

The Effect of Short-Term Preoperative Smoking Cessation on the Incidence of Post-Operative Pulmonary Complications in Patients Undergoing Elective Non-Cardiac Surgery

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ABSTRACT

This is a prospective cohort study to determine the effect of smoking cessation less than 8 weeks before elective surgery on the incidence of postoperative pulmonary complications (POPC). Subjects consisted of 237 adult patients who had smoked at least one cigarette within 8 weeks of their scheduled operation. They were observed up to 7 days post-surgery for development of atelectasis, tracheobronchitis, pneumonia, respiratory failure or bronchospasm. Fifty or 21.1% of the 237 patients had POPC during the observation period. Patients who quit smoking less than 2 weeks had a complication rate of 16.6%; while those who stopped between 2-4 weeks and 4-8 weeks before surgery had complication rates of 33% (OR 2.52; [1.11, 5.72]) and 25% (OR 1.68; [0.80, 3.55]), respectively. After adjusting for the effect of other risk factors, however, the impact of different intervals of smoking cessation on POPC was no longer apparent. In contrast, American Society of Anesthesiologists (ASA) status and chronic lung disease were found to be independent predictors of POPC. It was concluded that pre-operative smoking cessation less than 8 weeks neither reduced nor increased POPC and that any observed increase in POPC may be related to poorer medical condition, with sicker patients likely to undergo longer periods of abstinence to reduce the risk of pulmonary complications.

Key Words: smoking cessation, postoperative complications, pulmonary atelectasis

Introduction

Tobacco smoking is associated with increased risk of developing various types of cancers, as well as acute and chronic cardiovascular and pulmonary conditions.^{1, 2} It is also an important risk factor for the development of pulmonary complications such as atelectasis, pneumonia and respiratory failure in the immediate postoperative period.³ Chronic exposure to tobacco smoke causes mucus hypersecretion, impairment of tracheobronchial clearance and small airway narrowing.^{4,5} These chronic derangements, combined with the acute physiologic effects of surgery and

anesthesia, may cause difficulty in mobilizing respiratory secretions and lead to lung collapse, bacterial overgrowth, infection and abnormal gas exchange.^{6, 7} To minimize the risk of these respiratory complications, smokers are often advised by their physicians to quit smoking prior to their scheduled surgery.

Recommendations on the duration of smoking cessation needed to significantly reduce complications have varied anywhere from 1 to 8 weeks,⁸⁻¹¹ although the basis for these recommendations are not well defined. It takes at least 6 to 8 weeks of smoking cessation to reverse some of the abnormalities in respiratory function⁵ with longer periods of abstinence resulting into more significant reductions in postoperative complication rates.^{8,12} However, patients and physicians often will not wait for 8 weeks before proceeding with surgery. Most will allow for a few days to a few weeks of preoperative abstinence although it is uncertain if these periods of smoking cessation are actually of any benefit. Some studies even suggest that respiratory complications may actually increase during the first few weeks of abstinence. Warner and co-workers⁸ in a study of patients undergoing coronary by-pass surgery, found that the rate of POPC among patients who stopped smoking for 1 week or less was 33% but in those who stopped smoking between 1 to 8 weeks, the rate of POPC was slightly higher at 57.1%. Nakagawa et al¹² also found that the rate of POPC after pulmonary surgery was 53.8% among smokers who stopped smoking 2 to 4 weeks before surgery as compared to 43.2% in patients who stopped for 2 weeks or less. The risk in all smokers was significantly higher as compared to non-smokers and only started to decline when patients stopped smoking 5 to 8 weeks prior to surgery. The higher rates of POPC after 2 to 4 weeks smoking abstinence as compared to shorter smoke-free periods was attributed by Warner and co-workers to the abrupt absence of the irritant effect of cigarette smoke during the perioperative period when pain, together with little or no improvement in production or clearance of sputum, may augment the risk of retained secretions and obstructed airways.⁸ Bluman and co-workers also postulated that a transient increase in sputum volume during the first few days of smoking cessation combined with altered epithelium and poor ciliary activity may cause difficulties in expectoration. However, they also considered the possibility of selection bias (sicker patients were

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more likely to reduce smoking) and the effects of nicotine withdrawal as the cause for the increased risk.¹³

This paper aims to clarify the effect of smoking cessation efforts started within 8 weeks of elective non-cardiac surgery on the subsequent incidence of pulmonary complications with the end of providing more definite recommendations on the minimum period of smoking cessation that will produce a beneficial effect on patients.

