

Relevance of a Systematic Screening Strategy for Obstructive Sleep Apnea before Thoracic Surgery: A Prospective Monocentric Study

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Abstract

Background

Obstructive Sleep Apnea Syndrome (OSAS) is a frequent but often underdiagnosed condition, impacting patient health, especially during the postoperative period. This study aims to evaluate the prevalence of sleep apneas and hypopneas in patients scheduled for thoracic surgery.

Method

This prospective, single-center study was conducted at the University Hospital of Tours in France. Over a 12-week period, 81 patients scheduled for thoracic surgery were contacted. Evaluation was based on the STOP-Bang questionnaire, the Epworth Sleepiness Scale, and Body Mass Index (BMI) in combination with cardiovascular risk factors. Patients identified as being at high risk of sleep apneas and hypopneas were referred for polysomnography. We also assessed postoperative complications in our patient cohort as a secondary endpoint.

Results

Of 81 patients, 31 were excluded and 50 completed the screening process. 13 (26%) underwent home polysomnography, and 10 (77% of those tested) were newly diagnosed with OSAS needing continuous positive airway pressure (CPAP) therapy during sleep. Overall, 18 patients (22%) across the cohort (n = 81) had OSAS needing (CPAP); 8 previously diagnosed and 10 identified through screening and treated with CPAP before surgery. One year later, 50% of patients stopped their treatment.

Conclusion

Systematic preoperative screening for sleep apneas and hyponeas in thoracic surgery patients is feasible and reveals a high rate of undiagnosed cases. Integration of targeted screening into structured care pathways, such as the Enhanced Recovery After Surgery (ERAS) protocol, may represent a practical and clinically relevant strategy to optimize perioperative management of sleep disordered breathing in this high-risk population.

Introduction

Obstructive sleep apnea Syndrome (OSAS) is a common but frequently underdiagnosed condition, affecting up to 20% of the adult population. The prevalence of treated OSAS in France is estimated at approximately 3–4%(1), suggesting that a substantial proportion of cases remains undiagnosed. Some studies suggest that up to 90% of affected individuals are still undiagnosed(2)(3).

The disorder results from intermittent, partial or complete upper airway collapse during sleep. These events result in micro-arousals, hypoxemia, hypercapnia, and intrathoracic pressure fluctuations, which collectively contribute to heightened sympathetic nervous system activation(4). The typical daytime symptoms of OSAS include sleepiness, fatigue, headaches, and associated neurological and social disturbances(5).

In addition to increased prevalence with age(6), OSAS is also associated with male sex, obesity, alcohol consumption, and smoking(7).

Literature shows that untreated sleep apnea increases the risk of postoperative complications across all surgical fields, particularly cardiopulmonary complications such as myocardial infarction, and re-intubation(8). Furthermore, undiagnosed OSAS is associated with an increased incidence of postoperative hypoxia, transfers to intensive care units, longer hospital stays(9) and higher risk of opioid-induced respiratory depression due to increased sympathetic nervous system stimulation (10). Also, cardiopulmonary complications are common after thoracic surgery(11).

Therefore, we sought to evaluate the prevalence of undiagnosed sleep apnea in patients scheduled for thoracic surgery. The objective of this study is to assess the relevance of a systematic preoperative screening strategy for obstructive sleep apnea, considering the impact of this frequently underdiagnosed condition on postoperative complications.

Methods

This was a prospective, monocentric epidemiological study conducted in the thoracic surgery department of the Tours University Hospital in France. The primary outcome was the proportion of screened patients in whom CPAP therapy was newly initiated before surgery. Secondary outcome was the feasibility of an OSAS preoperative screening for thoracic surgery patients.

All patients consecutively scheduled for thoracic surgery (including pulmonary, mediastinal, pleural, and chest wall procedures) between December 16, 2024, and March 6, 2025, were contacted by phone to collect the data required for screening.

OSAS was defined, according to the American Academy of Sleep Medicine criteria(12), by the presence of either criterion A or B associated with criterion C:

A. Excessive daytime sleepiness not explained by other factors

B. At least two of the following symptoms, also not explained by other causes: loud and frequent snoring, choking or gasping during sleep, non-restorative sleep, daytime fatigue, difficulty concentrating, nocturia (more than one urination per night)

C. Polysomnographic or polygraphic criteria: apneas + hypopneas ≥ 5 per hour of sleep (apnea-hypopnea index [AHI] ≥ 5).

Exclusion criteria were age under 18 years, a prior diagnosis and treatment of sleep apnea, a negative polysomnography within the past two years, refusal to participate, or failure to respond to phone calls.

