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Original Research Article

Haemodynamic changes and oxygen saturation during general anaesthesia in smokers and non-smokers

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Abstract

Introduction and Objectives: Smoking and tobacco chewing causes many physiological changes in the body cardiovascular, cancer and pulmonary morbidity and mortality. The aim of this study is to evaluate the effect of smoking and tobacco chewing on cardio-respiratory system during preoperative and postoperative period.

Materials and Methods: The present study was conducted on patients of either sex ranging from 18-60 years of ASA (American Society of Anesthesiology) grade I and grade II scheduled for elective surgical procedures at Nehru Hospital, B.R.D. Medical College, Gorakhpur after the permission of ethical committee. Detailed history and physical examination was done. Arterial blood gas analysis was done and partial pressure of oxygen was recorded preoperatively and on postoperative day 1, 2 and 3. Patients were divided into three groups according to smoking and tobacco chewing habits. Statistical analysis was done using SPSS version 16.0 software. t-test, and Mann–Whitney test were applied according to the requirement. The level of significance was fixed at 95%. $P < 0.05$ was considered statistically significant.

Results: The proposed study was done on 50 patients of ASA grade I and II who were scheduled to undergo elective surgical intervention. Out of 50 patients 37 were male and 13 were female in the ratio of 2.84:1. Mean pulse rate was increased in all groups just after intubation and just after extubation but the amplitude of rise was maximum in Group-III. A significant rise in systolic blood pressure was observed in Group-I (control) just after intubation which came to basal value within 5 minutes of intubation. A significant rise in mean arterial blood pressure was observed in Group-I (control) just after intubation which came to basal value within 5 minutes of intubation.

Conclusion: Most of the smokers and tobacco chewers had significant reduction in preoperative bedside pulmonary function tests and associated decrease in partial pressure of oxygen. These patients required oxygen inhalation postoperatively to prevent hypoxia.

Introduction

Cigarette smoking and its consequences comprise a worldwide epidemic and is attributed to at least 20% of all deaths in developed countries.[1] Cigarette smoke contains over 4700 additional chemical compounds other than nicotine. It includes at least 43 carcinogens which collectively generate a very broad range of pathophysiological effects.[2] Failure to quit smoking before elective or emergency surgery is ill judged which can lead to subsequent risk of intraand postoperative complications.[3] Smoking up to the time of any surgery increases cardiac and pulmonary complications, impairs tissue healing, and is associated with more infections and other problems at the surgical site.[3,4] The relative risk of complications after surgery for smokers compared to nonsmoker has been reported to increase from 1.4-fold to 4.3-fold.[5] These adverse effects compromise the intended procedural outcomes and increase the costs of care. The preoperative stage may offer an opportunity for smoking cessation in surgical patients. All available measures must be taken to help patients to stop smoking prior to surgery. It is both accountable and ethical to implement a policy that those unwilling or unable to stop should have low priority for, or be excluded from, certain elective surgical procedures.[6] Nicotine also increases intracellular calcium during ischemia. This may exacerbate myocardial cell damage.[7] In smokers, the plasma concentration of nicotine reaches 15-50 mg/ml. The half life of nicotine is 30-60 minutes.[8] Nicotine is the principal ingredient responsible for tobacco's addictive character, which acts through the sympatho-adrenergic system causing an increase in heart rate.[9] Smoking and tobacco chewing causes many physiological changes in the body cardiovascular (atherosclerosis, hypertension, coronary artery disease, thromboembolism, peripheral vascular disease), cancer (oral, larynx, esophagus, pancreas, kidney) and pulmonary (chronic obstructive pulmonary disease, lung cancer) morbidity and mortality. Smokes have a high incidence of postoperative

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respiratory complication and although there is evidence of increased upper airway sensitivity, the assumption that smokers suffer stormy induction of anaesthesia seems unsubstantiated.[10] The aim of this study is to evaluate the effect of smoking and tobacco chewing on cardio-respiratory system during perioperative and postoperative period.