Objectives:

The study aims to determine the effect of short-term smoking cessation (8 weeks or less) on the incidence of pulmonary complications after elective non-cardiac surgery. The specific objectives are:

1. To determine the incidence of post-operative pulmonary complications after periods of smoking cessation lasting 8 weeks or less;
2. To determine if the incidence of post-operative pulmonary complications increases, decreases or remains the same after the first few weeks of smoking cessation.
3. To determine the interval wherein the risk of postoperative pulmonary complications becomes significantly reduced as compared to the first few weeks of smoking cessation.
4. To determine if the effect of preoperative smoking cessation on postoperative pulmonary complications is confounded by patient characteristics, co-morbid conditions, type of surgical and anesthetic procedure and previous smoking history.
5. To determine if the presence of craving and restlessness as symptoms of nicotine withdrawal is associated with increased incidence of postoperative pulmonary complications.

Materials and Method

Subjects:

This is a prospective cohort study. Subjects consisted of eligible patients from the East Avenue Medical Center, Philippine General Hospital, Capitol Medical Center, Veteran's Memorial Medical Center and the Lung Center of the Philippines who were scheduled for elective non-cardiac surgery.

Inclusion criteria:

1. 18 years old or above
2. Regular smoker or smoking history of at least 1 pack-year
3. Smoking within 8 weeks of expected schedule of surgery
4. Elective non-cardiac surgery
5. Willing to sign informed consent

Exclusion criteria:

1. Cigar or pipe smokers only
2. Obstetrical procedures, including normal delivery
3. Repeat operation within the same hospital

confinement

4. Respiratory infection within the past 2 weeks
5. Pre-operative chest x-ray showing pneumonia, atelectasis or pleural effusion
6. Active TB, acute exacerbation of COPD, asthma or bronchiectasis

Procedure:

All patients referred to the medical or anesthesia department of the participating hospitals for preoperative evaluation were monitored and screened for eligibility by the author or co-investigators. Subjects who met the inclusion criteria and none of the exclusion criteria underwent a review of their medical history, complete physical examination, and evaluation of results of all available laboratory tests such as the complete blood count (CBC), chest x-ray and 12-lead ECG (for patients more than 40 years old) or other tests deemed necessary by the attending physician. Smoking history measured as the number of pack-years was calculated by multiplying the number of years of regular smoking by the number of packs of cigarettes smoked per day (number of packs = number of cigarettes smoked per day ÷ 20). The date of the last cigarette smoked before the interview, the presence of craving and restlessness as possible symptoms of nicotine withdrawal were asked. Duration of smoking cessation in days, which is the primary study variable, was calculated as the number of days from the date of last cigarette smoked to the actual day of surgery. For the purposes of comparison, smokers who stop smoking for 14 days or less were considered to be "current smokers" while those who stop smoking from 15 days to 4 weeks were considered as "past-smokers". Patients who stopped smoking for more than 4 weeks were labeled as "ex-smokers."

The following data were collected using standard forms during the preoperative evaluation:

1. Age, in years
2. Sex
3. Body mass index (BMI) = weight in kilograms ÷ square of height in meters
4. Goldman cardiac risk index (CRI)
5. American Society of Anesthesiologists (ASA) classification. The ASA score divides patients into five groups: healthy (class 1), mild to moderate systemic disease (class 2), severe systemic disease (class 3), severe systemic disorders that are life threatening (class 4), and moribund (class 5).
6. Presence of chronic lung disease (asthma, chronic obstructive pulmonary disease, tuberculosis or bronchiectasis).

The following data were collected during the peri-operative period:

1. Actual date of surgery
2. General type of surgery, whether thoracic, upper abdominal, lower abdominal, orthopedic, head and neck or

eye, and the specific procedure

3. Duration of surgery, in minutes
4. Estimated blood loss, in milliliters
5. Type of anesthesia, whether general, spinal or regional
6. Duration of anesthesia, in minutes
7. Use of prophylactic antibiotics

Management of patients throughout the observation period was left to the complete discretion of the attending physicians and the investigators merely recorded their preoperative, intra-operative and postoperative status. There was no effort on the part of the investigators to institute measures to reduce risk of pulmonary complications other than reinforcing advice to do lung-inflation maneuvers like deep-breathing exercises and incentive spirometry which are considered standard practice for patients undergoing surgery. However, no additional efforts were exerted by the investigators to ensure or monitor compliance of the patients to these procedures before and after the surgery.

