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The effect of active smoking and secondhand smoke exposure on early outcomes of ambulatory surgery: A prospective observational study

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ABSTRACT

Purpose: Since the hospital stay of patients after ambulatory surgery is short, it is important to determine the factors that may cause problems in the early postoperative period. Among these factors, the effects of which are not fully known are active smoking and secondhand smoke exposure. This study aimed to elucidate how active smoking and secondhand smoke exposure effect early outcomes of ambulatory surgery.

Methods: A prospective observational study was conducted with 124 patients (42 active smokers, 40 nonsmokers exposed to secondhand smoke and 42 nonsmokers) who underwent ambulatory general surgery. Patients were closely monitored for cardiac and respiratory complications, as well as pain, opioid use, and nausea and vomiting until discharge from the hospital.

Results: Postoperative complications were observed in 50.8 % of the patients. Hypotension was more common in active smokers compared with nonsmokers and nonsmokers exposed to secondhand smoke. Smokers were more likely to require postoperative supplemental oxygen therapy. Pain intensity at 1st and 4th hours after surgery was significantly higher in smokers ($p < 0.005$). In addition, nonsmokers exposed to secondhand smoke exhibited more severe pain than nonsmokers ($p = 0.001$). There were no statistically significant differences between the groups with regard to opioid consumption.

Conclusion: Although smoking and secondhand smoke exposure are not associated with serious complications after ambulatory surgery, patients' comfort and the success of ambulatory surgery may be negatively affected due to severe pain associated with smoking and secondhand smoke exposure.

1. Introduction

Smoking continues to be a significant public health concern, resulting in millions of global fatalities annually. It is well-established that a substantial portion of patients scheduled for surgical procedures are active smokers, and their smoking habits have a detrimental impact on surgical outcomes.[1,2] Research has demonstrated that smokers face an elevated risk of perioperative complications affecting the respiratory, cardiovascular, and wound-related aspects compared to nonsmokers.[3,4] In addition to these complications, smoking leads to delayed discharge, increased likelihood of reoperation, readmission, and increased healthcare costs.[5,6]

The prevalence of smoking among adults underscores the shared risk posed to individuals exposed to secondhand smoke (SHS). SHS represents one of several terms used to describe involuntary exposure to smoke produced during the combustion of tobacco products and the exhalation of active smokers. This type of exposure, commonly linked to ailments like lung cancer, coronary heart disease, and stroke, mirrors the perioperative complications observed in smokers, particularly in patients with long-term SHS exposure scheduled for surgical intervention.[7] Existing literature predominantly investigates the impact of SHS on surgical outcomes in pediatric cases,[8] while studies focusing on adults, specifically regarding respiratory complications, are relatively scarce.[9–11]

Contemporary healthcare practices increasingly embrace complex ambulatory surgical procedures, capitalizing on the associated benefits. The ability of patients to return to their normal activities after surgery is an important indicator of the success of ambulatory surgery. While mortality and major complications remain infrequent, it is crucial to acknowledge that any untoward developments can impede the success

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of ambulatory surgery and diminish patient satisfaction.[12] Enhanced Recovery After Surgery (ERAS) protocols have been devised to ameliorate the outcomes of ambulatory surgery. These guidelines proffer recommendations to prevent postoperative symptoms, encompassing pain, nausea, vomiting, and complications in various domains, such as pulmonary, cardiac, neurological, and surgical (e.g. bleeding, hematoma, wound-related issues, and infections). Simultaneously, the adoption of prudent preoperative measures, including patient counseling, nutritional preparations, and the discontinuation of alcohol and tobacco use, is advocated.[13,14]

The few studies investigating the relationship between smoking and postoperative complications in ambulatory surgery have yielded different results. While some research has demonstrated an increased incidence of respiratory complications, wound infections,[15,16] and cardiovascular issues like myocardial infarction and deep vein thrombosis among smokers compared to nonsmokers,[17] other investigations have reported that smoking exerts no discernible impact on frequently encountered post-ambulatory surgery symptoms such as pain, nausea, and vomiting.[18,19] In some cases, it has even been suggested that smoking reduces the likelihood of unexpected hospital readmissions following discharge.[20] It is important to note that these studies focus primarily on the effects of smoking during the post-discharge period for patients. Surprisingly, the literature lacks any study that specifically delves into the impact of SHS exposure on early outcomes in adult patients undergoing ambulatory surgery.