Materials and Methods

The present study was conducted on patients of either sex ranging from 18-60 years of ASA (American Society of Anaesthesiology) grade I and grade II scheduled for elective surgical procedures at Nehru Hospital, B.R.D. Medical College, Gorakhpur after the permission of ethical committee.A thorough history including age, sex, smoking and tobacco chewing habits, if smoker number of bidi or cigarettes consumed per day, the number of years of smoking was taken. A day before operation thorough general and systemic examination was done. Those with known respiratory disease, recent upper respiratory tract infections, hypertensive, gastroesophageal reflux or those receiving medications affecting lung function were excluded. Arterial blood gas analysis was done and partial pressure of oxygen was recorded preoperatively and on postoperative day 1,2 and 3. Patients were divided into three groups according to smoking and tobacco chewing habits. Group I: Non-smokers (20 patients).Group-II: Smokers-Patients who smoked more than 10 cigarettes or bidi per day were classified as smokers (20 patients) and Group-III: Smokers and tobacco chewers (10 patients). The routine monitoring like pulse rate, blood pressure, electrocardiography, SpO2 recording were done throughout the surgery. At the end of surgery, the neuromuscular block was reversed with neostigmine and glycopyrrolate in appropriate dose. All the patients were monitored for pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure, partial pressure of oxygen every 8 hourly for 3 postoperative days.

Statistical Analysis

Statistical analysis was done using SPSS version 16.0 software. t-test and Mann–Whitney test were applied according to the requirement. The level of significance was fixed at 95%. P < 0.05 was considered statistically significant.

Result

The study included 50 patients undergoing elective surgery. The patients were divided into three groups. Group-l non-smokers, Group-II smokers and Group-II smoker and tobacco chewers.

Table 1 shows that most of the patients in the study were mule which constitutes 37 out of 50 patients i.e. 74%. Male Female ratio was 2.84:1. Minimum age in study was 18 years and maximum were 70 years. Patients between 31- 40 years were more in number which constitutes 14 out of 50 patients i.e. 28%. Above table shows distribution of cases in different groups according to various types of surgicalprocedures. Colostomy closure, cholecystectomy, nephrolithotomy, hernia repair were common operations done (Table 1).

Table 2 shows that mean pulse rate was increased in all groups just after intubation and just after extubation but amplitude of rise was maximum in group-III and most highly significant in group III. Significant rise in mean pulse rate was recorded just after intubation in Group-I (from 88.65± 13.38 to 96.70± 10.71; p<0.05). The mean pulse rate came to basal value with in 5 minutes of intubation (93.37±10.37; p>0.05) and persisted before extubation. There was a significant rise in mean pulse rate just after extubation (97.34±12.34; p<0.05). No significant changes were observed on consecutive 3 postoperative days. In Group-II (smokers) there was highly significant rise in the mean pulse rate per minute just after intubation (93.32±15.34 to 107.64± 14.32;p<0.01). This value returned to basal value after 5 minutes of intubation and showed no significant rise before extubation. There was highly significant rise in mean pulse rate per minute just after extubation (106.43±15.32; p<0.01). There was no significant change on postoperative day 1, day 2 and day 3. In Group-III (smokers and tobacco chewers), most highly significant rise in mean pulse rate was observed just after intubation (96.32±12.21 to 119.43±13.21; p<0.001). After 5 minutes of intubation, the mean pulse rate came to basal value and persisted just before extubation. After extubation again there was most highly significant rise in mean pulse rate (116.34± 13.23; p<0.001). There was no significant change on postoperative day 1, 2 and 3. (Table 2).

