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Preoperative Smoking Cessation and its Association with Postoperative Complications and Length of Hospital Stay in Patients Undergoing Herniorrhaphy

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Background: To assess the effect of preoperative smoking cessation on postoperative complications in patients undergoing herniorrhaphy.
Materials and Methods: This prospective study was conducted on 163 consecutive patients, undergoing herniorrhaphy. Demographic characteristics and postoperative complications were compared between smokers (group A), patients who reduced smoking by 50% (group B), and patients who completely quit smoking (group C).
Results: The mean age of the patients was 42.9 (SD=10.3) years. Group A (n=77), group B (n=27), and group C (n=59) were not significantly different in terms of age, body mass index (BMI), medical history, laboratory data, smoking habit, type of hernia, type of anesthesia, the American Society of Anesthesiologists (ASA) class, repair method, surgery approach, and duration surgery ($P>0.05$ for all). However, significant differences were observed between group B and group A, group C and group A, and group C and group B regarding postoperative complications, such as wound healing complications and length of hospital stay (LOS) ($P<0.05$ for all).
Conclusion: Decreased preoperative smoking is associated with the reduced risk of respiratory, cardiovascular, and wound healing complications and decreased LOS in patients undergoing herniorrhaphy.

Key words: Herniorrhaphy; Preoperative smoking cessation; Postoperative complications

INTRODUCTION

Despite major improvements in anesthetic and surgical procedures, postoperative complications remain one of the major challenges for patients and medical teams (1-2). These complications include morbidity, prolonged hospitalization, readmission to the intensive care unit (ICU), and mortality (1-2). The results of previous studies show that many factors, such as chronic diseases, malnutrition, excessive obesity, age, smoking, and alcohol consumption, contribute to postoperative complications (3-6). Some of these factors, such as age, are unavoidable; however, an intervention for potential smoking cessation is possible (7).

Several risk factors and comorbidities can negatively influence the outcomes of surgery. One of the most common comorbidities is cigarette smoking, which is the leading cause of preventable death around the world (8). Smokers have higher risks of intraoperative pulmonary complications and a wide range of postoperative complications, such as pulmonary (9) and wound healing (6, 10) complications. The efficacy of smoking cessation interventions is well-established in the primary care setting. Smoking cessation is associated with significant improvements in mortality rates, quality of life, life expectancy, and postsurgical complications (6).

Researchers have studied the association between preoperative smoking and postoperative complications, such as pulmonary complications; however, the optimal duration of preoperative smoking cessation is still unclear (9). On the other hand, preoperative smoking cessation and its association with postoperative complications of hernia repair surgery are less known. With a comprehensive understanding of the systemic and local effects of smoking and its influence on specific complications associated with hernia repair surgery, clinicians can be better prepared to devise customized treatment plans for patients and explain the effects of smoking on surgical outcomes to smoking patients (11,12).

This study aimed to assess the association of preoperative smoking cessation with the increased risk of complications, such as respiratory, cardiovascular, and wound healing complications and LOS in patients undergoing herniorrhaphy.

MATERIALS AND METHODS

Patients and data collection

A total of 163 consecutive patients undergoing herniorrhaphy were reviewed prospectively between November 2015 and November 2016 in a teaching hospital in Tehran, Iran. The inclusion criteria were as follows: 1) being a smoker for at least one year (one pack-year); 2) age range of 20-60 years; 3) being a candidate for elective hernia repair surgery; and 4) possibility of postponing the surgery for four weeks to quit smoking without experiencing any side effects. If a patient was taking acetylsalicylic acid (ASA) or warfarin, it was discontinued 7-10 days before surgery, and if necessary, heparin was replaced.

The exclusion criteria were as follows: 1) non-smoking patients; 2) having an underlying heart or lung disease; 3) a body mass index (BMI) ≥40 kg/m^2 or ≤15 kg/m^2; 4) diagnosis of cancer or human immunodeficiency virus (HIV) infection; 5) severe malnutrition; 6) uncontrolled diabetes; 7) advanced chronic kidney disease (CKD) or connective tissue disorder; and 8) immunocompromised patients due to infectious diseases.

