Original Research Paper

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A RANDOMISED STUDY OF POST OPERATIVE PULMONARY COMPLICATIONS AMONG SMOKERS UNDERGOING MAJOR SURGERY UNDER GENERAL ANAESTHESIA.

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ABSTRACT Smoking is considered to be a risk factor for patients undergoing anesthesia and surgery.Tobacco smoking has always been recognized as an important risk factor for perioperative complications. Despite large scale efforts to create awareness about the hazards of tobacco smoking, this habit has greatly increased in recent times.

Aim of this study was to compare the nature and incidence of post operative pulmonary complications in smokers undergoing major surgery under general anesthesia to that in non smokers in our hospital. **Methods:** This is a randomised comparative study. 50 current smokers determined by self report who smoked ten or more cigarettes per day for more than 5 years were taken into study groups. 50 non smokers were taken in the control group. Smokers were not instructed to quit smoking any time prior to surgery. Standard anesthetic technique was employed on both the groups. Any adverse respiratory adverse events like arterial oxygen desaturation, laryngospasm, bronchospasm, severe coughing, oral secretions during recovery and any incidence of reintubation, naloxone use or pulmonary edema were recorded in each group. Chi-square test and Fischer exact test have been used as statistical tool to test the significance of events. **Results:** Samples were matching for age, ASA status and surgical procedures undergone. Smokers had a higher rate of respiratory complications (56% versus 16%). When all the perioperative events were considered it was 6.8 times significantly more in smokers when compared to non smokers with chi-square X2= 17.361 , p<0.001. Oxygen desaturation in smokers was significantly higher than among non smokers (p value = 0.0271). Oral secretions during recovery was also significantly more in smokers (p = 0.012). **Interpretation and conclusions:** Smoking was associated with increased risk of post operative pulmonary complications in patients undergoing general anesthesia. These findings warrant increased vigilance with such patients coming for anesthesia with efforts to motivate them to avoid or stop smoking completely.

KEYWORDS : Anesthesia, general/ae (adverse Effects); Bronchospasm , Comparative Study; Postoperative, Pulse Oximetry; Partial Pressure; Smoking/pp(pathophysiology); Surgical Procedure.

INTRODUCTION:

Tobacco smoking has always been recognized as an important risk factor for postoperative complications. Despite large scale efforts to create awareness about the hazards of tobacco smoking, this habit has greatly increased in recent times. As anesthesiologists we encounter smokers frequently in our day to day practice. Many of them do report their smoking status themselves; while a large majority denies this habit and many a times an anesthesia resident is taken by surprise when complications do arise during the procedure.

Postoperative complications in smokers have been described and studied by many people. It has been found that frequency and severity of different specific respiratory events are higher in smokers compared to non smokers. These specific respiratory events include laryngospasm, bronchospasm, aspiration, hypoventilation, hypoxemia, reintubation after planned extubation, and pulmonary edema. Risk of wound infections, marked hemodynamic changes following tracheal intubation also add to the perioperative morbidity of smokers.[1]

Exposure to surgery and anesthesia can be considered as an excellent opportunity to counsel and help the smokers to quit their habit not only for the short term benefits during the post operative period but also from the serious health hazards of smoking.

AIMS AND OBJECTIVES

Primary Objective:

1. To study the nature and incidence of Post operative pulmonary complications in smokers undergoing major surgery under general anesthesia and compare it with that in non-smokers.

Secondary Objectives:

1.To review the literature
2.To evolve a method of identifying patients at risk.

MATERIALAND METHODS:

Ethical clearance was obtained from ethical committee and informed consent was obtained from each patient.

Study Design

This was a prospective comparative study.

Subject and data collection

Fifty consecutive patients who satisfied the inclusion criteria were selected for smokers group of the study.

Data was collected from patients undergoing major elective surgery under general anesthesia at Rajendra institute of medical sciences, Ranchi, jharkhnad.