In order to ensure the safe transfer of patients to their homes after ambulatory surgery, the surgical team must be aware of the factors that may affect the success of this process. Accordingly, they can focus on controlling these factors in preoperative patient preparation. Early complications associated with both active smoking and SHS exposure are of paramount importance, as they have the potential to necessitate inpatient care, affect patients' comfort levels, and incur higher healthcare costs. Therefore, the current study aimed to elucidate the influence of active smoking and SHS exposure on early outcomes of ambulatory surgery. Specifically, we assessed respiratory and cardiac complications that may develop in the early period after ambulatory surgery, as well as symptoms such as pain, nausea, and vomiting.

2. Materials and methods

2.1. Study design and sample

Following approval by the Clinical Research Ethics Committee (approval number: 2023–10–27), a prospective observational study was conducted in a training and research hospital located in Istanbul, Turkey, spanning the period from October 2022 to August 2023. This study structured according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[21] With the

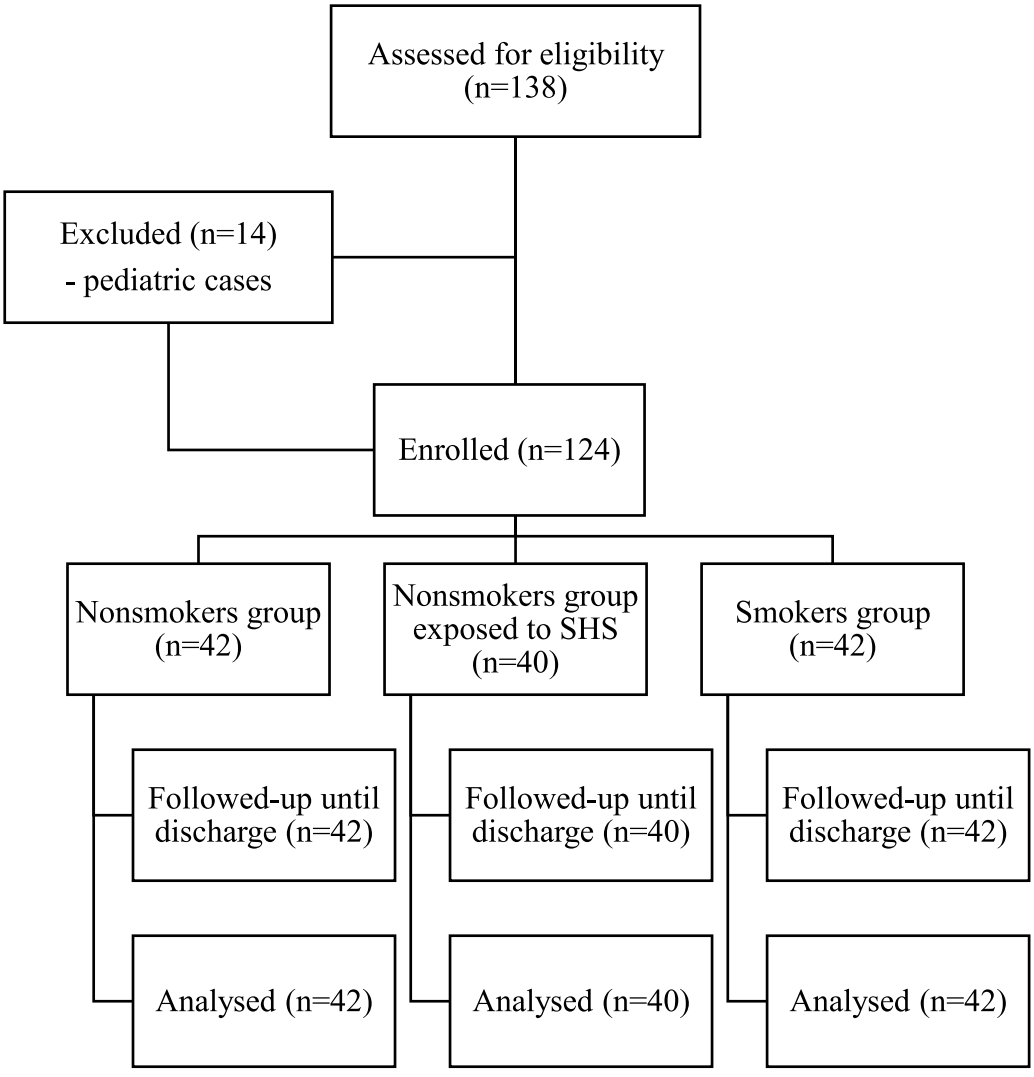

Fig. 1. Patient eligibility and selection process.

significance level at 5 %, effect size at 0.5, and power of the study at (1-b) 80 %, the sample consisted of 124 patients, (42 smokers, 40 nonsmokers exposed to SHS, and 42 nonsmokers). The study's inclusion criteria required that participants be 18 years or older, have undergone ambulatory general surgery with general, spinal, or epidural anesthesia, and have an American Society of Anesthesiologists (ASA) physical condition classification of 1 or 2. Individuals under 18, those classified as ASA 3 or 4, individuals who had been operated on under local anesthesia, and patients necessitating a hospital stay exceeding 24 h after surgery were excluded from the study. The Fagerström Test for Nicotine Dependence (FTND) was administered to assess the nicotine addiction level in the smoking group (Group S). Meanwhile, patients from the SHS exposure group (Group SHS) were identified based on self-reports from patients who indicated they either cohabitated or worked with a smoker. Patients who had never smoked previously constituted the nonsmoker group (Group NS). After the study groups were determined, there was no patient dropped out (Fig. 1).