After giving their informed consent, patients were screened using either the internationally validated questionnaires STOP-Bang score and Epworth Sleepiness Scale (13)(14).

In addition to the two questionnaires, patients with obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) associated with cardiovascular risk factors (Arrhythmia, Smoking, High blood pressure, Dyslipidemia, Diabetes) , or those with class II obesity ($\text{BMI} \geq 35 \text{ kg/m}^2$) regardless of comorbidities, were considered at high risk for undiagnosed obstructive sleep apnea (OSA) and were referred for polysomnography at the discretion of the anesthesiology and thoracic surgery teams.

Questionnaire scores were calculated from patients’ responses during a telephone interviews. The STOP-Bang questionnaire (Table 1) consists of eight items assessing snoring, daytime fatigue, witnessed apneas, treated hypertension, $\text{BMI} > 35 \text{ kg/m}^2$, age > 50 years, male sex, and increased neck circumference (> 41 cm for women, > 43 cm for men). We used a modified seven-item STOP-Bang questionnaire because the neck circumference criterion was not being used due to the telephone format.

Patients with a STOP-Bang score of 5 to 7 were classified as high risk for obstructive sleep apnea and were referred for polysomnography.

The Epworth Sleepiness Scale (Table 2) assesses the likelihood of dozing off in eight common daily situations (e.g., reading, watching TV, in public places, as a passenger, etc.). A score of 10 or higher was considered pathologic and prompted polysomnography.

BMI and cardiovascular risk factors were obtained from preoperative surgical and anesthetic consultation records and were supplemented by information collected during the phone calls.

Table 1: STOP-BANG score

STOP	BANG
Do you snore loudly at night?	Body Mass Index (BMI) $\geq 35 \text{ kg/m}^2$
Do you often feel tired, fatigued, or sleepy during the daytime?	Age > 50 years
Has anyone observed you stop breathing during your sleep?	<i>Neck circumference $> 41 \text{ cm}$ (female) or $> 43 \text{ cm}$ (male)</i> <i>=> not used in our study</i>
Are you being treated for high blood pressure?	Male gender
Low risk: Total score of 0 to 2, Intermediate risk: Score of 3 to 4, High risk: Score of 5 to 7, or STOP ≥ 2 and male gender, or STOP ≥ 2 and BMI $> 35 \text{ kg/m}^2$, or STOP ≥ 2 and neck circumference $> 40 \text{ cm}$	

Table 2: Epworth sleeping scale

<i>How likely are you to nod off or fall asleep in the following situations, in contrast to feeling just tired?</i> Score: Never-0, Slight chance-1, Moderate chance-2, High chance-3
While reading a document?
While watching television or a movie?
Sitting inactive in a public place (e.g., waiting room, theater, classroom, conference...)?
As a passenger in a car or public transport (train, bus, plane, subway...) for at least one hour without a break?
Lying down to rest in the afternoon when circumstances permit?
Sitting and talking to someone (including on the phone)?
Sitting quietly after a meal without alcohol?
While stopped for a few minutes in traffic while driving?

Most polysomnography recordings were carried out by CA. However, two patients opted to undergo the examination with their referring pulmonologists. All tests were conducted at the patients' homes, according to standardized protocols, and included one night of monitoring.

The severity of obstructive sleep apnea syndrome (OSAS) were assessed based primarily on the Apnea-Hypopnea Index (AHI), together with the clinical presentation, including excessive daytime sleepiness after exclusion of alternative causes.

In accordance with the clinical guidelines of the French Pulmonology Society (15)(16), initiation of nocturnal continuous positive airway pressure (CPAP) therapy was indicated for the following situations:

- AHI > 15-30 / h (moderate OSAS) with cardiovascular/respiratory comorbidities or excessive daytime sleepiness
- AHI > 30 / h (severe OSAS), regardless of symptoms
- **A suggestive symptom profile**, including severe and daily snoring, choking episodes, nocturia, night sweats, morning headaches, morning fatigue, and daytime sleepiness
- Additional criteria: sleep fragmentation with a micro-arousal index > 10/h, and nocturnal desaturation on polysomnography

Postoperative complications in the 50 patients who completed screening and in the eight patients who were already receiving CPAP at initial contact were also retrospectively recorded. A one-year follow-up of patients treated with CPAP was also conducted.

Data were analyzed descriptively. Continuous variables are reported as mean and range, and categorical variables as number and percentage. No inferential comparison of postoperative outcomes was planned.

Results

Among the 81 patients initially contacted, 31 were excluded for the following reasons: 12 declined to participate in the screening process, 7 did not respond to phone calls, 8 were already receiving treatment for a previously diagnosed OSAS, and 4 had a negative sleep study within the past two years (Figure 1).