Inclusion criteria

1. Patients who gave assent to informed consent and were ready to be part of study willingly
2. ASA 1 & ASA II Grade patients.
3. Patients who were habitual smokers and are still smoking.

Exclusion criteria

1. Patients not giving consent.
2. ASA status 3 and above who were diseased.
3. Acute emergency surgeries when pre operative evaluation not possible
4. Patients less than 18 years and more than 60 yrs of age.
5. Patients with history of atopy and hypersensitivity.
6. Patients with history of adverse events during previous exposure to general anesthesia.

Control Group

Fifty non smokers aged above 18 years of ASA 1 and 2 physical status presenting for major elective surgery.

Many similar studies included all current smokers in their study. Our reference study regarding the risk of pulmonary complications in smokers by Paul S. Myles et al [1] included patients smoking more than ten cigarettes per day for more than 10 years. So we also followed the same inclusion criteria.

Pre Anaesthetic Check Up:

General examination and routine investigations were done.

Patients were not advised to stop smoking at any time prior to surgery. The day before surgery all the patients were instructed to keep fasting

for at least 6 hrs.

Premedication :
All the patients will be pre medicated with oral diazepam 0.1 mg/ kg body weight on the night before surgery and tab. rantidine 3 mg/ kg bw on the night before and on the morning of day of surgery.

Preparation :
In the operating room, patients were connected to monitors including, ECG with heart rate, non invasive blood pressure and pulse oximeter. Baseline values of heart rate, blood pressure and arterial oxygen saturation were recorded. Intravenous access was established.

Pre anaesthetic check up:
General examination and routine investigations were done.
Patients were not advised to stop smoking at any time prior to surgery.
The day before surgery all the patients were instructed to keep fasting for at least 6 hrs.

Premedication :
All the patients will be pre medicated with oral diazepam 0.1 mg/ kg body weight on the night before surgery and tab. rantidine 3 mg/ kg bw on the night before and on the morning of day of surgery.

Preparation :
In the operating room, patients were connected to monitors including, ECG with heart rate, non invasive blood pressure and pulse oximeter. Baseline values of heart rate, blood pressure and arterial oxygen saturation were recorded. Intravenous access was established.

Reversal :
At the end of the surgical procedure, all the patients were reversed with 50 µg/kg Neostigmine and 10 µg/kg glycopyrrolate I.V. Patients were extubated following standard protocols.

Monitoring :
Both the groups were monitored carefully. SpO2, incidences of laryngospasm, bronchospasm, secretions, use of bronchodilator, coughing, pulmonary edema and reintubation if any were watched carefully till patient is recovered

Observation :
Both the groups were evaluated according to appendix 1 in our study. Data was collected every 5 minutes and analyzed.

Statistical Methods:
Chi-square test was used to test the significance of events that occured during the surgery. The resultant were considered significant if $p < 0.05$. Microsoft word and Excel were used for presentation.

Assessments:
1) Arterial oxygen desaturation.
This condition was recorded if pulse oximeter showed SpO_2 value less than 92% for more than 1 minute, either during induction or maintenance or recovery from anesthesia.

2) Laryngospasm
The Incidence of audible stridor or airway obstruction, not relieved by airway manipulations by anesthesiologist.

3) Bronchospasm
Audible wheezing or unexplained increase in airway pressure.

4) Increased oral secretions: classified as Grades:
1. Wet (dry by one suction)
2. Moderate (2-3 suction)
3. Copious (more than 3 times)
4. Thick (Thready secretions)

5) Severe Coughing.
More than 2 paroxysms or coughing for more than 5 seconds.
6) Re intubation after planned extubation.
7) Requirement of opioid antagonists (Naloxone) in the post anaesthesia care unit.
8) Incidence of pulmonary oedema.

Statistical Methods:
Chi-square test was used to test the significance of symptoms, desaturation and Oral secretions between Smokers and nonsmokers.

1.Chi-Square Test

$$^2=\sum(\quad - \quad)^2$$

o= The Frequencies Observed
E= The Frequencies Expected
∑= The "sum of"

Study Design:
A Comparative randomised study consisting of 50 smokers and 50 non-smokers undertaken to the compare the pulmonary complications in the post operative period between the two groups.