2.2. Study outcomes

The primary outcomes sought in this study were the development of early postoperative complications, and symptoms of pain, nausea, and vomiting. Postoperative complications included respiratory (cough, laryngospasm, hypersecretion, apnea, and hypoxia) and cardiac (orthostatic hypotension, hypotension, hypertension, arrhythmia, and wound site bleeding) complications. Secondary outcomes were the use of supplemental oxygen therapy, opioid consumption, and antiemetic administration. The focus was on comparing these outcomes between the three groups.

2.3. Data collection

Data was collected using a questionnaire that inquired about the patients' sociodemographic characteristics and included specific questions tailored to the created groups. Patients in Group S were additionally queried about their smoking habits, including the duration, quantity, and time of their last cigarette. Group SHS patients were asked to provide information about where and for how long they had been exposed to SHS.

The FTND administered to Group S comprises six questions, each assigned a different score. This tool, developed by Heatherton et al., is widely used to assess nicotine dependence. Uysal et al. conducted a Turkish validity and reliability study of the tool in 2004, determining internal consistency reliability coefficient of 0.56. Nicotine dependence severity is categorized based on the total scores: 0–2 points as very low dependence, 3–4 points as low dependence, 5 points as moderate dependence, 6–7 points as high dependence, and 8–10 points as very high dependence.[22]

Postoperative patient follow-up began at minute 0 in the Post-anesthesia Care Unit (PACU) and continued until the patients' discharge. Since the hospital where the study was conducted did not have an ambulatory surgery unit, the patients were transferred to the general surgery unit after their follow-up in the PACU. The researchers of the postoperative course was not aware of the patient's smoking status. Researchers conducted postoperative evaluations for pain, nausea, vomiting, and respiratory and cardiac complications every 15 min in the PACU and every four hours in the general surgery unit.