Outcome Measures:

The primary outcome of interest is any post-operative pulmonary complication (POPC). The following events were considered as post-operative pulmonary complications:

1. Pneumonia, defined clinically as presence of crackles on auscultation or new infiltrates on chest x-ray with any 2 of the following 4 criteria: a) cough; b) purulent phlegm; c) fever or temperature $\geq 38^\circ\text{C}$ ¹⁹; d) leukocytosis or $\text{WBC} \geq 10,000/\text{mm}^3$
2. Tracheobronchitis, defined as any 2 of the above 4 criteria in the absence of both new crackles on auscultation and new chest x-ray infiltrates
3. Atelectasis, or lung collapse visible on chest x-ray film
4. Respiratory failure, with or without associated respiratory infection, indicated by any of the following: a) hypoxemia or $\text{PO}_2 < 60$ mm Hg, documented by arterial blood gases; b) requirement of supplemental oxygen for 48 hours or more; c) delayed extubation or need for endotracheal intubation outside of the recovery room; d) re-intubation at anytime in the post-operative period; or e) need for mechanical ventilation.
4. Bronchospasm or new onset of wheezing, requiring at least 2 separate doses of bronchodilator
5. Postoperative fever, defined as temperature of 38.0°C or more for 2 consecutive days in the absence of clear criteria for pneumonia, tracheobronchitis, atelectasis or any non-respiratory infection.

The presence of any post-operative pulmonary complication was initially determined 48 to 72 hours after surgery by interview and physical examination of the patient, and review of the medical chart and chest x-ray films. The attending physician determined the diagnostic evaluation to be done but a chest x-ray and arterial blood gases were suggested if the patient develops fever of more than 24 hrs, cough, purulent phlegm or desaturation on

pulse oximetry during the first 3 days. In patients who did not develop pulmonary complications during the first 3 days, another evaluation was done from the fifth to the seventh post-operative day or at the time of discharge, whichever occurred earlier.

Sample Size Calculation:

The sample size of 237 was based on an anticipated increase in the incidence of postoperative pulmonary complications from 20% in patients with smoking cessation of less than 2 weeks (the reference group) to 40% in those quitting from 2 to 8 weeks, with the 60% of the subjects coming from the reference group, and other independent variables accounting for 30% of the variance in the logistic regression analysis. This sample achieves a power of 80% at a level of significance of 0.05.

Ethical Considerations:

The study protocol was approved by the respective Research Committee or Ethical Review Committee of all 5 participating centers. Informed consent was obtained from all included patients. The informed consent stated that the research was strictly observational and that investigators were not to be involved in any active intervention nor would they influence the post-operative course or management of their attending physicians. Confidentiality of all information obtained from their medical charts was ensured.

Data Analysis:

Data analysis consisted of summary descriptive statistics for baseline demographic, preoperative and postoperative clinical characteristics of the study population, Chi square test and t test to determine association of smoking history and other risk factors with the incidence of POPC, and logistic regression analysis to further identify independent predictors of the primary outcome.

Results

The study population consisted of 237 subjects, with 199 males (84%) and 38 (16%) females, and a mean age of 46.51 yrs (SD, 14.99 yrs). The results of the preoperative medical assessments of the 237 subjects are seen in Table 1. The subjects had a mean smoking history of 20.87 (SD, 20.9) pack-years. One hundred three (103) or 43.5% of patients underwent surgery after 7 days or less of smoking abstinence, and just over 60% of them within the first 2 weeks. At the time of surgery, 47 (24.1%) reported cravings for cigarettes and 24 (10.1%) noted feelings of restlessness and anxiety. Table 2 shows the types of surgical procedures that were done in the 237 patients. 64% of the procedures were performed under general anesthesia and nearly two-thirds of all procedures lasted between 60 to 180 minutes, with a mean duration of 140.77 minutes (SD, 110.0 minutes).

Postoperative pulmonary complications developed in fifty patients (21.1%), with atelectasis as the most common event (Table 3). There were differences in the incidence of

Table 1. Baseline demographic and clinical characteristics of the study population (N=237).