Table 3 shows that mean systolic blood pressure was increased in all groups just after intubation and just after extubation but amplitude of rise was maximum in Group-III and most highly significant in group III. A significant rise in systolic blood pressure (120.6±10.32 to 128.2 l± 11.21; p<0.05) was observed in Group-I (control) just after intubation which came to basal value with in 5 minutes of intubation (123.43±9.21; p>0.05). A significant rise in mean systolic blood pressure was also observed just after extubation (129.54; p<.0.00l). There was no significant change in mean systolic blood pressure on postoperative day 1, 2 and 3. In Group-II (smokers) there was highly significant rise in the mean systolic blood pressure per minute just after intubation (123.2±9.16 to 132.20±10.32; p<0.01). This value returned to basal value after 5 minutes of intubation and showed no significant rise before extubation. There was highly significant rise in mean systolic blood pressure just after extubation (133.32±12.21; p<0.01). There was no significant change observed on postoperative day 1, day 2 and day 3 in both groups. In Group-III (smokers and tobacco chewers), most highly significant rise in mean systolic blood pressure was observed just after intubation (128.42±9.05 to 149.32±10.32; p<.0.00l). After 5 minutes of intubation the mean systolic blood pressure came to basal value and persisted till extubation. After extubation again there was most highly significant rise in mean systolic blood pressure (153.32±9.43; p<0.001). There was no significant change observed on postoperative day 1, 2 and 3. (Table 3)

Table 4 shows that mean diastolic blood pressure was increased in all groups just after intubation and just after extubation but amplitude of rise was most highly significant in group III. A significant rise in mean diastolic blood pressure (90.03±7.31 to 96.43±10.42; p<0.05) was observed in Group-I (control) just after intubation which came to basal value within 5 minutes of intubation (93.32±10.27; p>0.05). A significant rise in mean diastolic blood pressure was also observed just after extubation (93.93±4.28; p<0.05). There was no significant change observed on postoperative day 1, 2 and 3. In Group-II (smokers) there was highly significant rise in the mean diastolic blood pressure just after intubation (95.48±5.98 to 104.34± 10.43; p<0.01). This value returned to basal value after 5 minutes of intubation and showed no significant rise before extubation. Again, there was highly significant rise in mean diastolic blood pressure just after extubation (102.20±8.82; p<0.01). There was no significant change observed on postoperative day 1, day 2 and day 3. In Group-III (smokers and tobacco chewers), most highly significant rise in mean diastolic blood pressure was observed just after intubation (86.50±7.76 to 113.70±10.27; p<0.001). After 5 minutes of intubation the mean diastolic blood pressure came to basal value and persisted till extubation. After extubation again there was most highly significant rise in mean diastolic blood pressure (107.40±10.61; p<0.001). There was no significant change observed on postoperative day 1, 2 and 3. (Table 4)

Table 5 shows that mean arterial blood pressure was increased in all groups just after intubation and just after extubation but the amplitude of rise was most highly significant in group III. A significant rise in mean arterial blood pressure (92.83±7.31 to 98.65±10.54; p<0.05) was observed in Group-I (control) just after intubation which came to basal value with in 5 minutes of intubation (95.43±7.54; p>0.05). A significant rise was also observed just after extubation (98.50±8.65; p<0.05). There was no significant change observed on postoperative day 1, 2 and 3. In Group-II (smokers) there was highly significant rise in the mean arterial blood pressure just after intubation (95.48±5.98 to 103.23±8.65; p<0.01). This value returned to basal value within 5 minutes of intubation and showed no significant rise before extubation. There was highly significant rise in mean arterial blood pressure just after extubation (103.42±9.75; p<0.01). There was no significant change observed on postoperative day 1, day 2 and day 3. In Group-III (smokers and tobacco chewers), most highly significant rise in mean arterial blood pressure was observed just after intubation (101.15±7.58 to 131.53±10.08; p<0.001). After 5 minutes of intubation the mean arterial blood pressure came to basal value and persisted till extubation. After extubation again there was most highly significant rise in mean arterial blood pressure (127.85±7.70; p<0.001). There was no significant change observed on postoperative day 1, 2 and 3. (Table 5)