A visual analog scale (VAS) was employed to assess the severity of patients' pain, classifying it as mild (1–4), moderate (5–6), or severe (7–10).[23] Furthermore, instances of pain were documented, along with any associated analgesic interventions and the specific type of analgesic administered. Patients were verbally queried about nausea, and the occurrence of vomiting was observed. Instances of administering antiemetics to patients reporting nausea and vomiting were also recorded.

Cough (more than 15 s), laryngospasm (failure to ventilate the patient and requirement of additional doses of muscle relaxants), hypersecretion (according to the increase of quantity and density of secretions and more than 2 times the necessity of oral or nasal aspiration), apnea (breath-holding for more than 15 s), and hypoxia (SPO_2 below 95 %) were considered respiratory complications during the intraoperative and postoperative periods.[11] The occurrence of respiratory complications were assessed intraoperatively by the anesthesiologist and postoperatively by the researcher. The use of supplemental oxygen therapy was documented as well. Patients with less than 95 % peripheral arterial oxygen saturation or feeling of dyspnea required oxygen support. Nasal cannula was used to deliver oxygen at a flow rate of 2 to 4 liters per minute.

In addition, patients were monitored for cardiac complications, including hypotension (systolic arterial pressure less than 90/60 mm Hg), orthostatic hypotension (reduction in systolic blood pressure of at least 20 mmHg or a reduction in diastolic blood pressure of at least 10 mmHg, and dizziness or lightheadedness when standing up), hypertension (systolic blood pressure $\geq$140 mm Hg and/or diastolic blood pressure $\geq$90 mm Hg), arrhythmia, and wound site bleeding. The patients were followed up by the researcher to identify cardiac complications until their discharge from the hospital.

2.4. Data analysis

Data obtained in this study were analyzed using IBM SPSS v.21 (IBM Corp., Chicago, IL, USA) and NCSS v.21.0.3 (NCSS, LLC, Kaysville, UT, USA) software. Continuous variables were presented as mean and standard deviation. Categorical variables were presented as frequencies and percentages. The suitability of continuous variables for normal distribution was assessed using the Shapiro-Wilk test. One-way analysis of variance (ANOVA) was employed for comparisons among Groups S, SHS, and NS when continuous variables followed a normal distribution, whereas the Kruskal-Wallis test was used to compare study groups for continuous variables not conforming to normal distribution. The chi-square test was used to compare the percentages of categorical variables. In all the analyses, $p < 0.05$ was considered statistically significant.

3. Results

3.1. Patient's characteristics and smoking status

Of the 124 patients included in the study, 56.5 % were male. The mean age was 42.48±13.81 years, and the mean BMI was 25.96±4.21. While 73.4 % of the patients did not have a chronic disease, hypertension was the most common chronic condition among patients (10.5 %). In terms of ASA classification, 54.8 % of patients were categorized as ASA 1. The most frequently performed surgical procedure was inguinal hernia repair, accounting for 25.8 % of cases, followed by laparoscopic cholecystectomy at 19.4 %. The average duration of surgical interventions under general anesthesia for 71 % of the patients was 59.6 ± 23.27 min. After surgery, patients spent an average of 37.8 ± 14.14 min in the PACU. No significant differences were observed among smokers, nonsmokers, and SHS exposed patients regarding demographic and clinical characteristics ($p > 0.005$; Table 1).

Among patients who smoked, 40.5 % showed a moderate level of addiction according to the FTND. The average daily cigarette consumption for these patients, with 26.2 % of them having a smoking history of 10 years, was 17.86±8.61 cigarettes. The majority of patients (73.8 %) reported that they had smoked the day before their surgery. SHS exposed patients stated that they had been exposed to cigarette smoke at least twice daily for an average of 18.45±9.39 years.

3.2. Overall postoperative complications

Following ambulatory general surgery procedures, postoperative complications were observed in 50.8 % of the patients. Among these

Table 1
The clinical and demographic characteristics of patients.