A total of 182 patients were randomly allocated to the following groups, using computerized random allocation software: group A, including smoking patients (n=86); group B including patients who reduced smoking by 50% (n=31), and group C including patients who quit smoking completely (n=65). For patients in group C, four weeks of smoking cessation was considered (but not for group A). Sixty-five patients (group C) were followed-up for four weeks, and smoking cessation was investigated. At the end of the fourth week, the cotinine test was negative for 65 patients (group C), and 31 patients stated that their smoking was reduced by 50% (group B). Six patients from group C, nine patients from group A, and four patients from group B were excluded from the study. The remaining patients underwent herniorrhaphy. The demographic characteristics and postoperative complications were compared between group A (n=77), group B (n=27), and group C (n=59).

Postoperative complications, such as respiratory, cardiovascular, and wound healing complications and length of hospital stay (LOS), were assessed in this study. Wound healing complications were considered as wound dehiscence, fat or flap necrosis, incisional herniation, vein thrombosis of surgical bed, hematoma, seroma, wound infection, and cellulitis. Respiratory complications were as follows: bronchospasm, atelectasis, pulmonary infection, pleural effusion, pneumothorax, empyema, pulmonary embolism, acute respiratory distress syndrome (ARDS), pulmonary arrest, re-intubation, ventilation, tracheostomy, and need for supplemental oxygen for 24 hours. Besides, cardiovascular complications were as follows: life-threatening arrhythmia, severe hemodynamic disorder, myocardial infarction (MI), congestive heart failure (CHF), and cerebrovascular accident (CVA).

Statistical analysis

Descriptive statistics, including mean, standard deviation (SD), and percentage, were used to explore quantitative and categorical variables. One-way analysis of variance (one-way ANOVA), followed by Bonferroni's post hoc comparison test, was applied to compare the mean values of all quantitative variables between group A, group B, and group C. Besides, t-test was used for continuous variables and χ^2 test for categorical variables. The level of statistical significance was defined as $P<0.05$.

SPSS version 18 (SPSS Inc., Chicago, IL, USA) was used for all data analyses.

Ethical considerations

The Ethics Committee of Shahid Beheshti University of Medical Sciences (Tehran, Iran) approved this study.

RESULTS

A total of 163 patients were included in this study. The mean age of the patients was 42.4 (SD=10.3) years. The characteristics of the patients and clinical factors are presented in Table 1 and Table 2, respectively. Group A (n=77), group B (n=27), and group C (n=59) were not significantly different in terms of age, BMI, medical history, laboratory data, smoking habit, type of hernia, type of anesthesia, ASA class, repair method, surgery approach, and duration of surgery (P>0.05 for all).

Table 1. Baseline demographic data by preoperative smoking cessation in patients undergoing herniorrhaphy (n=163)

	Group A (n=77)	*Group B* (n=27)	*Group C* (n=59)	ANOVA *P*-value#
Characteristics				
Age (Year)	44.2 (9.4)	42.4 (11.2)	41.5 (11.1)	0.12
Gender (Male %)	100	100	100	
BMI (kg/m^2)	23.5 (2.1)	23.2 (2.1)	23.9 (2.1)	0.17
Medical history				
Cardiovascular disease	-	-	-	-
Pulmonary disease	-	-	-	-
Diabetes	5(6.5%)	2(7.4%)	4(6.7%)	0.88
Hypertension	5(6.4%)	2(7.4%)	6(10.1%)	0.43
Laboratory data				
Hemoglobin (gr/dl)	13.3(1.0)	13.3(0.9)	13.4(0.9)	0.87
Creatinine (mg/dl)	0.80(0.2)	0.86(0.2)	0.8(0.2)	0.32
FEV1(L/S)	3.16(0.5)	3.1(0.4)	3.2(0.4)	0.33
Blood sugar (mg/dl)	86.9(9.4)	89.8(6.3)	87.9(9.7)	0.37
Smoking habit				
Pack-years	14.8(7.4)	15.2(7.1)	14.3(6.5)	0.68
NRT	-	12(44.4%)	35(59.3%)	0.20

A: No quitting smoking; B: Quit smoking by 50%; C: Complete quitting smoking.
* Values are mean (SD) or number (%).
# Derived from one-way analysis of variance (abbreviated one-way ANOVA).
Post hoc ANOVA analysis were not shown a significant difference between both groups (A vs. B; C vs. A and C vs. B) (P>0.05 for all).

