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Effects of smoking on postoperative pain and opioid consumption in patients with major abdominal oncological surgery

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ABSTRACT

Aims: Major abdominal oncologic surgeries cause serious postoperative pain because they contain extensive tissue damage and large skin incision. Therefore, major abdominal oncological surgeries require more opioid consumption. In addition, there is an association between smoking and opioid use. The objective of this study is to evaluate the potential relationships between smoking status and postoperative pain and opioid analgesic consumption in patients after major abdominal oncological surgery.

Methods: For the study, the approval was obtained from the ethics committee of our institution. 130 patients between 18-75 years of age who underwent elective major abdominal oncological surgery under general anesthesia, had ASA I-III score and was planned for intravenous morphine-controlled analgesia for postoperative analgesia were included in the study. The patients were divided into two groups as smoking (65 patients) and non-smoking (65 patients). ASA scores, age, gender, height, weight, and additional diseases were recorded. Fagerström Test for Nicotine Dependence was applied to patients who had been smoking for at least 1 year. In the postoperative care unit, heart rate, blood pressure, SpO2 values, blood pressure values, Ramsey sedation scores were recorded at 0 hours, 2 hours, 6 hours, 12 hours, 24 hours and 48 hours. At these measurement times, the pain intensity of the patients was evaluated by a visual pain scale. Patients' additional analgesic requirement, total morphine consumption, demand from patient-controlled analgesia device, nausea-vomiting, itching, gas release times, hypotension and dry mouth were recorded.

Results: In this study, postoperative 0-hour, 2nd hour, 6th hour, 12th hour, 24th hour and 48th hour VAS values and the amount of morphine consumed were significantly higher in the smokers compared to non-smokers. In terms of additional analgesic use, it was found that the use of additional analgesics was significantly higher in the group of smokers. Dry mouth and the incidence of nausea/vomiting were significantly higher in smoking patients than in non-smoking patients.

Conclusion: It has been found that smoking increases the severity of postoperative pain in patients who underwent major abdominal cancer surgery and these patients need more opioids. We are of the view that while planning postoperative analgesia, effective treatment strategies can be determined by considering that there may be more severe pain in smoking patients.

Keywords: Smoking, adverse effects, analgesia, postoperative pain, oncologic surgery

INTRODUCTION

Major abdominal oncologic surgeries consist of extensive tissue damage and large skin incision. Therefore, it can cause serious postoperative pain. Inadequate pain control may also delay the overall healing of cancer patients and their return to normal function and limiting their planned oncological treatments.[1] An effective treatment plan by determining patient-specific risks for postoperative pain can help to improve their outcomes.

Experimental studies have shown that nicotine has analgesic efficacy.[2] The analgesic effect of nicotine is likely due to its effects on central and peripheral nicotinic acetylcholine receptors. Another possible explanation for the mechanism of nicotine's analgesic effect may be an increase in plasma endorphins after smoking.[3,4]

On the other hand, epidemiological studies have supported that smoking is a risk factor for acute and chronic pain. This paradox is of increasing clinical significance for smokers and smokers with chronic pain during the perioperative period.[5]

The nicotine in cigarettes affects many physiological systems including the peripheral nervous system, central nervous system, cardiovascular system, gastrointestinal tract, and exocrine glands.[6] In addition, nicotine regulates the natural neuroendocrine-opioid system, causing an increased perception of pain and decreasing the analgesic effect of applied opioid drugs.[7] According to a study by Hooten et al.[7]; smokers have a higher rate of opioid use compared to those with previous smokers and non-smokers. After surgical procedures, nicotine withdrawal in nicotine-dependent patients results in hyperalgesia or lower pain threshold.[8] Failure to manage postoperative pain results in effects on many systems such as an increased proinflammatory cytokine, a decreased anti-inflammatory cytokine, changes in the acute-phase proteins, and coagulation system.[9]

Several studies have shown a relationship between smoking and opioid use.[10] However, we could not find any study which evaluates the relationship between smoking status and opioid consumption in patients undergoing major abdominal oncological surgery.[11,12] It is not clear whether these patients need more analgesics in the postoperative period or not. If such a risk arises, smoking can be used as a marker when postoperative analgesia is planned for this patient population.