Table 6 shows mean changes in mean oxygen saturation in percentage with standard deviation at different intervals in each group and there was no change in mean oxygen saturation in all groups except there was a decrease just after extubation in Group-II and Group-II and the amplitude of reduction was most highly significant in group III. There was no significant change in any of the group during general anaesthesia. But just after extubation there was a highly significant fall in mean oxygen saturation in Group-II (smokers) andmost highly significant reduction in Group-III (smokers and tobacco chewers). There was significant reduction in mean oxygen saturation in Group-II (97.30±2.10 to 94.0±4.34; p<0.01) and most highly significant reduction in Group-III (96±1.15 to 1.15 to 90.3±1.69; p<.0.00l). (Table 6)

Table 1: Showing distribution of patients according to age, gender and surgical Procedure in different groups

	Group-I		**Group-11**		**Group-Ill**	
	No.	**%**	**No.**	**%**	**No.**	**%**
Age (Years)						
10-20	01	05.0	01	05.0	-	-
21-30	05	25.0	04	20.0	03	30.0
31-40	06	30.0	07	35.0	01	10.0
41-50	05	25.0	03	15.0	02	20.0
51-60	02	10.0	02	10.0	04	40.0
61-70	01	05.0	03	15.0	-	-
Gender						
Male	15	75.0	15	75.0	7	70.0
Female	5	25.0	5	25.0	3	30.0
Surgical Procedure						
Colostomy closure	03	15.0	03	15.0	02	20.0
Cholecystectomy	03	15.0	03	15.0	01	10.0
Vaginal hysterectomy	02	10.0	02	10.0	01	10.0
Nephrolithotomy	04	20.0	02	10.0	01	10.0
Suprapubic prostatectomy	01	05.0	03	15.0	02	20.0
Hernia repair	03	15.0	03	15.0	01	10.0
Abdominal hysterectomy	03	15.0	02	10.0	01	10.0
Orthopaedic surgery	-	-	01	05.0	01	10.0
Mastectomy	01	05.0	01	05.0	-	-

Table 2: Showing means pulse rate in minute with standard deviation at different intervals in different groups

Group	Pre operative	Just after intubation		5min. after intubation		30min. after intubation		Before extubation		Just after extubation		Post operative day l		Postoperative day 2		Postoperative day 3	
Group -I	88.65± 13.38	96.70± 10.71	SIG	93.37± 10.34	INS	88.15 ± 9.932	INS	90.95 ± 10.80	INS	97.34± 12.34	SIG	93.57± 10.17	INS	92.40± 9.83	INS	93.60± 9.72	INS
Group-II	93.32± 15.34	107.64 ± 14.32	HS	96.23± 11.20	INS	95.6± 11.44	INS	99.45 ± 13.35	INS	106.43 ± 15.32	HS	101.10 ± 12.78	INS	95.55± 12.34	INS	95.55± 12.34	INS
Group-III	96.32± 12.21	119.43 ± 13.21	MHS	110.32 ± 13.21	INS	103.43± 10.34	INS	105.7 ± 6.48	INS	116.34 ± 13.23	MHS	97.20± 10.70	INS	93.20± 10.06	INS	99.63± 10.30	INS

INS (>0.05) = Insignificant; SIG (<0.05) =Significant; HS (<0.01) = highly significant. MHS (<0.001) = Most Highly Significant

Table 3: Showing means systolic blood pressure changes in mmHg with standard deviation at different intervals in different groups

Group	Pre operative	Just after intubation		5min. after intubation		30min. after intubation		Before extubation		Just after extubation		Post operative day l		Post-operative day 2		Postoperative day 3	
Group-I	120.6± 10.32	128.21± 11.21	SIG	123.43± 9.21	INS	121,70 ± 5.88	INS	122.75± 5.52	INS	129.54 ± 14.21	SIG	125.90 ± 5.67	INS	126.70± 5.63	INS	125.90+ 5.64	INS
Group-II	123.2±9.16	132.20± 10.32	HS	126.20± 10.32	INS	124.25 ± 6.08	INS	123.80± 7.77	INS	133.32 ± 12.21	HS	125.90 ± 8.72	INS	127.50± 8.41	INS	128.70± 8.06	INS
Group-III	128.42± 9.05	149.32± 10.32	MHS	137.32± 11.32	INS	132.70 ± 8.85	INS	129.20± 8.95	INS	153.32 ± 9.43	MHS	131,00 ± 5.98	INS	130.40± 6.65	INS	128.40± 7.41	INS

