Original article

Incidence of peri-operative cardio-respiratory complications in smokers versus non-smokers

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Abstract

Introduction: Smoking is considered to be an independent risk factor for many diseases as well as cardio-respiratory events in patients undergoing anaesthesia and surgery. This study was aimed at finding out the incidence of peri-operative cardio-respiratory complications in cigarette smokers undergoing intermediate and major surgery under general anesthesia with endotracheal intubation and compare with that in non smokers in our hospital.

Methods: A prospective case control and single blinded study was conducted. Standard anaesthetic technique was employed to 40 current smokers who smoked 5 or more cigarettes per day for at least 5 years and 40 non smokers. Any adverse cardio respiratory adverse events like tachycardia during intubation, increased oral secretions, desaturation, bronchospasm, laryngospasm, severe coughing or pulmonary edema were recorded in each group. Chi-square test and Fischer exact test have been used to test the significance of events.

Results: Increase in heart rate during intubation was significantly higher in smokers $p<0.001$. Respiratory events like severe cough and bronchospasm was significantly high among smokers. This study however did not show any statistical difference in incidence of desaturation between the two groups. The amount of secretions on extubation was similar in both the groups.

Conclusions: Smoking was associated with increased risk of cardio -respiratory complications in patients undergoing general anaesthesia.

Key words: Cigarette smoking, cardio-respiratory, complications, tachycardia, bronchospasm, cough, laryngospasm

Introduction

Smoking is a major health problem in developing countries. It is an unhealthy behavior and has become an addiction. The prevalence of smoking among Nepalese citizens is 13.9% and 78% among urban college students of age group 15-28 years.[1, 2]

Cigarette smoke contains over 4000 substances, many of which are toxic and cause cardiovascular and respiratory problems. Toxins include carbon monoxide (CO), nicotine, formaldehyde and cyanide. Carbon monoxide forms carboxy-haemoglobin (COHb) producing absolute decrease in oxygen content and shift of oxygen-haemoglobin dissociation curve to the left side causing tissue hypoxia. Chronic exposure to tissue hypoxia causes polycythemia and increased blood viscosity and further deterioration in tissue perfusion. COHb is also associated with negative ionotropy and arrhythmias. CO effects the cardiac rhythm exhibiting ventricular arrhythmias during anesthesia at COHb levels more than 6%.[3] Nicotine stimulates the autonomic ganglia of adrenal medulla, causing increase in sympathetic tone resulting in hypertension, tachycardia and increased peripheral vascular resistance.[4] Nicotine also increases intracellular mitochondrial calcium transport during ischemia and this may exacerbate myocardial cell

damage.[5]

Specific respiratory complications like laryngospasm, brochospasm, hypoxaemia and cough, has been found to be common among the smokers.[6]

Cilia of the respiratory tract are destroyed and laryngeal and bronchial reactivity are increased, leading to airway disease. The mucus of smokers also becomes hyperviscous, with altered elasticity. Other peri-operative complications include deep vein thrombosis, pulmonary embolism, pulmonary edema, delayed wound healing and wound infections by impairing the immune response.[7]

Smoking also causes pulmonary edema. Cigarette smoking damages the lung epithelium and effects the amiloride-sensitive epithelial sodium channel which plays a critical role in lung fluid clearance leading to pulmonary edema.[8]

This study was carried out to determine the incidence of cardiac and respiratory complications among smokers and compare the same with non-smokers.

Tachycardia during intubation was defined as increase in heart rate by 25% or a by 20/min from the baseline[9]. Similarly, desaturation was defined as having SpO_2<92% on room air[10]. Laryngospasm , bronchospasm and severe cough was defined according to the study done by Batra et al[11]. We further graded tachycardia and post-extubation oral secretions (Table 1).

Methods:

A prospective case control single-blinded study was performed at Dhulikhel Hospital Kathmandu University Hospital after obtaining approval from the Institution Review Committee and informed consent from the patients.

Over duration of 4 months, 80 adult patients of age group between 20 years and 75 years of American Society of Anesthesiologists (ASA) physical status grade I and II undergoing intermediate to major elective surgery under general anesthesia with endotracheal intubation were enrolled in the study. Smoker was defined as having consumed 5 or more cigarettes per day for 5 or more years and is current smokers. Non-smoker was defined as have never smoked in life-time. Forty patients meeting the inclusion criteria as smokers were compared against forty non-smokers. Smoking status was determined by self report.

Patients with, ASA grade III or more, ex-smokers, patients with respiratory diseases, any surgery on the airway, emergency surgeries where rapid sequence induction were performed, difficult intubation where duration of laryngoscopy exceeded 40sec and those denying concent for the study were excluded from the study.