In this study, our hypothesis that we aim to observe, and test is: Is the postoperative pain level higher in smokers compared to non-smokers after major abdominal oncological surgery? Does this increase vary depending on the duration of smoking and the degree of nicotine dependence? Additionally, do smokers consume more opioids than non-smokers, and is this consumption positively correlated with the duration of smoking?

METHODS

This study was a prospective, observational study. This study was conducted after the approval of the Ethics Committee of Dr. Abdurrahman Yurtaslan Ankara Oncology Health Practice and Research Centre (Date: 06.03.2019, Decision No: 2019-03/230). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki. The patients who underwent major abdominal oncological surgery and planned for PCA with intravenous morphine for postoperative analgesia in the postoperative care unit (PACU) were included in the study between March 2019 and October 2019. According to the power analysis calculated in G Power 3.1 program (alpha 0.05 1-beta 0.80). The patients were divided into two groups, and we planned to enroll patients in groups until 65 patients in each group and 130 patients in total.

Group 1: Smoker for at least 1 year.

Group 2: Never smoked before or no smoking for at least 6 months.

After all the patients to be operated on were informed in the preoperative anesthesia outpatient clinic, their written consents were obtained. The patients were informed about patient-controlled analgesia (morphine-PCA) and a 10 cm visual analog scale (VAS) before an operation. After being taken to the intensive care unit postoperatively, age, weight, gender, ASA score, comorbidities, previous operations, operation time, intraoperative crystalloid, colloid and blood products, and Fagerström Test for Nicotine Dependence (FTND) score values were recorded.

The FTND was applied to assess the level of nicotine dependence in smoking patients. FTND is a widely used 6-item questionnaire designed to determine the severity of nicotine addiction. The total score ranges from 0 to 10, and the levels of dependence are classified as follows:

- 0-2 points: Low dependence

- 3-4 points: Mild dependence

- 5-7 points: Moderate dependence

- 8-10 points: High dependence

In our study, preoperative FTND scores were recorded for all smoking patients. These scores were analyzed to investigate the relationship between nicotine dependence, postoperative pain intensity, and opioid consumption. The FTND scores were compared with the VAS values and total morphine consumption at different postoperative time points.

Additionally, smoking patients were categorized based on their nicotine dependence level, and we examined whether individuals with higher nicotine dependence had a different postoperative analgesic requirement. Spearman correlation analysis was used to evaluate the relationship between FTND scores and VAS scores at 24 and 48 hours, as well as total morphine consumption.

Inclusion criteria;
- 18 years and older
- ASA physical risk scores I-III
- Patients undergoing elective major abdominal oncological surgery under general anesthesia and PCA with intravenous morphine to be used for postoperative pain control.

Exclusion criteria ;
- Emergency operations
- Younger than 18 and older than 75 years
- Patients with body mass index ≥35
- Patients with an ASA IV and above
- Pregnant women, hemodynamically unstable patients
- Morphine allergy, chronic opioid use, alcohol or drug addictions
- Neurological and psychiatric illness, liver and kidney failure
- Illiterate and non-cooperative patients
- Cardiac rhythm disorder, diabetic neuropathy

- Patients who do not agree to participate in the study
- Epidural PCA for postoperative analgesia

Study Design

The patients who were included in the study was taken to the operation room on the morning of the operation and evaluated by an anesthesiologist who was independent of the study. Patients who underwent standard anesthesia after monitoring (electrocardiogram, noninvasive blood pressure, SpO_2) according to ASA criteria were included in the study (propofol 2 mg/kg, fentanyl 1.5 µg/kg, lidocaine 1.5 mg/kg and rocuronium 0.6 mg/kg in anesthesia induction, and 2% sevoflurane in 40% nitrogen oxide/oxygen mixture for maintenance of anesthesia). In our clinic, intraoperative acetaminophen and/or nonsteroidal anti-inflammatory analgesics and/or 0.05 mg/kg iv morphine is applied to all patients as standard procedure in major abdominal oncological surgeries. For postoperative analgesia, one of the PCA with iv opioid or epidural PCA methods is preferred. Among these patients, patients with PCA with iv morphine were included in the study. PCA was set as 1mg/h infusion, 1 mg bolus, 10-minute lock time.