Observation:

Table 1. Age Distribution

age in yrs	smokers		non smokers	
	No	percentage	No	percentage
≤ 20	4	8	2	4
21 - 30	7	14	8	16
31 - 40	13	26	9	18
41 - 50	12	24	14	28
51 - 60	14	28	17	34
total	50	100	50	100
mean ± SD	43.1 ± 12.58		40.33 ± 12.51	
p value is > 0.05, hence age is comparable.				

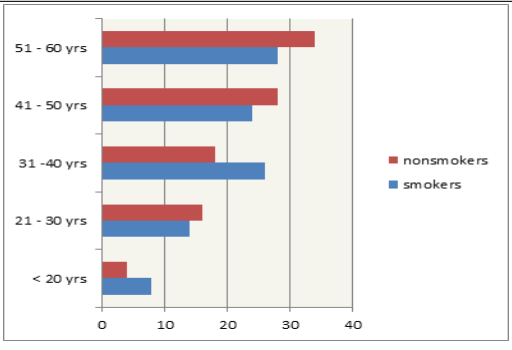

Fig1.a

Table 2: Sex distribution

sex	non smokers n= 50		smokers n= 50	
	no	percentage	no	percentage
male	27	54	38	76
female	23	46	12	24
total	50	100	50	100

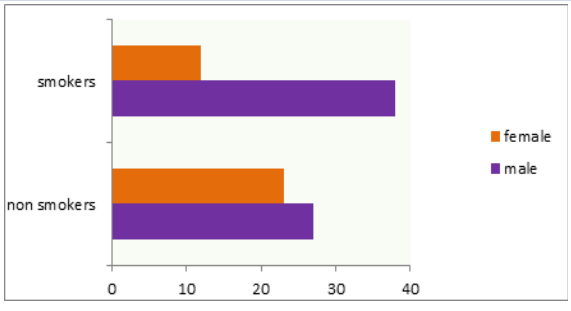

Fig 2.a

Table 3 ASA Grading

ASA Grade	non smokers n=50		smokers n= 50	
	no	percentage	no	percentage
I	27	54	26	52
II	23	46	24	48
Total	50	100	50	100

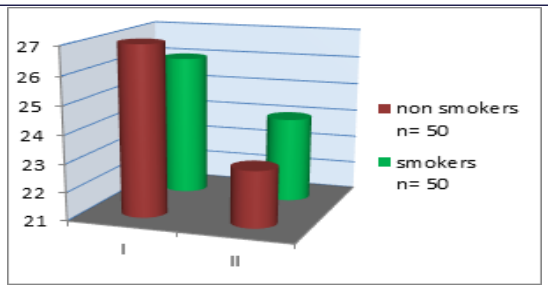

Fig3.a

Table 4 Comparison Of Procedures

Procedures	non smokers		smokers	
	no	percentage	no	percentage
Laproscopic cholesystectomy	28	56	26	52
Exploratory laprotomy	10	20	12	24
Total abdominal hystrectomy	8	16	7	14
Liver and biliary tract surgery	4	8	5	10
Total	50		50	

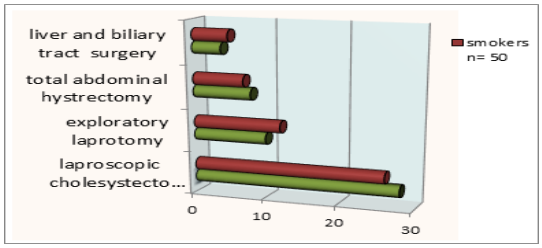

Fig 4.a

Table 5 No of cigarettes per day

no of cigarets per day	non smokers		smokers	
	no	percentage	no	percentage
nil	50	100	nil	
≤ 10	nil	_	21	42
1 1 - 20	nil	_	27	54
21 - 30	nil	_	2	4
≥ 31	nil	_	nil	_
total	50	100	50	100