Table 2. Clinical factors by preoperative smoking cessation in patients undergoing herniorrhaphy (n=163)

Clinical Factors	A group (n=77)	B group (n=27)	G group (n=59)	P value#
Hernia type				0.34
Groin hernia	63(81.8%)	23(85.1%)	48(81.4%)	
Abdominal wall hernia	14(28.2%)	4(14.9%)	11(18.6%)	
Type of anesthesia				0.96
Spinal anesthesia	56(72.7%)	19(70.4%)	42(71.2%)	
General anesthesia	21(27.3%)	8(29.6%)	17(28.8%)	
ASA Class				0.27
I	65(84.4%)	23(85.2%)	55(93.2%)	
II	12(15.6%)	4(14.8%)	4(6.8%)	
Repair method				0.72
With mesh	69(89.6%)	24(88.9%)	55(93.2%)	
Tissue repair	8(10.4%)	3(11.1%)	4(6.8%)	
Approach				0.55
Open	73(94.8%)	24(88.9%)	54(91.5%)	
Laparoscopic	4(5.2%)	3(11.1%)	5(8.5%)	
Duration of surgery (minute)	74.3±18.7	73.4±16.5	70.6±19.4	0.12

A: No quitting smoking; B: Quit smoking by 50%; C: Complete quitting smoking.
* Values are mean (SD) or number (%).
# Derived from one-way analysis of variance (abbreviated one-way ANOVA).
Post hoc ANOVA analysis were not shown a significant difference between both groups (A vs. B; C vs. A and C vs. B) (P>0.05 for all).

Complications reported in the patients are presented in Table 3. Significant differences were observed between the groups (group B vs. group A; group C vs. group A; and group C vs. group B) regarding postoperative complications, such as respiratory and wound healing complications and LOS (P<0.05 for all).

Table 3. Complications by preoperative smoking cessation in patients undergoing herniorrhaphy (n = 163)

Complication	A group (n=77)	B group (n=27)	C group (n=59)	P value#
Complication**	20(25.9%)	4(14.8%)	4(6.8%)	0.015
Respiratory complications	11(14.3%)	2(7.4%)	2(3.4%)	0.079
Cardiovascular Complications	3(3.9%)	0(0%)	0(0%)	0.227
Wound healing complications	13(16.9%)	2(7.4%)	2(3.4%)	0.034
Duration of hospitalization	1.45(0.8)	1.1(.3)	1.2(0.4)	0.003

A: No quitting smoking; B: Quit smoking by 50%; C: Complete quitting smoking.
* Values are mean (SD) or number (%).
**Some patients had several complications
Derived from one-way analysis of variance (abbreviated one-way ANOVA).
Post hoc ANOVA analysis were showed a significant difference between both groups (A vs. B; C vs. A and C vs. B) (P>0.05 for all, except for cardiovascular and Respiratory Complications).

DISCUSSION

The present results showed significant differences in terms of surgical complications among patients undergoing herniorrhaphy, depending on the duration and intensity of smoking. Therefore, perioperative smoking cessation seems to be an effective tool to reduce postoperative complications, and clinics should help patients quit smoking before hernia repair surgery. In this regard, Lindström et al. (13) reported that perioperative smoking cessation four weeks before and after hernia repair (n=21) would reduce the frequency of postoperative complications. Other studies revealed that smoking was related to an increased risk of respiratory complications, postoperative wound infection, and surgical-site infection in cases undergoing surgery (3,10,14,15), which is in line with our findings. Likewise, Musallam et al. (16) reported that smoking cessation at least one year before a major surgery diminished the risk of postoperative mortality and reduced the risk of arterial and respiratory events in current smokers.

Researchers have reported that smoking increases the risk of unplanned intensive care admission, and smoking cessation three weeks before surgery is effective in wound healing (17). Duchman et al. (8) found that current smokers had an increased risk of wound healing complications, and both current and former smokers had an increased risk of complications following surgery. Smoking has a prolonged effect on inflammatory and reparative cell functions, leading to delayed healing and complications (18). Teng et al. (19) and Armaghani et al. (20) reported that increased preoperative cigarette smoking was associated with increased LOS in patients undergoing surgery, which is consistent with our results.

There are several limitations to this study. First, there is a lack of standard criteria for the assessment of complications in the study. Second, we were unable to assess all medical interventions and related complications; therefore, further studies including such information are needed.

CONCLUSION

Decreased preoperative smoking is associated with the reduced risk of respiratory, cardiovascular, and wound healing complications and reduced LOS in patients undergoing herniorrhaphy. Research is now being conducted on treatments that can overcome the undesirable effects of smoking; also, it is important to find alternatives to smoking that may better allow smokers to quit perioperatively.

Competing interests

The authors declare that they have no competing interests.

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