 8 points, a two-sided significance level of 0.05, and 90% power, approximately 170 evaluable participants would be required. The planned sample of 800 participants substantially exceeds this minimum and will provide adequate precision for the assessment of postoperative recovery trajectories and the planned multivariable analyses.

Recruitment feasibility was initially estimated based on the surgical activity at the coordinating center, Hospital Universitari Vall d'Hebron. Based on approximately 490 elective surgical procedures performed annually in patients aged 80 years and older, and assuming that around 50% of patients would meet the main eligibility criteria, approximately 245 patients per year were expected to be potentially eligible for inclusion. Assuming a consent rate of approximately 45%, recruitment of around 100 participants per year at the coordinating center was considered feasible. Following expansion of the study to three additional tertiary university hospitals with comparable surgical activity, an overall recruitment rate of approximately 400 participants per year was projected.

Over the planned 2-year recruitment period, this would allow recruitment of approximately 800 participants. Potential losses to follow-up of approximately 10–15% were also considered in the recruitment strategy.

Statistical analysis

A descriptive analysis will be performed for all variables. Categorical variables will be summarized as absolute and relative frequencies, while continuous variables will be reported as mean $\pm$ standard deviation or median and interquartile range, depending on the distribution of the variable. To explore the relationship between a continuous variable and a dichotomous categorical variable, the Student's t-test will be used for normally distributed variables, and the Mann–Whitney U test if normality assumptions are not met. Associations between categorical variables will be assessed using the Pearson chi-square test or the Fisher exact test, as appropriate. For comparisons of quantitative variables across different time points, repeated measures ANOVA will be applied if normality assumptions are satisfied; otherwise, the non-parametric Friedman test will be used. The longitudinal evolution of QoR-15E scores will be analyzed using linear mixed-effects models to account for the correlation between repeated measurements within the same participant. Time will be modeled as a fixed effect and participant as a random effect. The multivariable models will include clinically relevant covariates selected a priori based on the study objectives and existing evidence, which may include age, sex, preoperative frailty, relevant comorbidities, surgical characteristics, type of anesthesia, prehabilitation interventions, and postoperative complications. Participating centers will be included as a fixed effect to account for potential differences among the four hospitals. Adjusted regression coefficients with 95% confidence intervals will be reported to quantify the independent association between each predictor and QoR-15E scores. Where clinically relevant, interactions between time and selected predictors, particularly frailty and postoperative complications, will be explored to determine whether their associations with recovery vary over the postoperative period. Model assumptions, collinearity among candidate predictors, and goodness of fit will be assessed.

Missing QoR-15E assessments will be described by follow-up time point and, whenever available, according to the reason for non-completion, including postoperative delirium or cognitive impairment, clinical deterioration, inability to communicate, or refusal. Longitudinal mixed-effects models will include all available QoR-15E measurements, allowing participants with incomplete repeated assessments to contribute available data without being automatically classified as lost to follow-up. Patterns and reasons for missing data will be examined and sensitivity analyses will be considered where appropriate to assess the potential impact of informative missingness. A two-sided p value < 0.05 will be considered statistically significant. All analyses will be performed using SPSS Statistics version 29.0 (IBM Corp., Armonk, NY, USA).

Discussion

Advances in medicine, the adoption of healthy lifestyle habits and the consistent application of bio-psycho-social measures are contributing to a continuous increase in life expectancy. As a result, the demand for surgical procedures among elderly patients is constantly growing, motivated by both the wish to maintain quality of life and the responsibility of healthcare systems to provide effective and appropriate care [8]. Despite this, evidence of postoperative recovery in older populations, particularly those aged 80 years and above, remains limited. In this context, our study provides novel insights into postoperative recovery from the perspective of this frequently underrepresented group of patients. By integrating patient-reported outcomes with clinical variables, our findings will contribute to a more comprehensive evaluation of recovery that extends beyond traditional endpoints.

Frailty appears as a key determinant of postoperative recovery in very old patients. Rather than chronological age alone, frailty captures the cumulative decline in physiological reserve and resilience and has been consistently associated with adverse outcomes, including complications, prolonged recovery and mortality [8–10, 15]. Despite its recognized prognostic value, frailty assessment is not yet systematically embedded in perioperative

care settings. Our results may support its integration into routine risk stratification, particularly in the context of an ageing surgical population with increasing clinical complexity. Previous studies in very old and nonagenarian surgical populations have mainly focused on traditional outcomes such as surgical risk, mortality and survival [16–18], whereas patient-reported postoperative recovery in this population remains less well characterized.

The implementation of the QoR-15E questionnaire provides a standardized, patient-centered approach to assessing recovery [7]. Previous research has demonstrated that QoR-15 scores are sensitive to clinical changes and correlate with postoperative morbidity and complications [4, 5, 19]. In this context, our study may extend existing evidence by applying this instrument to a cohort of very elderly patients, providing insights into how recovery is perceived in this specific population. The follow-up assessment at multiple postoperative time points reinforces the concept of recovery as a dynamic and evolving process rather than a single outcome measurement. Of note, our findings may highlight the potential discrepancy between clinical outcomes and patient-perceived recovery. While traditional indicators such as morbidity and length of stay remain essential for evaluating surgical quality [3], they may not fully reflect aspects that are highly relevant to older adults, including functional independence, symptom burden and overall well-being [1, 2]. This reinforces the need to incorporate PROMs into perioperative evaluation frameworks, as recommended by international initiatives focused on patient-centered outcomes [2, 3].