Variable	No.	%
Age, years		
20 or less	7	2.9
21 to 40	77	32.5
41 to 60	109	46.0
> 60	44	18.6
Sex		
Male	199	84.0
Female	38	16.0
Body Mass Index (BMI)		
20 or less	66	27.8
21 to 24	107	45.2
25 and above	64	27.0
ASA Class		
I	190	80.2
II	43	18.1
III	4	1.7
Cardiac Risk Index Score		
0-5 pts.	225	94.9
6-12 pts	11	4.6
> 12 pts	1	0.5
Chronic lung disease		
No	203	85.7
Yes	34	14.3
Smoking history, pack-yrs		
10 or less	103	43.5
11 to 20	57	24.1
21 to 30	28	11.8
31 to 40	17	7.2
41 to 50	12	5.1
> 50	20	8.4
Smoking cessation, days		
0 to 7	103	43.5
8 to 14	42	17.7
15 to 21	23	9.7
22 to 28	13	5.5
29 to 35	29	12.2
36 to 42	10	4.2
43 to 49	7	3.0
50 to 56	10	4.2
Craving for cigarettes		
No	180	75.9
Yes	47	24.1
Restlessness or anxiety		
No	213	89.9
Yes	24	10.1

POPC among the 3 smoking cessation groups. 24 patients or 16.6% in the 0-2 week smoking cessation group (“current smokers”) had a postoperative complication. The 2-4 week smoking cessation group (“recent smokers”) had a significantly higher complication rate of 33.3%, with an odds ratio (OR) of 2.52 (95% CI: 1.11, 5.72). The 4-8 week smoking cessation group (“ex-smokers”) also had a higher complication rate than current smokers but the difference was not statistically significant (OR=1.68; 95% CI: 0.80, 3.55).

Initial analysis also showed significant p values (see Table 4) for variables known to be risk factors for postoperative pulmonary complications. Of the so-called patient-related

Table 2. Operative data of the study population (N=237).

Variable	No.	%
Type of surgery		
Thoracic	31	13.1
Upper abdominal	35	14.8
Lower abdominal, pelvic, urologic	69	29.1
Orthopedic	37	15.6
Head, face & neck	48	20.3
Eye	17	7.2
Duration of surgery, minutes		
60 or less	53	22.4
61 to 180	154	65.0
181 to 360	17	7.2
> 360	13	5.4
Intra-operative blood loss, ml		
500 or less	203	85.7
501 to 1000	23	9.7
> 1000	11	3.6
Type of anesthesia		
General	152	64.1
Spinal/regional	85	35.9
Prophylactic antibiotic use		
No	57	24.1
Yes	180	75.9

Table 3. Incidence of post-operative pulmonary complications in the study population

Complications*	No.	%
Atelectasis	24	10.1
Tracheobronchitis	17	7.2
Respiratory failure	10	4.2
Pneumonia	9	3.9
Postoperative fever	9	3.9
Bronchospasm	4	1.7

* Subjects may have more than one complication

risk factors, age, male sex, ASA classification, Cardiac Risk Index (CRI) score, and the presence of chronic lung disease were significantly associated with postoperative respiratory complications. Smoking-related factors, such as duration of smoking history and the presence of withdrawal symptoms such as craving for cigarettes, restlessness or anxiety, were also associated with increased risk of POPC by univariate analysis. Similarly, factors related to surgical and anesthetic procedure, and intra-operative course were associated with the occurrence of POPC (see Table 5). As expected, the risk for POPC was highest for thoracic procedures (crude OR = 7.05; 95%CI: 2.69, 18.5) and lowest with eye operations. The risk with general anesthesia was more than three-fold compared to spinal or regional anesthesia. Procedures longer than 60 minutes and those causing blood losses of more than 500 ml had a higher risk of POPC with crude OR of 3.10, and 2.77, respectively. Use of prophylactic antibiotics also had significantly higher incidence of respiratory morbidity.

Table 4. Incidence of POPC according to demographic and clinical characteristics

Variable	No POPC No.	Any POPC No.	p value	Crude OR
Age, yrs				
40 or less	68	16	0.84	1.00
41 to 60	85	24		1.20 (0.59, 2.44)
> 60	34	10		1.25 (0.51, 3.05)
Sex				
Male	152	47	0.02	3.61 (1.06, 12.3)
Female	35	3		1.00
BMI, kg/m ²				
< 20	44	14	0.76	1.24 (0.59, 2.58)
20 to 24	105	27		1.00
> 25	38	9		0.92 (0.40, 2.13)
ASA Class				
1	163	28	< 0.001	1.00
2 & 3	24	22		5.33 (2.64, 10.8)
CRI Class				
1	180	45	0.07	1.00
2, 3, & 4	7	5		2.86 (0.87, 9.42)
Chronic lung disease				
No	171	32	< 0.001	1.00
Yes	16	18		6.01 (2.78, 13.0)
Smoking history, pack-yrs				
20 or less	135	25	0.004	1.00
> 20	52	25		2.60 (1.37, 4.92)
Smoking cessation, wks				
0 to 2	121	24	0.07	1.00
2 to 4	24	12		2.52 (1.11, 5.72)
4 to 8	42	14		1.68 (0.80, 3.55)
Craving for cigarettes				
No	155	35	0.04	1.00
Yes	32	15		2.07 (1.01, 4.24)
Anxiety				
No	175	38	< 0.001	1.00
Yes	12	12		4.60 (1.92, 11.0)