Variable	Group S ($n = 42$)	Group SHS ($n = 40$)	Group NS ($n = 42$)	p
Age [mean years (SD)]	42.74 (12.27)	41.58 (13.44)	43.1 (15.77)	0.876
Gender [n (%)]				
Female	18 (42.9)	19 (47.5)	17 (40.5)	0.809
Male	24 (57.1)	21 (52.5)	25 (59.5)	
BMI [mean (SD)]	24.77 (3.45)	26.18 (4.57)	26.95 (4.37)	0.054
Chronic disease [n (%)]				
Yes	12 (28.6)	10 (25)	11 (26.2)	0.933
No	30 (71.4)	30 (75)	31 (73.8)	
Smoking habits				
Smoking quantity, cigarette per day [(mean (SD)]	17.86 (8.61)	NA NA	NA NA	NA NA
Smoking duration, years [(mean (SD)]	15.90 (9.77)	NA	NA	NA
FTND [(mean (SD)]	4.33 (2.28)			
Anesthesia type [n (%)]				
General	30 (71.4)	29 (72.5)	29 (69)	0.972
Spinal	9 (21.4)	9 (22.5)	11 (26.2)	
Epidural	3 (7.1)	2 (5)	2 (4.8)	
ASA class [n (%)]				
1	22 (52.4)	22 (55)	24 (57.1)	0.939
2	20 (47.6)	18 (45)	18 (42.9)	
Operative time [mean minutes (SD)]	60.24 (21.33)	59.13 (24.02)	59.40 (24.91)	0.975
Duration of PACU stay [mean minutes (SD)]	40.12 (14.33)	39.13 (16.87)	34.40 (10.25)	0.143
Surgical procedures [n (%)]				
Inguinal hernia repair	12 (28.7)	11 (27.5)	9 (21.4)	0.197
Cholecystectomy	9 (21.4)	8 (20)	7 (16.8)	
Appendectomy	4 (9.5)	8 (20)	4 (9.5)	
Pilonidal sinus	4 (9.5)	6 (15)	8 (19)	
Hemorrhoidectomy	4 (9.5)	2 (5)	5 (11.9)	
Others[†]	9 (21.4)	5 (12.5)	9 (21.4)	

Group S, smokers; Group SHS, secondhand smokers; Group NS, nonsmokers.
SD, standard deviation; BMI, body mass index; ASA, American Society of Anesthesiologists; FTND, Fagerström test for nicotine dependence; NA, not applicable.
[†] thyroid lobectomy, anal fistula surgery, umbilical hernia
Group S, smokers; Group SHS, secondhand smokers; Group NS, nonsmokers.

complications, 44.4 % were cardiac, and 16.1 % were respiratory. Orthostatic hypotension was the most common complication, accounting for 40.3 % of all complications and within the cardiac category. Cough, experienced by 12.9 % of patients, was the most common respiratory complication. Oxygen support via nasal cannula was administered to 12.9 % of patients. No patients exhibited arrhythmia or apnea. Four hours after the surgery, severe pain was reported by 36.3 % of the patients, and coincidentally, this time frame marked the most frequent need for analgesic intervention, with 71.8 % of patients requiring it. Opioid analgesics were used for pain management in 68.5 % of the patients. Nausea occurred in 52.4 % of patients, while 17.7 % experienced vomiting, with both symptoms being most prevalent at the fourth hour post-surgery (35.5 % for nausea and 8.9 % for vomiting), similar to pain. Antiemetic therapy was required in 30.6 % of patients.

3.3. Comparison of postoperative complications between the groups

A comparison of postoperative complications between smoker, nonsmoker, and SHS exposed patients revealed no significant differences in total complications, cardiac complications, and respiratory complications ($p > 0.05$). Hypotension, one of the cardiac complications, was more common in Group S than in the other groups ($p = 0.021$). Incidences of wound site bleeding were 19 % in Group S, 7.9 % in Group NS, and 7.5 % in Group SHS patients, but the differences among the groups were not statistically significant. Cough, a respiratory complication, occurred in 17.5 % of Group SHS patients, 14.3 % of Group S patients, and only 7.1 % of Group NS patients, with no significant differences among the groups. Hypersecretion was observed solely in Group SHS patients at a rate of 5 %, while laryngospasm occurred at a rate of 5 % in Group NS patients. Although there was no significant difference between the groups in terms of respiratory complications, the oxygen requirement was higher in Group S patients (Table 2).