After being taken to the PACU, the patients were visited at the 0, 2nd, 6th, 12th, 24th, and 48th hours. Heart rate (HR), blood pressure, SpO_2 values, and frequency of PCA demands, and total morphine consumption was recorded. Patients were evaluated in terms of Ramsey Sedation Score, nausea/vomiting, itching, hypotension, and dry mouth. Postoperative pain severity was evaluated by visual pain scale (VAS, 0=no pain, 10=most severe pain). Extra analgesic applications (patients with VAS values of 4 and above) in PACU were considered as additional analgesic requirements. Extra analgesic applications and its dosage was recorded.

Statistical Analysis

Research data was uploaded to the computer environment and evaluated via "SPSS (Statistical Package for Social Sciences) for Windows 22.0 (SPSS Inc, Chicago, IL)". Descriptive statistics were presented as mean±standard deviation (minimum-maximum), frequency distribution and percentage. In the evaluation of categorical variables, Pearson Chi-square test and Fisher's Final test were used. The suitability of variables to normal distribution was examined using visual (histogram and probability plots) and analytical methods (Kolmogorov-Smirnov test). Mann-Whitney U test was used as a statistical method for statistical significance between the two independent groups, and Friedman test was used as a statistical method between 3 and more dependent groups. When a significant difference was found between three and more groups, the Wilcoxon signed ranks test was used in post-hoc binary comparisons to determine the source of the significant difference. The relationship between the variables was evaluated with the Spearman correlation test. The statistical significance level was accepted as $p<0.05$.

RESULTS

Demographic characteristics and clinical data of patients are shown in Table 1. 15.4% of patients had ASA-I, 66.9% ASA-II and the remaining 17.7% had ASA-III risk scores. There was a statistically significant difference between the two groups in terms of ASA classification ($p<0.001$).

There was no statistically significant difference between smokers and non-smokers in terms of surgery branch, types of cancer, duration of operation, presence of comorbidity and all comorbidities present ($p>0.05$).

In terms of VAS values a significant difference was found between smoker and non-smoker groups at all postoperative measurement times ($p<0.001$) (Table 2). In addition, there was a statistically significant difference between smokers in comparison to VAS values over time ($p<0.001$). As a result of post-hoc binary comparisons; it was determined that only VAS value at the 12th hour showed a significant decrease compared to the 6th hour, there was not any significant decrease compared to the previous time, but there was a significant decrease compared to the 2nd or 3rd or 4th time.

When compared to VAS values in non-smokers group, there was not any significant decrease compared to the previous time, but there was a significant decrease compared to the 2nd or 3rd, or 4th time ($p<0.001$). Unlike smokers, there was no significant difference between the 12th hour and 48th hour in terms of VAS values in non-smokers.

The change in the amount of morphine given at different times according to the smoking status is presented in Figure 1. There was a statistically significant difference between the two groups in terms of the amount of morphine given at all measurement times ($p<0.001$).

Also, the percentage of those who needed additional analgesia among smokers was significantly higher than those who did not smoke ($p<0.001$) (Figure 2).

In the smoker group, while there was a positive, moderate statistically significant relationship between the VAS at the 24th hour ($r=0.33$) and the 48th hour ($r=0.28$) and the FTND (Fagerstöm Test for Nicotine Dependence) Score. There was no statistically significant relationship between the FTND test scores with the VAS values at other times ($p>0.05$) (Table 3).

The frequency of patient analgesic demand at all measurement times of smokers was significantly higher than non-smoker patients (Table 4).

A positive and mild relationship was found between the amount of morphine given at 48 hours and the Fagerström Test Score in smokers, which was statistically significant ($r=0.29$, $p=0.019$).

The average of FTND score for smoking patients was 5.1±1.4 (min: 2-max: 8). While only 1 (1.5%) of 65 patients were mildly (2 points) and only 1 (1.5%) was highly dependent (8 points), the remaining 63 patients (97.0%) were moderately dependent.

There was no significant difference between the two groups in terms of intraoperative parameters such as the amount of bleeding, intraoperative crystalloids, and colloids, blood transfusion requirements, and transfused blood product components ($p>0.05$).