INS (>0.05) = Insignificant; SIG (<0.05) =Significant; HS(<0.01) = highly significant. MHS (<0.001) = Most Highly Significant

Table 4: Showing mean diastolic blood pressure changes in mmHg with standard deviation at different intervals in different groups

Group	Pre operative	Just after intubation		5min. after intubation		30min. after intubation		Before extubation		Just after extubation		Post operative day l		Post-operative day 2		Postoperative day 3	
Group-I	90.03± 7.31	96.43 ± 10.42	SIG	93.32 ± 10.27	INS	94.46 ± 5.08	INS	81,05 ± 3.86	INS	93.93 ± 4.28	SIG	84.60± 2.98	INS	84.90 ± 2.71	INS	84.80± 3.31	INS
Group-II	95.48± 5.98	104.34± 10.43	HS	99.53 ± 7.88	INS	95.98 ± 6.84	INS	8I.25 ± 5.69	INS	102.20± 8.82	SIG	83.30± 4.88	INS	84.30 ± 3.79	INS	84.70± 3.74	INS
Group-III	86.50± 7.76	113.70± 10.27	MHS	93.62 ± 9.54	INS	91.10 ± 5.82	INS	85.50 ± 5.79	INS	107.40± 10.61	HS	86.00± 4.1 1	INS	86.20 ± 4.04	INS	85.40± 5.08	INS

INS(>0.05) = Insignificant; SIG(<0.05) =Significant; HS(<0.01) = highly significant. MHS(<0.001) = Most Highly Significant

Table 5: Showing mean of arterial blood pressure changes in mmHg with standard deviation at different intervals in different groups

Group	Pre Operative	Just after intubation		5min. after intubation		30min. after intubation		Before extubation		Just after extubation		Post operative day l		Post-operative day 2		Postoperative day 3	
Group-I	92.83± 7.31	98.65± 10.54	SIG	95.43± 7.54	INS	94.46 ± 5.08	INS	95.43 ± 7.54	INS	98.50 ± 8.65	SIG	94.30 ± 7.32	INS	93.20 ± 624	INS	94.50 + 8.20	INS
Group-II	95.48± 5.98	103.23± 8.65	HIS	99.54± 7.65	INS	95.95 ± 6.58	INS	95.42 ± 6.14	INS	103.42± 9.756	HS	98.60 ± 4.90	INS	98.66 ± 4.90	INS	99.33 ± 4.36	INS
Group-III	101.15± 7.58	131.53± 10.08	MHS	106.32 ± 8.34	INS	103.50± 4.28	INS	100.05± 6.29	INS	127.85± 7.70	MHS	101.66± 4.80	INS	103.92± 4.37	INS	99.59 ± 5.50	INS

INS (>0.05) = Insignificant; SIG (<0.05) =Significant; HS(<0.01) = highly significant. MHS (<0.001) = Most Highly Significant

Table 6: Showing mean oxygen saturation changes in percentage with standard deviation at different intervals in different groups

Group	Pre operative	Just after intubation		5min. after intubation		30min. after intubation		Before extubation		Just after extubation	
Group-I	98.70± 0.57	97.30± 1.10	SIG	98.60± 0.93	INS	99.60± 0.50	INS	99.10± 0.56	INS	98.45± 0.60	SIG
Group-II	97.30± 2.10	96.20± 1.12	HS	98.54± 0.65	INS	98.90± 0.68	INS	98.06± 1.20	INS	94.00± 4.34	HS
Group-III	96.00± 1.15	94.60± 1.72	MHS	97.32± 0.64	INS	97.40± 0.42	INS	97.20± 1.31	INS	90.30± 1.69	MHS

INS (>0.05) = Insignificant; SIG(<0.05) =Significant; HS(<0.01) = highly significant. MHS (<0.001) = Most Highly Significant