Another relevant aspect is the interaction between perioperative optimization strategies and perceived recovery. Prehabilitation programs have demonstrated benefits in improving clinical outcomes in high-risk populations [11]. However, their effect on subjective recovery remains less well established. Similarly, improved recovery pathways have increasingly emphasized patient-reported outcomes as key indicators of quality of care [2, 3]. In this context, our results may suggest that evaluating both clinical and patient-reported endpoints may provide a more complete understanding of the effectiveness of these interventions. Recovery in elderly patients is often prolonged and heterogeneous, and short-term outcomes may not adequately reflect progression over time. By incorporating assessments up to one year, using clinical endpoints such as readmissions and survival, our study may provide a broader perspective on recovery and its long-term implications.

From a healthcare system's perspective, these findings align with the principles of value-based care, which emphasize outcomes that matter most to patients while considering resource utilization [2, 3]. The routine implementation of PROMs such as the QoR-15E may facilitate early identification of patients at risk of poor recovery, supporting targeted interventions and more efficient allocation of healthcare resources. Furthermore, incorporating patient-reported outcomes into clinical practice may improve communication and support shared decision-making, which is particularly relevant in complex surgical decisions involving frail elderly patients [20, 21]. Future studies should determine whether standardized care-related data routinely captured in electronic health records explain additional variation in recovery beyond frailty, comorbidity and surgical characteristics, thereby improving the multidimensional characterization and risk stratification of older surgical patients [22–27].

Implications for practice and future research

The identification of factors associated with poor patient-reported recovery may support more individualized perioperative care in elderly patients. Incorporating QoR-15E into routine assessment could facilitate early detection of suboptimal recovery and guide targeted interventions, including rehabilitation and follow-up strategies. Future research should focus on determining whether interventions that improve clinical outcomes also translate into meaningful improvements in patient-perceived recovery, particularly in frail and elderly populations. Future studies should also consider whether missed nursing care contributes to differences in patient-reported recovery that are not fully explained by frailty, clinical characteristics, or surgical factors [28].

Strengths and limitations

Our study has several strengths. First, to our knowledge, this is the first study conducted in tertiary hospitals in Spain to specifically evaluate postoperative recovery from the patient's perspective in individuals aged 80 years and older. Second, the prospective and multicenter design and inclusion of a heterogeneous elderly population may allow the generalizability of our findings to similar healthcare systems. Third, the use of validated and culturally adapted PROMs ensures a robust assessment of patient-perceived recovery. Fourth, an initial cohort of 103 patients was included early in the study period, allowing an internal assessment of feasibility and data collection procedures. These patients were recruited according to the study protocol and will form part of the final study cohort. This initial experience supported the adequacy of the study design and suggested that the protocol is feasible and performs appropriately in routine clinical practice, particularly regarding the implementation of patient-reported outcome measures such as the QoR-15E. No formal analysis of study outcomes was performed to inform or modify the study hypotheses or statistical analysis plan, and no data-driven modifications to the protocol or planned analyses were made. Finally, the longitudinal design, with repeated measurements and extended long-term follow-up, allows a systematic evaluation of recovery trajectories over time.

Our study also has some limitations which should be considered. First, the restriction to Spanish-speaking patients may limit external generalizability to other countries. Second, the exclusion of some surgical populations, such as urgent or emergency cases and highly specialized procedures like neurosurgery and cardiac surgery, may limit the applicability of our findings to broader surgical settings. Third, despite efforts to monitor postoperative delirium, pre-existing or postoperative cognitive impairment may still affect patients' ability to complete questionnaires in some cases. Finally, as an observational study, the influence of unmeasured confounders cannot be entirely ruled out, despite adjustment for known risk factors.

Abbreviations

QoR	Quality of Recovery questionnaire
ERAS	Enhanced Recovery After Surgery
CFS	Clinical Frailty Scale
CAM	Confusion Assessment Method
POMS	the Postoperative Morbidity Survey
CRF	Case Report Form

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1186/s12877-026-08420-8>.

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Author contributions VMA as principal Investigator and coordinator of the study wrote the first draft of the protocol manuscript. VMA, EP and MdN developed conceptualization and the design of the study. VMA, YLA, RR, FD, GAC, SBH, LAC, PGM, AFM, GMHC, DPG, MdM, PCL, MGR, AF, MMFDB, HRI and SA contributed to the implementation of the protocol. All authors reviewed the manuscript, provided critical revisions and approved the final version. MdN obtained funding for this work.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate The study protocol was approved by the Ethics Committee of Coordinating center, University Hospital Vall d'Hebron, Barcelona, Spain, on 30 January 2024. Following the inclusion of an initial cohort of patients, a protocol amendment requesting the expansion of the project into a multicenter study which was approved on 28 October 2024. Subsequently, the additional participating centers obtained their respective ethics approvals prior to initiating recruitment: Hospital Clínic de Barcelona Research Ethics Committee: approval issued on 19 February 2025. Hospital de la Santa Creu i Sant Pau Research Ethics Committee: approval issued on 12 March 2025. Hospital del Mar Research Ethics Committee: approval issued on 8 May 2025. All centers received approval before enrolling participants, in accordance with national and institutional regulatory requirements. The study has been designed in accordance with the Declaration of Helsinki, as a statement of ethical principles for medical research. Every patient had the right to leave the study at any time, for any reason, without having to give explanations and without repercussions on his or her aftercare. Likewise, the investigating physician had the right to withdraw a patient from a study when he/she believed it was in the patient's best interest. All the information obtained from the study participants will be treated confidentially, complying with current regulations. Written informed consent will be obtained from all participants before including in the study. Results of the study will be disseminated through events, professional organizations, and publications in peer-reviewed open-access journals as well as presentations at scientific congresses.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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