Table 5. Incidence of POPC according to procedure-related factors

Variable	No POPC No.	Any POPC No.	p value	Crude OR
Type of surgery				
Thoracic	13	18	< 0.001	7.05 (2.69, 18.5)
Upper abd.	33	2		0.29 (0.06, 1.39)
Lower abd.& uropelvic	58	11		1.00
Orthopedic	31	6		1.05 (0.35, 3.14)
Head & neck	37	11		1.51 (0.59, 3.85)
Eye	15	2		0.68 (0.13, 3.39)
General anesthesia				
No	76	9	0.003	1.00
Yes	111	41		3.12 (1.43, 6.79)
Duration of procedure				
≤ 60 min	48	5	0.02	1.00
> 60 min	139	45		3.10 (1.16, 8.28)
Blood loss				
≤ 500 mL	166	37	0.008	1.00
> 500 mL	21	13		2.77 (1.27, 6.05)
Prophylactic antibiotic				
No	52	5	0.008	1.00
Yes	135	45		3.47 (1.30, 9.20)

While univariate analysis showed that different durations of preoperative smoking cessation was associated with varying incidence of postoperative pulmonary complications, this was not supported in the subsequent logistic regression analysis. Our results showed that any smoking cessation within an 8-week period neither increased nor decreased the occurrence of POPC. On the other hand, ASA class, presence of lung disease, general anesthesia and blood loss > 500ml were found to be independent predictors for an increased incidence of postoperative complications while upper abdominal surgery was predictive of a lower incidence of morbidity when compared to lower abdominal procedures (Table 6). Thus, the results show that postoperative complications were more likely to be due to poorer medical conditions of patients rather than any short-term interval of preoperative smoking cessation. The resulting prediction model had a fairly high coefficient of prediction (R^2) of 0.24 ($p < 0.001$) suggesting that the major contributory factors had been adequately considered.

Table 6. Logistic regression analysis

VaVariables	Odds Ratio	SE	Lower 95% CI	Upper 95% CI	p value
Recent smoker	1.45	0.76	0.52	4.03	0.47
Ex-smoker	1.39	0.63	0.46	3.38	0.47
Male	2.83	1.97	0.72	11.05	0.13
ASA > 1	2.71	1.43	0.96	7.62	0.05
Lung disease	3.74	2.00	1.31	10.69	0.01
Pack-yrs > 20	0.98	0.46	0.39	2.45	0.96
Thoracic surgery	1.57	1.16	0.37	6.69	0.54
Upper abd, surgery	0.16	0.15	0.03	1.00	0.05
Orthopedic surgery	0.83	0.54	0.23	2.43	0.79
Head & neck surgery	0.68	0.44	0.19	2.07	0.55
Eye surgery	0.39	0.39	0.06	3.61	0.34
General anesthesia	3.34	2.04	1.00	10.72	0.05
Blood loss > 500 mL	2.39	1.14	0.93	6.10	0.07

Discussion

The present study showed that there are no significant changes in the incidence of postoperative pulmonary complications that is directly attributable to smoking abstinence among patients undergoing elective non-cardiac surgery if the cessation period is 8 weeks or less. After adjusting for confounding and interaction between variables, the risk of respiratory complications after elective surgery with recent smoking (smoking cessation of 2 to 4 weeks) and with past smoking (smoking cessation of 4 to 8 weeks) were not significantly diminished as compared to *current smokers* (smoking abstinence for 2 weeks or less). The adjusted odds ratio for POPC with recent smoking was only 1.45 (95% confidence interval 0.52, 4.03) and with past smoking, 1.39 (95% confidence interval 0.46, 3.38), with p values of 0.470 and 0.465, respectively.