There was no statistically significant difference between smokers and non-smokers in terms of HR, systolic artery

Table 1. Demographic characteristics and clinical data of patients

	Total (n=130)	Smoking (n=65)	Non-smoking (n=65)	p
Age (year)	58.2±10.4 (19-89)	57.3±9.6 (27-89)	59.2±11.2 (19-76)	0.097[a]
Gender				
Male	56 (43.1)	31 (47.7)	25 (38.5)	0.288[b]
Female	74 (56.9)	34 (52.3)	40 (61.5)	
Body weight (kg)	74.9±13.6 (40-125)	73.9±14.2 (40-125)	75.9±13.0 (50-115)	0.302[a]
ASA				
I	20 (15.4)	0	20 (30.8)	
II	87 (66.9)	54 (83.1)	33 (50.8)	<0.001[b**]
III	23 (17.7)	11 (16.9)	12 (18.5)	
Type of surgery				
General surgery	70 (53.8)	37 (56.9)	33 (50.8)	
Gynecological surgery	44 (33.8)	20 (30.8)	24 (36.9)	0.744[b]
Urological	16 (12.3)	8 (12.3)	8 (12.3)	
Cancer type				
Endometrium	36 (27.7)	16 (24.6)	20 (30.8)	
Stomach	24 (18.5)	13 (20.0)	11 (16.9)	
Colon	21 (16.2)	11 (16.9)	10 (16.9)	
Rectum	17 (13.1)	9 (13.8)	8 (12.3)	
Prostate	10 (7.7)	4 (6.2)	6 (9.2)	0.959[b]
Ovary	8 (6.2)	4 (6.2)	4 (6.2)	
Pancreas	6 (4.6)	4 (6.2)	2 (3.1)	
Bladder	4 (3.1)	2 (3.1)	2 (3.1)	
Klatskin tumor	3 (2.3)	1 (1.5)	2 (3.1)	
Renal cell tumor	1 (0.8)	1 (1.5)	0	
Operation time (min)	172.9±68.2 (50-480)	174.7±74.8 (50-480)	171.1±61.4 (75-350)	0.968[a]
Presence of comorbidity	79 (60.8)	37 (56.9)	42 (64.6)	0.369[b]
Comorbidities				
CAD	59 (45.4)	26 (40.0)	33 (50.8)	0.218[b]
Endocrine	45 (34.6)	20 (30.8)	25 (38.5)	0.357[b]
Respiratory	11 (8.5)	4 (6.2)	7 (10.8)	0.344[b]
Neurological	2 (1.5)	0	2 (3.1)	0.496[c]
Urinary	1 (0.8)	0	1 (1.5)	1.000[c]

* Continuous variables are presented as "mean±standard deviation (minimum-maximum)" and categorical variables as "number (percent of column)"; n: Number of patients, a: Mann-Whitney U test; b: Pearson Chi-square test; c: Fisher's exact test; **p<0.01; CAD: Coronary artery disease, Min: Minimum

Table 2. VAS scores at different times according to smoking status

	Total (n=130)	Smoking (n=65)	Non-smoking (n=65)	p[a]
	Mean±SD (min-max)	Mean±SD (min-max)	Mean±SD (min-max)	
VAS score				
0	5.0±1.8 (1-9)	5.7±1.8 (2-9)	4.3±1.7 (1-8)	<0.001[**]
2[nd] hour	4.0±1.6 (1-8)	4.7±1.5 (2-8)	3.4±1.3 (1-6)	<0.001[**]
6[th] hour	3.0±1.3 (0-8)	3.7±1.2 (2-8)	2.3±1.0 (0-4)	<0.001[**]
12[th] hour	2.5±1.1 (0-6)	3.0±1.0 (1-6)	1.9±1.0 (0-4)	<0.001[**]
24[th] hour	2.0±0.9 (1-4)	2.6±0.8 (1-4)	1.5±0.7 (1-4)	<0.001[**]
48[th] hour	1.8±0.8 (1-4)	2.2±0.7 (1-4)	1.4±0.6 (1.3-)	<0.001[**]

n: Number of patients; mean: Average; SD: Standard deviation, Min: Minimum, Max: Maximum, VAS: Visual pain scale, a: Mann-Whitney U test, **: p<0.01.

pressure (SAP), diastolic artery pressure (DAP), and oxygen saturation (SpO_2) at all postoperative measurement times (p>0.05).