The 50 included patients had a mean age of 63 years (range: 20-82). The cohort consisted of 27 women (54%) and 23 men (46%). Of the 50 screened patients, 13 (26%) underwent nocturnal polysomnography. Among these 13 patients: 7 had a STOP-Bang score ≥ 5 , 5 had an Epworth score ≥ 10 , 6 had a BMI above the screening threshold. Notably, 3 patients met both the STOP-Bang and Epworth criteria, while 2 had both a high STOP-Bang score and a BMI above threshold.

Of the 13 patients identified for further investigation based on initial phone screening, all of them had polysomnography and 10 (77%) were diagnosed with obstructive sleep apnea requiring CPAP therapy both pre- and postoperatively by their **pulmonologist**. Among those, 2 patients had an AHI < 30/h but had multiple nocturnal desaturations and (ODI 45/h and 25/h) and a micro-arousal index > 10/h and were prescribed CPAP by the referral **pulmonologist**. The remaining three patients had mild OSA and did not meet the criteria for CPAP initiation. **Thus, among the 50 patients who completed the screening process, 10 (20%) ultimately required CPAP therapy. Across the entire cohort of 81 patients initially contacted, 18 (22%) were identified as having OSAS requiring nocturnal CPAP therapy, including 8 with a prior diagnosis and 10 newly diagnosed through this screening strategy.**

Table. 3: Post operative complications during hospitalization

Post operative complication during hospitalisation	Newly diagnosed OSAS with CPAP prescribed (n= 10)	No newly identified indication for CPAP (n= 40)	Diagnosed patient with OSAS using CPAP before the study (n = 8)
Fever/Infection	0	5 (12.5%)	0
Post operative O2 needed > 48 hours	1 (10%)	4 (10%)	0
Cardiovascular	0	0	0
Respiratory decompensation	0	1 (2.5%)	0

Regarding postoperative outcomes during hospitalization, among the 10 patients newly diagnosed with OSAS and treated with CPAP following screening, only one patient required postoperative oxygenotherapy for more than two days, while the remaining nine patients had no postoperative complications. In the group of 40 screened patients without newly identified indication for CPAP therapy, more than 2 days postoperative oxygenotherapy was required in four patients (for 3 to 6 days), five patients developed postoperative fever or infection (2 patients with fever needed O2 therapy), and one patient required close monitoring in the intensive care unit due to respiratory decompensation. Among the eight patients with previously diagnosed OSAS who were already treated with CPAP before inclusion in the study, no postoperative complications were observed (Table. 3).

At 1-year follow-up, 5 patients (50%) decided to discontinue CPAP (2 because of postoperative pain and 3 due to discomfort related to the equipment). 1 patient (10%) died, while 4 patients (40%) chose to continue nocturnal CPAP (Table4).

Table 4: Screening Results, Polysomnography Findings, and One-Year Follow-up of Patients Evaluated for Severe Obstructive Sleep Apnea

Patients	STOP BANG	Epworth	BMI and CV risk factors	Polysomnography results for OSAS	CPAP	1 year follow up
1	5	7	36	AHI 37/h, ODI 20/h, MEI 47/h	Yes	Remained on CPAP
2	6	9	45, diabetes, hypertension	AHI 10/h, ODI 45/h, MEI 23/h	Yes	Remained on CPAP
3	6	9	24	AHI 58 /h, MEI 28/h	Yes	Discontinued CPAP
4	5	4	30, HTA, dyslipidemia	AHI 59/h, ODI 4/h, snoring 274/h, MEI 46/h,	Yes	Discontinued CPAP
5	6	10	22	AHI 43/h, ODI 36/h, MEI 35/h	Yes	Discontinued CPAP
6	4	10	27	AHI 7/h, MEI 15/h	No	/
7	5	11	25	AHI 34/h, ODI 27/h, MEI 22/h	Yes	Deceased
8	4	9	36, smoker	AHI 38/h, ODI 32/h, MEI 15/h	Yes	Discontinued CPAP
9	1	11	23	AHI 5/h; MEI 14/h	No	/
10	4	7	31, hypertension	AHI 32/h, ODI = 29/h, MEI = 11/h	Yes	Remained on CPAP
11	3	9	30, Coronary stent, hypertension	AHI 27/h, ODI 25/h, MEI 13/h	Yes	Discontinued CPAP
12	2	14	26	AHI 5/h, MEI 26/h	No	/
13	5	2	28	AHI 31/h, ODI 25/h, MEI 18/h	Yes	Remained on CPAP