Our findings are in agreement with a growing number of studies indicating that long periods of smoking cessation are required to substantially reduce the respiratory risks associated with tobacco smoking. There are no changes in

mucociliary clearance rates after one week of abstinence¹⁴ but mucociliary clearance returns to normal values after a period of smoking abstinence of several months in a substantial number of patients, although clearance rates may remain abnormal for many months.⁵ For small airway disease, there was no improvement after 1 week smoking abstinence¹⁵ but some improvement was seen in 8 out of 12 smokers after 2 months¹⁶ and was significantly improved after 6 months smoking cessation.¹⁷ Observational studies by Warner et al⁸ in patients undergoing coronary artery bypass graft and Nakagawa et al¹² in patients undergoing lung surgery found similar findings. Warner recommended that cigarette smoking be discontinued for more than 2 months before elective surgical procedures if any benefit is to be realized.⁸ Nakagawa, et al recommended a period of smoking cessation of at least 4 weeks before undergoing pulmonary surgery although the incidence of postoperative pulmonary complications only approached the incidence in never smokers after a smoke-free period of 9 to 12 weeks.¹²

Busch and co-workers in a review of 103 patients undergoing thoracotomy for primary lung cancer, also were unable to find a decreased incidence of complications in patients who have stopped smoking for any given time interval, even though 45 patients had stopped smoking more than 3 weeks prior to surgery.¹⁸ A few small randomized trials showed no differences in postoperative pulmonary complications after programmed smoking cessation of 8 weeks or less. Moller et al¹⁹ randomly assigned patients to undergo elective hip or knee arthroscopy into a smoking cessation intervention arm for 6 to 8 weeks and a control arm without active smoking intervention. Although the overall postoperative complication rate was 18% in the intervention group and 52% in the control group ($p=0.0003$), most of the benefit was in the rate of postoperative wound infection (5% versus 31%, $p=0.001$) and the study was unable to demonstrate an impact on postoperative pulmonary morbidity. A more recent randomized, controlled trial of 60 patients undergoing colorectal surgery likewise found no reduction in the low rates of postoperative pulmonary complications among

patients randomly assigned to a 2- to 3-week preoperative smoking cessation intervention.²⁰

The present study also clarified why some studies showed an increase in POPC among recent smokers as compared to current smokers. The results indicate that selection bias is the more likely explanation for the apparent increased morbidity for smokers quitting for 2 to 4 weeks or longer. Univariate analysis showed that risk of POPC in recent smokers was 2.52 times greater than current smokers while those of past smokers was 1.68 times, but subsequent logistic regression analysis showed that the risk due to smoking cessation was significantly reduced when adjustments for ASA class, the presence of chronic lung disease, smoking history of the patients and other independent predictors of the outcome were made. This means that patients with poorer overall medical condition as indicated by a higher ASA classification and the presence of a chronic lung disease are more likely to undergo surgery after longer periods of smoking cessation as compared to those who were relatively well. In other words, patients who are perceived to be at higher risk for complications are likely to delay surgery in order to allow more time to improve their general medical condition or to correct specific abnormalities before undergoing the rigors of the procedure.

The study ruled out the role of nicotine withdrawal syndrome in the causation of the apparent increase in morbidity. Craving for cigarettes, a symptom of nicotine withdrawal, was most common among smokers who have stopped for 2 weeks or less and became less as the duration of smoking increased. The report of craving was seen in 23.4% for current smokers, and only 13.9% and 14.3% for recent and past smokers, respectively. The adjusted odds ratio for postoperative morbidity with craving was only 0.50 (95% CI 0.14, 1.80) and not statistically significant.

Conclusion

In conclusion, the study shows that there are no significant changes in the risk of postoperative pulmonary complications during the first 8 weeks of smoking cessation in patients undergoing elective non-cardiac surgery. Specifically, the risk of postoperative pulmonary complications is not reduced significantly in smokers quitting smoking from 2 to 8 weeks before surgery as compared to those who smoked within 2 weeks of the procedure. Therefore, the interval wherein the risk of postoperative pulmonary complications become significantly reduced as compared to the first 2 weeks is still uncertain but is not within the first 8 weeks of smoking abstinence. The study also shows that the general medical status as determined by the preoperative ASA classification and the presence of lung disease, and the duration of smoking history affect the smoking behavior of patients undergoing non-cardiac elective surgery and the subsequent incidence of postoperative complications. Smokers quitting more than 2 weeks may seem to be predisposed to increased risk of pulmonary complications but this is very likely due to a

selection bias; smokers quitting more than 2 weeks are more likely to be sicker and smoking longer and, hence, more likely also to develop complications. Nicotine withdrawal symptoms such as craving of cigarettes, anxiety and restlessness which accompany smoking cessation during the first few weeks do not contribute significantly to the occurrence of postoperative pulmonary complications.

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