Pre-anesthetic check up was done by the attending anesthesiologist a day prior to surgery and informed

Table 1: Terminology for the variables under study and their grading:

Terminology:	Grades:
Tachycardia: increase in heart rate immediately after endotracheal intubation	**I: increase by >10/min from baseline** **II: increase by >20/min from baseline** **III: increase by >30/min from baseline** **IV: increase by 40/min from baseline**
Oral secretion: amount of oral secretions suctioned at extubation	**I: dry with single suction** **II: needed 2-3 suctions to clear secretions** **III: needed >3 suctions** **IV: thick and copious**
Desaturation: saturation <92% by pulse oximetry for more than 1 min any time during induction, maintenance or recovery	
Bronchospasm: audible wheeze/unexplained increase in airway pressure of more than 20mmHg	
Laryngospasm: audible/stridor or airway obstruction which is not relieved by airway manipulations	
Severe post-extubation cough: more than 2 paroxysm of cough lasting more than 5 sec	
Pulmonary edema: bilateral crackles heard on auscultation of the chest, accompanied by desaturation and confirmed by chest radiograph	

consent was obtained. Smoking status was classified as <10sticks/day, 10-20 sticks/day or >20sticks/day. All patients were kept nil per oral for at least 6 hours prior to surgery. They were premedicated with tab lorazepam 1mg and tab ranitidine 150mg per oral in the night before surgery and in the morning of surgery. No restriction for smoking was requested to the smokers.

On arrival to the operating room, intravenous (IV) line was secured, preinduction monitors attached which included electrocardiography (ECG), non-invasive blood pressure (NIBP) and pulse oximetry (SpO_2). Patients were then premedicated with inj. midazolam 40µg/kg and inj. fentanyl 3µg/kg IV. Intravenous induction was done with inj propofol and titrated to loss of verbal response. Neuromuscular blockade was achieved with inj. vecuronium 0.1mg/kg IV. After assisted ventilation with 100% oxygen and 1.5% isoflurane for 3 minutes, trachea was intubated with 7.5mm ID cuffed tube for females and 8mm ID for males. Anesthesia was maintained with 1.5% isoflurane, 60% oxygen with air and maintenance vecuronium 20µg/kg. Post intubation monitors included ECG, SPO_2, NIBP, end tidal carbon dioxide ($ETCO_2$), spirometry and temperature.

At the end of surgery, inhalation agents stopped and neuromuscular blockade reversed with 50µ/kg neostigmine and 20µ/kg atropine IV. Patients were extubated after being awake and breathing spontaneously with adequate tidal volume.

Any complications of interest to this study as occurring intraoperatively and postoperatively in the PACU were recorded to a case report including the above mentioned variables.

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 17.0. Chi-square test and Fisher's exact test was used to analyze the nominal data. Continuous and descrete data, reported as mean ± standard deviation was analyzed using t-test. P-value<0.05 was considered significant.

Results

Age, gender and ASA physical status were comparable among the two groups (p>0.05) (Table 2). Smoking was significantly common among males. Majority (65%) of the smokers in our study consumed 5-10 cigarettes per day (Fig 1). Most of the patients in our study underwent laparoscopic surgery (Fig. 2).

Table 2 : Basic characteristics of the patients

	Non-smokers	Smokers	p-value
Age (years)	*45±12.97*	45.85±10.01	0.7
Gender			
Male	13	24	0.02
Female	*27*	*16*	
ASA physical status			
Grade I	33	37	0.176
Grade II	7	3	
Amount of cigarette			
5-10/day	-	26	
10-20/day	-	11	
>20/day	-	3	

ASA= American Society of Anesthesiologists

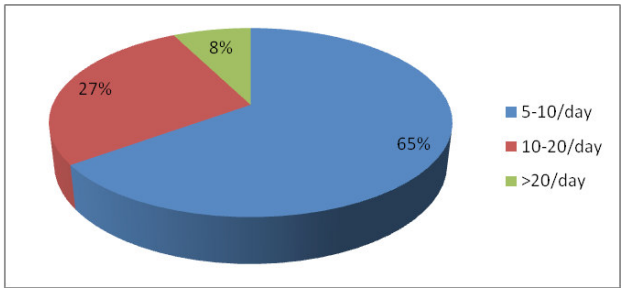

Fig 1: Amount of cigarettes/day

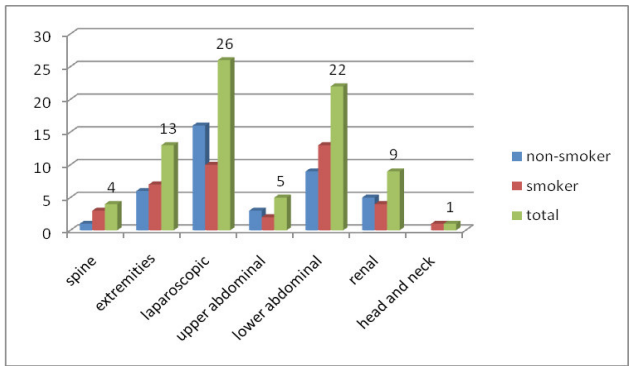

Fig 2: Spectrum of different surgeries

Incidence of tachycardia was significantly high among the smokers (p<0.0001) (Table 2). Twenty nine smokers (72%) had their heart rate increased by more than 20bpm from baseline. Only 8 (20%) of the non-smokers had tachycardia of more than 20bpm from baseline. The heart rate response to intubation is more in the smoker group (Fig. 3).