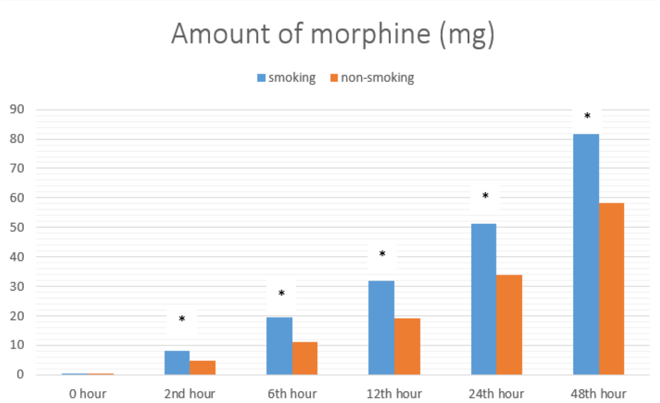

Figure 1. The distribution of the total amount of morphine between smokers and non-smokers

When the two groups were compared in terms of the Ramsey sedation score, it was observed that there were similar sedation scores at all measurement times except for the 12[th] hour (Table 5).

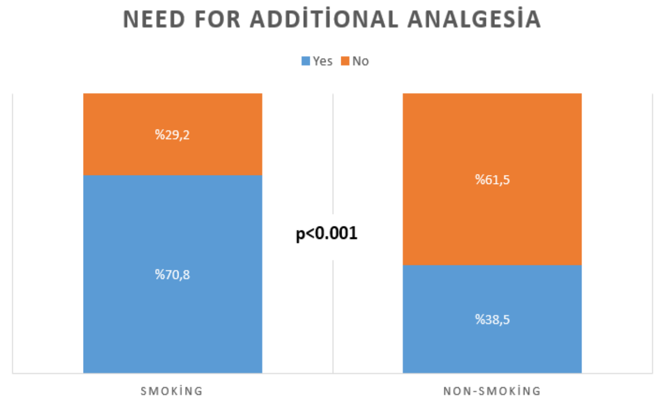

Figure 2. Distribution of the need for additional analgesia

Table 3. Relationship between FTND (Fagerström Test for Nicotine) scores and VAS values at different times and morphine amounts in smokers

	Test score of Fagerström Test for Nicotine Dependence (n=65)	
	r	p
VAS		
0	0.047	0.713
2nd hour	0.011	0.931
6th hour	0.209	0.094
12th hour	0.225	0.072
24th hour	0.327	0.008**
48th hour	0.282	0.023*

n: Number of patients, r: Spearman correlation coefficient, VAS: Visual analog scale, *: p<0.05, **: p<0.01

The most common side effect among the patients included in the study was nausea/vomiting and dry mouth. There was a statistically significant difference between the two groups in terms of the presence of nausea/vomiting (30 (46.2%) vs. 13 (20.0%)) and dry mouth (24 (36.9%) vs. 8 (12.3%)) (p=0.002; p=0.001, respectively). The percentage of patients with nausea/vomiting and dry mouth was significantly higher in smokers than in non-smokers. There was no statistically significant difference between the two groups in terms of urinary/fecal retention, hypotension, and itching (p>0.05) (Table 6).

Table 6. Side effects in both groups

	Total (n=130)	Smoking (n=65)	Non-smoking (n=65)	p^a
	n (%)	n (%)	n (%)	
Nausea/vomiting	43 (33.1)	30 (46.2)	13 (20.0)	0.002**
Dry mouth	32 (24.6)	24 (36.9)	8 (12.3)	0.001**
Urinary/fecal retention	27 (20.8)	16 (24.6)	11 (16.9)	0.280
Hypotension	15 (11.5)	11 (16.9)	4 (6.2)	0.055
Itching	10 (7.7)	7 (10.8)	3 (4.6)	0.188

n: Number of patients, %: Percentage of column, a: Pearson Chi-square test, **: p<0.01

DISCUSSION

In our study, we found that VAS values were always significantly higher in the smoker group in the postoperative period. At the same time, it was observed that an additional analgesic requirement and morphine consumption were also higher in smoking patients at the end of 48 hours.