Regarding pain levels, at the first hour after surgery, 70.4 % of Group S patients reported mild pain and 33.3 % severe pain. In contrast, 35.7 % of Group NS patients had mild pain, 4.8 % experienced severe pain, and 7.5 % of Group SHS patients experienced severe pain. Group S patients experienced mild pain more frequently than Group NS patients and severe pain was more common in Group S than in Group SHS and Group NS patients ($p < 0.001$). Differences in pain levels between the groups persisted at the fourth hour after surgery. At that time, 31 % of Group S patients and 64.3 % of Group NS patients reported moderate pain. The rate of severe pain was 59.5 % in Group S, 32.5 % in Group SHS, and 16.7 % in Group NS. Notably, Group NS patients experienced more moderate pain than Group S patients, while Group S patients experienced more severe pain than Group SHS and Group NS patients. Furthermore, severe pain was significantly higher in Group SHS patients compared to Group NS patients ($p = 0.001$). Opioid use for pain management was necessary for 78.6 % of Group S patients, 67.5 % of Group SHS patients, and 59.5 % of Group NS patients, with no significant differences between the groups (Table 3).

Nausea, vomiting, and antiemetic requirements did not differ significantly among the groups. Vomiting occurred in 23.8 % of Group S patients, 22.5 % of Group SHS patients, and 7.1 % of Group NS patients. Antiemetic administration was required by 38.1 % of Group S patients, 27.5 % of Group SHS patients, and 26.2 % of Group NS patients (Table 3).

4. Discussion

Complications arising after ambulatory surgery can negatively affect recovery and lead to delayed discharge. Smoking, often considered a controllable risk factor for these complications, can, in practice, be challenging to control. The current study investigates the effects of active smoking and SHS exposure on early outcomes of ambulatory surgery. The research revealed a higher incidence of hypotension and

Table 2
Incidence of postoperative complications following ambulatory surgery by smoking status.

	Group S ($n = 42$)	Group SHS ($n = 40$)	Group NS ($n = 42$)	Total ($n = 124$)	p
Cardiovascular complications [n (%)]					
Orthostatic hypotension	16 (38.1)	18 (45)	16 (38.1)	50 (40.3)	0.765
Hypotension	9 (21.4)	4 (10)	1 (2.4)	14 (11.3)	0.021
Hypertension	0 (0)	1 (2.5)	1 (2.4)	2 (1.6)	0.594
Bleeding	8 (19)	3 (7.5)	3 (7.9)	14 (11.3)	0.148
Respiratory complications [n (%)]					
Hypoxemia	5 (11.9)	2 (5)	4 (9.5)	11 (8.9)	0.537
Cough	6 (14.3)	7 (17.5)	3 (7.1)	16	0.356
Hypersecretion	0 (0)	2 (5)	0 (0)	(12.9)	0.118
Laryngospasm	0 (0)	0 (0)	2 (5)	2 (1.6)	0.374
Oxygen requirement	10 (23.8)	3 (7.5)	3 (7.14)	2 (1.6) 16 (12.9)	0.045

Group S, smokers; Group SHS, secondhand smokers; Group NS, nonsmokers.

Table 3
Comparisons for postoperative pain scores, opioid consumption and nausea and vomiting by smoking status.