Incidence of severe cough was significantly high among smokers (p=0.03) (Table 3). There were 4 incidences of bronchospasm and 2 incidences of laryngospasm, both of which were observed exclusively in smokers.

Desaturation, though more common among smokers was not statistically significant. The amount of secretions was similar in both the groups. Heart rate response to endotracheal intubation was significantly high among smokers (Fig. 3).

Table 3: Incidence of perioperative events

Perioperative events	Non-smokers (n=40)	Smokers (n=40)	p-value
Tachycardia			
<20bpm from baseline	32	11	<0.0001
>20,<30bpm from baseline	5	18	
>30, <40bpm from baseline	3	7	
>40bpm from baseline	0	4	
Total patients with HR>20bpm from baseline	8	29	
Secretions			
Grade I	26	18	0.072
Grade II	11	14	
Grade III	3	8	
Grade IV	-	-	
Respiratory events			
Desaturation	9	16	0.091
Bronchospasm	0	4	0.04
Laryngeal spasm	-	2	NA*
Severe cough	5	13	0.03
Pulmonary edema	-	-	

**Not applicable*

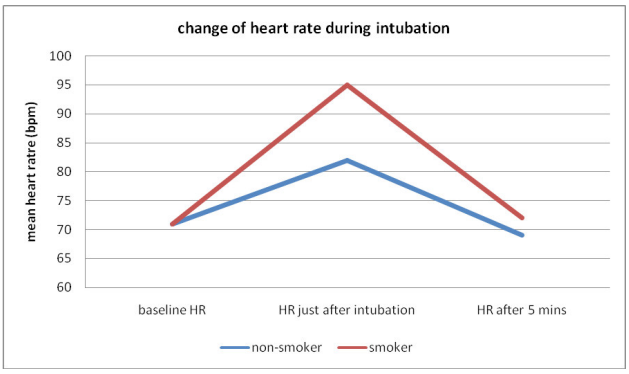

Fig 3: heart rate response to endotracheal intubation in non-smokers and smokers.

Discussion

Smoking has always been associated with various diseases. It has also been associated with perioperative cardiovascular and respiratory events.

Our study revealed that heart rate response to endotracheal intubation was significantly high among smokers. This is similar to other studies which demonstrates a significantly high incidence of hemodynamic response to endotracheal intubation among smokers.[12,13]

It has been observed that postoperative incidence of severe hypoxemia is limited entirely to the smoking group when partial arterial oxygen tension is measured.[14,15] In our study, however, desaturation was similar in both the groups. Use of pulse-oximetry alone for detection for hypoxemia in our study might have been insufficient.

Significantly high incidence of severe paroxysm of cough in the smoker group in our study indicates their susceptibility to airway responsiveness. The results were similar to that observed by by Erskine et al.[16] In this study, chronic cigarette smokers were found to have significantly greater upper airway reflex sensitivity compared with non smokers; the sensitivity was unaltered even after 24 hours of abstinence.

Other variables indicating respiratory events like bronchospasm and laryngospasm were limited to smoker group in our study. Myles et al and Mc Kay et al also reported that the risk of respiratory complications, i.e., desaturation, cough, laryngospasm, bronchospasm, breath-holding, or apnea were high in smokers.[6, 17]

These findings in our study suggest that the peri-operative cardio-respiratory complications are significantly high among smokers.

It is a common practice that pre-operative patients are interviewed and examined by the anaesthesiologists just a day or two prior to the scheduled date of operation. Warner,

David O et al performed a survey on the role of anesthesiologists and surgeons on tobacco intervention and found that only 30% of anesthesiologists and 58% of surgeons routinely advise their patients to quit smoking.[18] Studies have shown that 6-8 weeks of abstinence from smoking has reduced the overall complication rate and morbidity.[19,20] This suggests that the patients for elective and planned operation should be examined by the anaesthesiologists earlier when they can suggest and motivate them for smoking cessation.

We had measured only conventional two diode pulse oximetry and this cannot distinguish COHb from oxyHb, leading to false impression of high arterial oxygenation saturation in smokers.[21] A small sample size did not allow us to compare complications that are rare in contemporary anaesthetic practice. Smoking status determined by self report could not be confirmed by expired CO levels due to unavailability of this device in our country.

Conclusions

Smoking poses special risk to the preoperative cardiac and respiratory complications. These findings warrant increased efforts at promoting smoking avoidance and cessation. Measures should be undertaken to allow the patients for abstinence from smoking.

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