AHI: Apnea-Hypopnea Index, ODI: Oxygen Desaturation Index, MEI: Micro-arousal (Micro-Electroencephalographic Arousal) Index, BMI: Body Mass Index (kg/m^2)

Discussion

This study demonstrates that 20% of patients without a prior diagnosis of OSAS, who were evaluated preoperatively for thoracic surgery, were found to have OSAS requiring CPAP therapy. In total, among the 81 patients initially contacted, 22% (18/81) had an indication for CPAP therapy. This prevalence is markedly higher than that of the general French adult population, in which only 2.3% are currently treated with CPAP (17). This discrepancy underscores a higher prevalence of sleep-related breathing disorders

among patients undergoing thoracic surgery, likely attributable to underlying risk factors, such as tobacco use, that are more frequent in this population.

At present, research specifically addressing OSAS in the context of thoracic surgery remains limited. Nevertheless, several studies have explored OSAS in broader surgical populations. Finkel et al. evaluated more than 2,000 patients undergoing preoperative assessment and found that 23.7% were at high risk for OSAS, with 81% of diagnoses established during the preoperative evaluation (2). In specific surgical populations such as bariatric surgery, the prevalence of OSAS can reach up to 70% (18)(19), underscoring the importance of targeted screening in high-risk groups. Considering in one hand that untreated OSAS increases postoperative cardiopulmonary complications (8)(9), and in the other hand that the main complications after thoracic surgery are cardiopulmonary, and following this study showing that more than 20% of our patient are suffering from OSAS, there is a potential benefit of implementing systematic preoperative screening for OSAS in candidates for thoracic surgery. These results echo earlier studies which have demonstrated a high prevalence of undiagnosed OSAS (20) and emphasized the value of early identification in at-risk patients.

The main limitations of this study include its relatively small sample size (81 patients) and its single-center design. Additionally, a potential underestimation bias may have occurred due to the exclusion of the neck circumference variable from the STOP-Bang score (because the questionnaire was administered by phone). With the positivity threshold maintained at a score of 5, this omission could have led to an underestimation of the number of patients eligible for polysomnography. Notably, 11 patients (22% of the 50 analyzed) had a STOP-Bang score of 4 and could have reached the screening threshold if neck circumference had been assessed.

Although limited by the small sample size, postoperative outcomes appeared favorable in patients with newly diagnosed or previously treated OSAS receiving CPAP therapy, whereas postoperative respiratory complications and infections were mainly observed in patients without diagnosed OSAS, suggesting that systematic screening and perioperative management may contribute to reducing postoperative morbidity in this population. Also, underdiagnosed OSAS may have contribute to limit the power of some studies assessing non invasive ventilation after thoracic surgery(21).

However, statistical analysis were not designed to answer this question, already well documented in literature (8–10). Here we only described postoperative outcomes of our consecutive patients.

Inversely, there is a possible overdiagnosis bias, leading to an overtreatment, considering the low rate of therapeutic observance of our cohort one year later.

The questionnaires used in this study are non-invasive and easy to administer, making them well suited for integration into the preoperative care pathway for thoracic surgery patients, as in our center. The Enhanced Recovery After Surgery (ERAS) protocol may play a key role in facilitating rapid screening, diagnosis and treatment of OSAS. This patient-centered approach aims to optimize pre-, peri-, and postoperative care through improved coordination between surgical, anesthetic, and allied health teams.

Incorporating targeted sleep apnea screening into the ERAS pathway for thoracic surgery appears to be both practical and promising. Beyond its well-established benefits in reducing complications and shortening hospital stays(22), the ERAS pathway also represents an effective lever for implementing preventive measures and targeted screening strategies. It offers a valuable opportunity to address cross-cutting health issues such as sleep apnea within the perioperative management of surgical patients. Our study was made possible by establishing a rapid access screening pathway using polysomnography, which was essential in the management of patients with oncological conditions.

Conclusion

Systematic screening for obstructive sleep apnea and its therapeutic management in the preoperative setting of thoracic surgery is feasible, even within the tight timelines imposed by oncologic procedures. This strategy is supported by the 20% rate of newly diagnosed cases in our study, particularly given the well-documented perioperative benefits of nocturnal non-invasive ventilation in patients with OSAS. The development of a dedicated care pathway should therefore be encouraged to optimize perioperative outcomes in this high-risk population.

Declarations

Ethics approval and consent to participate: This prospective, single-center observational study was conducted at Tours University Hospital, France. Postoperative outcomes were subsequently collected from the patients' medical records.