Discussion

Over 1000 component of cigarette smoke have been identified with wide ranging effects on the cardiovascular, respiratory, immune systems, haemostasis, drug metabolism and patient psychology.[11] The proposed study was done on 50 patients of ASA grade I and II who were scheduled to undergo elective surgical intervention. Out of 50 patients 37 were male and 13 were female in the ratio of 2.84:1. Maximum cases were in fourth decade comprising 14 patients i.e. 28%. Colostomy closure, cholecystectomy, nephrolithotomy, hernia repair were the common operations done in various groups. The haemodynamic variables were compared statistically with the preoperative (basal) value just after intubation, at 5 minutes after intubation, 30 minutes after intubation, before extubation, just after extubation, postoperative day 1, day 2 and day 3. Mean pulse rate was increased in all groups just after intubation and just after extubation but the amplitude of rise was maximum in Group-III. In Group-II (smokers) there was highly significant rise in the mean pulse rate per minute just after intubation. In Group-III (smokers and tobacco chewers), most highly significant rise in mean pulse rate was observed just after intubation. In addition, similar finding were reported by king et al (1951).[12] Mean systolic blood pressure was increased in all groups just after intubation and just after extubation but the amplitude of rise was maximum in Group-III. A significant rise in systolic blood pressure was observed in Group-I (control) just after intubation which came to basal value within 5 minutes of intubation. A significant rise in mean systolic blood pressure was also observed just after extubation. In Group-II (smokers) there was highly significant rise in the mean systolic blood pressure per minute just after intubation and just after extubation. In Group-III, after extubation again there was most highly significant rise in mean systolic blood pressure. Moreover, Laxton (1999)[13] studied the haemodynamic changes in response totracheal intubation in 60 ASA I women undergoing elective gynaecological surgery. The pulse rate, systolic blood pressure, diastolic blood pressure and mean arterial blood pressure of smokers was significantly greater than that of non-smokers just after intubation.

King et al (1951)[12] studied reflex circulatory responses to endotracheal intubation in 46 patients, who received various combinations of intravenous or inhalational agents. In all patients there was a significant rise in mean pulse rate, mean systolic blood pressure, mean diastolic blood pressure, mean arterial blood pressure just after intubation, which gradually returned to prelaryngoscopy levels within 5 minutes after intubation probably owing to fatigue of reflex receptors. In present study, mean arterial blood pressure was increased in all groups just after intubation and just after extubation but the amplitude of rise was maximum in Group-III. A significant rise in mean arterial blood pressure was observed in Group-I (control) just after intubation which came to basal value within 5 minutes of intubation. Thus, we have seen that all patients were haemodynamically stable during perioperative period. There was significant haemodynamic change only after intubation and extubation which was most exaggerated in smokers and tobacco chewers. No significant change in any of the group during general anaesthesia. But just after extubation there was a highly significant fall in mean oxygen saturation in Group-II (smokers) and most highly significant reduction in Group-III (smokers and tobacco chewers). In concord, Dennis et al (1994)[14] studied the effect of smoking on induction of anaesthesia on 120 patients undergoing elective surgery and concluded that the reduction in SpO2 was also greater in those with adverse events during induction. Furthermore, perioperative smoking cessation seems to be an effective tool to reduce postoperative complications even if it is introduced as late as 48 hours before surgery for cardiovascular and wound related benefits.[15] Thus, we have seen that haemodynamic changes and perioperative and postoperative complications were more common in smokers and tobacco chewers followed by smokers.

Conclusion

All the patients were haemodynamically stable except a heightened haemodynamic response to laryngoscopy just after intubation and just after extubation was observed in all groups, maximum smokers and tobacco chewers followed by smokers. Most of the smokers and tobacco chewers had significant reduction in preoperative bedside pulmonary function tests and associated decrease in partial pressure of oxygen. These patients required oxygen inhalation postoperatively to prevent hypoxia.

Conflict of Interest: None.

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