	Group S (n = 42)	Group SHS (n = 40)	Group NS (n = 42)	p
Pain 1 h [n (%)]				
Mild	15 (35.7)	19 (47.5)	30 (71.4)	
Moderate	13 (31)	18 (45)	10 (23.8)	<0.001*
Severe	14 (33.3)	3 (7.5)	2 (4.8)	
Pain 4 h [n (%)]				
Mild	4 (9.5)	11 (27.5)	8 (19)	
Moderate	13 (31)	16 (40)	27 (64.3)	0.001
Severe	25 (59.5)	14 (32.5)	7 (16.7)	
Pain 8 h [n (%)]				
Mild	10 (23.8)	10 (25)	13 (31)	0.077
Moderate	12 (28.6)	18 (45)	21 (50)	
Severe	20 (47.6)	12 (30)	8 (19)	
Opioid consumption [n (%)]	33 (78.6)	27 (67.5)	25 (59.5)	0.061
Nausea 1 h	10 (23.8)	6 (15)	5 (11.9)	0.321
Nausea 4 h	14 (33.3)	14 (35)	16 (38.1)	0.899
Nausea 8 h	3 (7.1)	4 (10)	2 (4.8)	0.658
Vomiting 1 h	1 (2.4)	2 (5)	1 (2.4)	0.743
Vomiting 4 h	5 (11.9)	4 (10)	2 (4.8)	0.492
Need for antiemetic	16 (38.1)	11 (26.2)	11 (27.5)	0.439

Group S, smokers; Group SHS, secondhand smokers; Group NS, nonsmokers.

higher need for postoperative supplemental oxygen therapy among smokers. At the same time, smokers experienced more pain than nonsmokers and SHS exposed patients, with SHS exposed patients experiencing more pain than nonsmokers in the early postoperative period. Although coughing was more common in smokers and SHS exposed patients than in nonsmokers, the disparity did not reach statistical significance.

Notably, our study observed a higher prevalence of postoperative hypotension among smokers, which is intriguing given the established link between smoking and hypertension. Smoking can acutely increase blood pressure by causing overactivity of the sympathetic nervous system. The similar acute effect of nicotine on blood and cardiovascular vessels also applies to passive smoking. However, existing data on the chronic impact of smoking on blood pressure and hypertension incidence are inconsistent.[24] Some studies suggested that chronic smoking might lead to lower blood pressure through body weight reduction.[25] Unfortunately, no directly comparable literature exists on the relationship between smoking and postoperative blood pressure changes. Nevertheless, our findings are consistent with research by Fedorowski et al., which showed that current smoking status was associated with orthostatic hypotension.[26] Nazir et al. also reported an increase in systolic blood pressure in patients who quit smoking 1–4 weeks before surgery.[27] The higher prevalence of hypotension among smokers in the current study, a common postoperative finding due to various patient- and surgery-related factors, could potentially be attributed to their BMIs, despite the absence of a significant difference between the groups.

The most common symptom that causes discomfort in patients in the early postoperative period, often complicating recovery and discharge, is pain. Smokers tend to experience increased postoperative pain due to the absence of nicotine, which has analgesic properties.[28] In our study, smokers experienced more severe pain, especially during the first and fourth postoperative hours, when compared to other groups. This is an expected finding and is in line with existing literature. Similar to our study, Shen et al. (2018) compared the VAS scores of abstinent tobacco smokers and nonsmokers at different times during the early postoperative period and determined that pain scores were higher in the group that had quit smoking not at the first hour but at the sixth hour.[29] Wang et al. (2023) also observed higher postoperative pain scores in smokers compared to nonsmokers.[30] Furthermore, a meta-analysis study has established smoking as a determinant of poor postoperative pain control.[31] While previous studies have found a relationship between smoking and increased postoperative opioid consumption,[29,32] we did not observe any significant difference between the groups in terms of opioid use. Similarly, Oh et al. found that chronic smoking did not significantly affect postoperative opioid use in a study involving lung and esophageal cancer patients.[33]

Active smoking is recognized as an independent risk factor for postoperative pain.[30] Surprisingly, SHS exposure also influences pain perception, although the precise mechanisms remain unclear. In our study, patients exposed to SHS experienced more severe pain than nonsmokers during the fourth hour after surgery. This finding is consistent with those of An et al. and Aydogan et al. who conducted studies with adult patients undergoing major surgery.[28,34] Topaloglu et al. assessed the pain of peripheral venous catheterization intervention in children exposed to SHS using the faces rating scale and found higher pain scores in these patients compared to nonsmokers.[35] On the other hand, Lee et al. observed no significant difference in pain levels between SHS exposed patients and nonsmokers on the third postoperative day.[10] Although there is evidence of a relationship between SHS exposure and postoperative pain, the current literature contains limited studies on this topic, whether the surgical intervention is major or minor.