Before undergoing the preoperative telephone screening, all participants received information about the study and provided verbal informed consent to participate. The investigator documented each participant's consent at the time of the telephone interview. Personal health data were processed in accordance with applicable French data-protection regulations and the requirements of the *Commission Nationale de l'Informatique et des Libertés* (CNIL)- National Committee of Information and Freedom.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated and analysed during the current study are not publicly available because of participant confidentiality and applicable data-protection requirements.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions:

AM: collected and analysed the data, interpreted the results, and drafted the manuscript.

AL: conceived, designed, and supervised the study, and review the manuscript.

CA: coordinated most of the polysomnographic assessments and contributed to the interpretation of the findings and patient follow-up.

CP: helped collecting the data

BL, LL, LP, AL: reviewed the manuscript.

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Figures

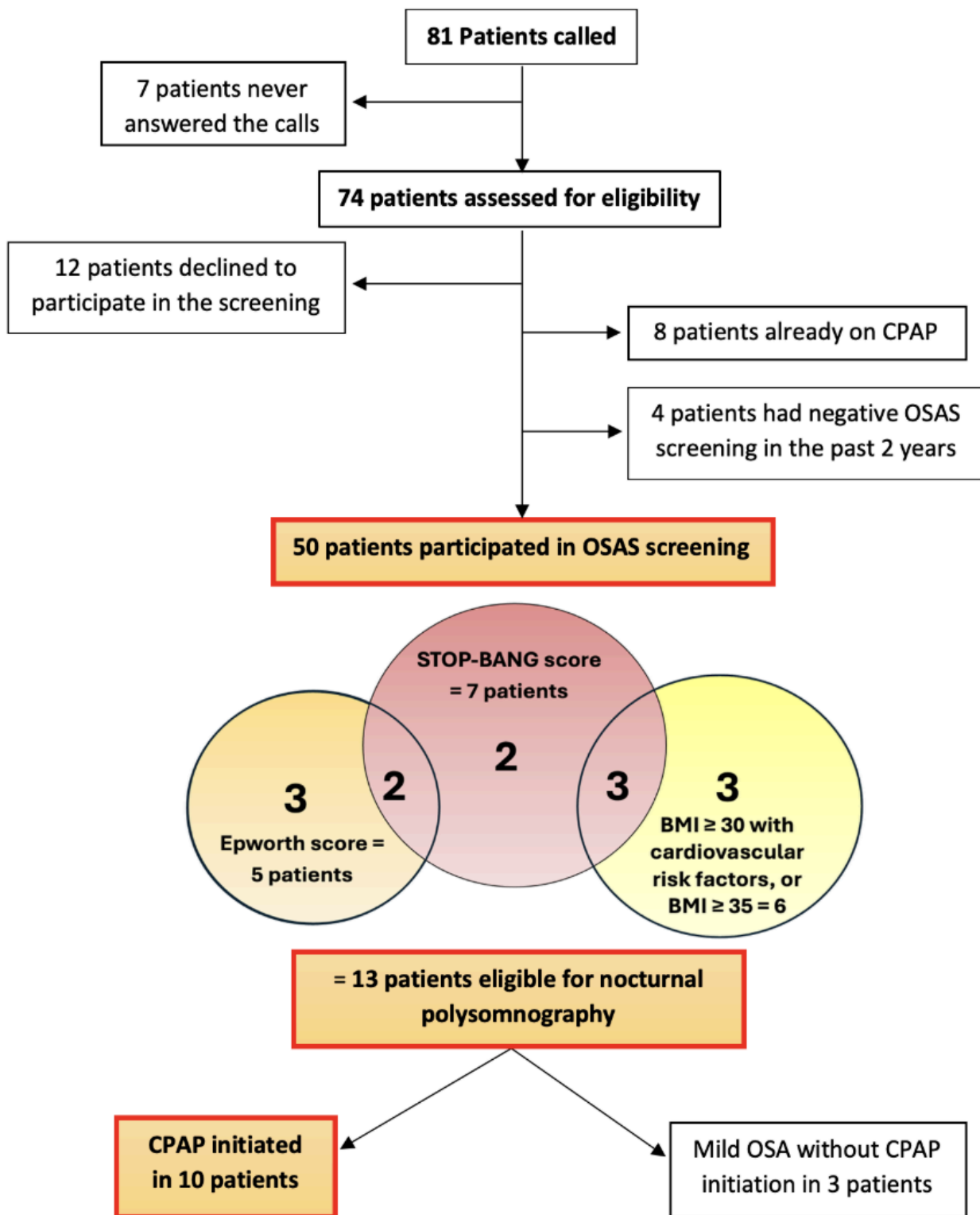


Figure 1

Flow Chart of the Preoperative Screening Process for OSAS in Thoracic Surgery Patients