Nicotine affects many systems, especially the peripheral nervous system, central nervous system, cardiovascular system, and gastrointestinal tract. In addition, nicotine can provide an analgesic effect through the release of nicotine neurotransmitters and the activation of inhibitory pain pathways in the central nervous system. In a study, nicotine nasal spray was used after transabdominal uterine surgery and less postoperative pain was observed.[13]

Table 4. Change in frequency of patient analgesic demand measured at different times

	Total (n=130)	Smoking (n=65)	Non-smoking (n=65)	p^a
	Mean±SD (min-max)	Mean±SD (min-max)	Mean±SD (min-max)	
Frequency of demand				
2nd hour	12.5±14.7 (0-86)	18.9±18.0 (0-86)	6.2±5.6 (0-21)	<0.001**
6th hour	20.6±20.4 (0-110)	31.6±22.8 (3-110)	9.6±8.7 (0-41)	<0.001**
12th hour	26.7±24.1 (0-122)	41.0±25.7 (6-122)	12.3±9.4 (0-43)	<0.001**
24th hour	33.4±29.2 (0-140)	51.3±30.9 (8-140)	15.4±11.0 (0-45)	<0.001**
48th hour	37.6±32.1 (0-150)	59.2±31.8 (8-150)	16.2±11.3 (0-52)	<0.001**

n: Number of patients, Mean: Average, SD: Standard deviation, Min: Minimum, Max: Maximum, a: Mann-Whitney U Test; **: p<0.01

Table 5. RAMSEY scores at different times according to smoking status

	Total (n=130)	Smoking (n=65)	Non-smoking (n=65)	p^a
	Mean±SD (min-max)	Mean±SD (min-max)	Mean±SD (min-max)	
RAMSEY score				
0	2.6±0.7 (1-4)$^{6;12;24;48}$	2.6±0.7 (1-4)$^{12;24;48}$	2.7±0.7 (1-4)$^{6;12;24;48}$	0.434
2nd hour	2.4±0.6 (1-4)$^{12;24;48}$	2.4±0.6 (1-4)^{48}	2.4±0.6 (2-4)$^{12;24;48}$	0.959
6th hour	2.2±0.5 (1-4)	2.3±0.6 (1-4)	2.2±0.4 (2-3)	0.456
12th hour	2.1±0.3 (2-3)	2.2±0.4 (2-3)	2.0±0.2 (2-3)	0.004**
24th hour	2.1±0.3 (1-3)	2.1±0.4 (1-3)	2.0±0.2 (2-3)	0.222
48th hour	2.0±0.2 (1-3)	2.0±0.3 (1-3)	2.0±0 (2-2)	0.173

n: Number of patients, Mean: Average, SD: Standard deviation, Min: Minimum, Max: Maximum, a: Mann-Whitney U Test, **: p<0.01, 6 : Post-hoc binary comparison showed a significant difference at 6th hour, 12 : Post-hoc binary comparison showed a significant difference at 12th hour, 24: Post-hoc binary comparison showed a significant difference at 6th hour, 48: Post-hoc binary comparison showed a significant difference at 24th hour

Although nicotine has an analgesic effect, the pharmacological effects of nicotine-dependent patients lack nicotine during hospital stay should also be considered. Nicotine appears to suppress the perception of pain. When nicotine use is stopped suddenly, nicotine-dependent patients show some symptoms such as depressed mood, insomnia, irritability, anger, anxiety, difficulty concentrating, restlessness, decreased HR, and increased appetite. However, the sudden withdrawal of nicotine in these patients results in hyperalgesia or lower pain threshold after surgery or painful procedures. In our hospital as in other hospitals, patients cannot smoke 48 hours.