The effects of smoking on the respiratory system and its relationship with postoperative respiratory complications such as laryngospasm, bronchospasm, hypoventilation, and hypoxemia are well-known.[1] However, in our study, we found no significant relationship between active smoking or SHS exposure and respiratory complications. We only determined that smoking was associated with increased need for postoperative supplemental oxygen therapy. While cough, the most frequently occurring respiratory complication in our study, was more prevalent in smokers and SHS exposed patients than in nonsmokers, the difference between these groups was not statistically significant. The effect of smoking on respiratory complications in patients undergoing ambulatory surgery was examined in Myles et al. 's study.[16] Similar to our findings, the authors reported that smoking did not have a significant effect on hypoxemia, laryngospasm, and apnea but did influence any respiratory complications, particularly cough.

In a study carried out by Eminoglu and Ozgunay on patients undergoing laparoscopic cholecystectomy, smokers showed notable distinctions when compared to nonsmokers and patients exposed to SHS, particularly in the occurrence of laryngospasm and increased secretion complications.[9] Lee et al. reported that smoking was associated with increased perioperative respiratory complications in patients undergoing major elective surgery, while SHS exposure had no such correlation.[10] On the other hand, some studies have indicated that hypersecretion is more likely to develop in individuals exposed to SHS,[36] and the risk increases with the degree of exposure.[11] Similar results have been reported in studies involving children exposed to SHS.[8,37] In this study, hypersecretion was observed only in patients exposed to SHS, although there was no significant difference. The disruption of ciliary functions in the respiratory tract, caused by both active smoking and SHS exposure, may explain the increase in secretion. The reasons why our results differ from the literature can be attributed to the fact that ambulatory general surgeries performed in our institution comprised minor cases, with the patients falling into ASA 1 and 2 classifications. Additionally, nearly half of the smokers in our study exhibited very moderate nicotine dependence according to the FTND.

4.1. Limitations of the study

There were several limitations to our study. First, the study was conducted at a single center where ambulatory surgeries were performed within the hospital, with only general surgery cases and a relatively small number of patient groups. Second, in line with existing literature, the patients were monitored for complications typically arising in the early postoperative period. Third, since the patients' hospital stay was short, the degree of nicotine exposure in smokers and

passive smokers was not confirmed using biological indicators. FTND test was used as an alternative in smokers. The fact that almost half of the smoking group exhibited a moderate level of nicotine addiction may have mitigated the potential impact of complications related to active and passive smoking. Despite these limitations, our study closely observed patients from the moment of surgery until discharge, shedding light on the similar or distinct effects of smoking and SHS exposure on early complications after ambulatory surgery, which is a relatively underexplored area in the existing literature.

5. Conclusion

In conclusion, our study findings highlight that hypotension and postoperative pain are more likely to develop in active smokers compared to nonsmokers and patients with SHS exposure after ambulatory surgery. No significant differences were observed in terms of respiratory complications. Notably, SHS exposed patients also experienced more severe postoperative pain than nonsmokers. This underscores the importance of promoting smoking cessation among patients undergoing not only major inpatient surgery but also ambulatory procedures. Additionally, it is essential to recognize that SHS exposure may also impact complications that could potentially lead to discharge delays in ambulatory surgery, warranting further detailed investigation in future research.

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CRediT authorship contribution statement

Betül Güven: Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Cemile Karaaslan Sevinç:** Validation, Resources, Methodology, Data curation, Conceptualization. **Birgül Ödül Özkaya:** Supervision, Resources, Methodology, Data curation, Conceptualization. **Okan Soyhan:** Supervision, Resources, Methodology, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

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