Creekmore et al.[6] conducted a retrospective study and examined 89 patients hospitalized for coronary artery bypass graft operation and showed that investigated whether the patients who suddenly quit smoking required more opioid analgesics than non-smokers. They demonstrated that smokers who were deprived of nicotine within the first 48 hours after surgery had a higher opioid requirement than non-smokers. In another study of 248 patients who underwent postoperative total hip arthroplasty, smokers showed significantly higher opioid consumption both in the early postoperative period (first 48 hours) and in the 90 days compared to non-smokers. Moreover, VAS values were higher in smokers than in non-smokers, but this was not statistically significant.[14]

Similarly, we found that the VAS values measured at all times were significantly higher in the smoker group than in the non-smoker group. Total morphine consumption was also higher. Zanaty[5] investigated the effect of smoking on perioperative pain and analgesic requirements in patients who had surgery due to lower limb fractures. In this study, patients with VAS higher than 3 were given NSAIDs, and those who were higher than 6 were given meperidine, and their analgesic needs were evaluated. While there was no difference in NSAID consumption of patients, meperidine consumption was found to be higher in favor of the smoker group. In addition, postoperative VAS values were significantly higher at the 8th hour and 24th hour in the smoker group compared to the non-smoker group.[5]

We also found that the need for additional analgesics was higher in the smoker group, and the VAS values were higher in the smoker group at all evaluation times. In our study, the reason for the high VAS in each follow-up interval may be that our patient group consists of patients who have undergone cancer surgery and cancer patients have a different pain character than orthopedic surgery patients. Woodside and Jack conducted a retrospective study on the relationship between smoking and postoperative opioid consumption in female patients following pelvic surgery. Patients were divided into 3 groups as "never smoked", "previous smoker" and "current smoker" according to smoking status. While previous smokers and current smokers used more opioids than patients who never smoked postoperatively, there was no difference between previous smokers and current smokers.[16]

In our study, both male and female patients were included and 56.9% of the patients were female and there was no statistically significant difference between groups.

FTND is a commonly used method to evaluate nicotine addiction levels. There are six questions in the test and the total score range in the test is 0-10. This test embodies addiction through physiological and behavioral symptoms, does not require an invasive procedure and can be applied easily. However, FTND is insufficient to control tobacco consumption and does not cover different aspects of addiction such as the failure of quitting attempts. Weingarten et al.[15] showed that the Brief pain inventory (FTND≥6) was higher in smokers with severe nicotine addiction. In our study, a positive correlation was found between the 24th and 48th-hour VAS values and the 48th-hour morphine consumption and FTND score in the smoker group. In patients with high nicotine dependence, the severity of pain and the morphine consumption were higher.

Opioid analgesics have side effects such as itching, urinary retention, ileus and bradycardia, especially nausea-vomiting. These side effects can delay the healing process and reduce patient satisfaction in the postoperative period. Morphine and synthetic opioids are assumed to increase vestibular sensitivity by activating μ receptors in the vestibular epithelium. In a previous study conducted by Ionescu[16], 71 patients were scheduled for elective laparoscopic cholecystectomy. They found that the incidence of postoperative nausea and vomiting was significantly lower in smokers than in non-smokers. In our study, the incidence of postoperative nausea and vomiting was significantly higher in the smoker group. We think that this result is due to the side effect of morphine consumed 1.4 times in the smoker group more than non-smokers at the end of 48 hours.

Limitations

Lack of standardization of intraoperative and postoperative use of additional analgesics due to the observational design of the study and not investigating the relationship between smoking duration and pain severity and opioid use may be the limitations of our study. In addition we think that it should be investigated whether the time of nicotine withdrawal affects analgesia and opioid use.

CONCLUSION

In this study, we found that smoking increased the severity of postoperative pain in patients undergoing major abdominal cancer surgery and that these patients needed more opioids. The relationship between smoking, perception of pain and opioid consumption, and increased pain severity due to nicotine withdrawal may be important for patients undergoing major oncological abdominal surgery. We think that effective treatment strategies should be determined by identifying the patients who are at risk for severe pain in the perioperative period.

ETHICAL DECLARATIONS

Ethics Committee Approval

This study was conducted after the approval of the Ethics Committee of Dr. Abdurrahman Yurtaslan Ankara Oncology Health Practice and Research Centre (Date: 06.03.2019, Decision No: 2019-03/230).

Informed Consent

All patients signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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