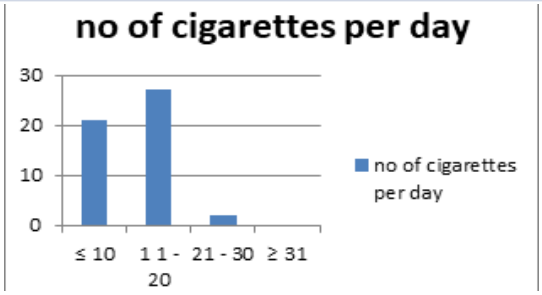

Fig 5.a

Table 6 Peri operative complications

perioperative complications	non smokers		smokers		p value
	no	percentage	no	percentage	
oxygen desaturation	1	2	7	14	0.0271*
laryngospasm	0	0	0	0	_
bronchospasm	2	4	4	8	0.401
secretion	3	6	12	24	0.012*
coughing	2	4	5	10	0.238
pul edema	0	0	0	0	_
reintubation	0	0	0	0	_
use of opioid antagonist	0	0	0	0	_
total	8	16	28	56	<< 0.05
inference	Peri-operative events are 6.781 times significantly more in Smokers groups when compared to nonsmokers with X 2 = 17.361, P<0.001				

* Significant at 5%

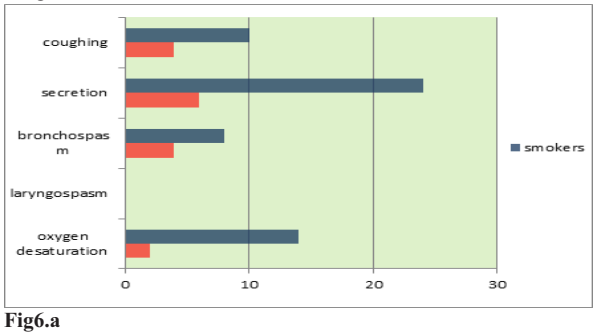

Fig6.a

Table 7 No of smokers / non smokers who have peri operative pulmonary complications

non smoker		smokers	
no	percentage	no	percentage
8	16	28	56

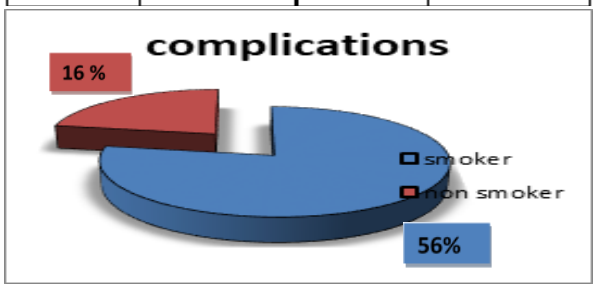

Fig7.a

Table 8 Oral secretions at recovery

oral secretions	non smokers		smokers		p value
	no	percentage	no	percentage	
grade I	26	52	15	30	0.025*
grade II	20	40	23	46	0.542
grade III	3	6	10	20	0.037*
grade IV	1	2	2	4	0.555

* Significant as p < 0.05

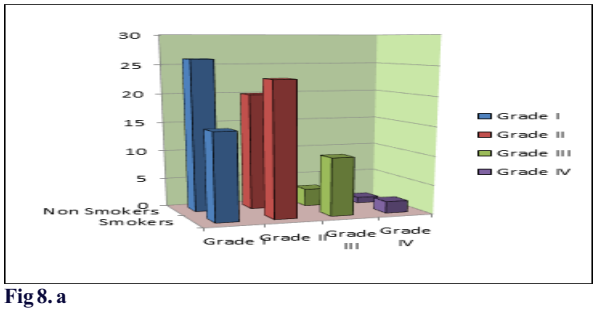

Fig 8. a

RESULTS

We studied 50 smokers and 50 non-smokers who were eligible and willing to be included in our study. Samples were age matched with p<0.05.

In smokers group, most of the patients belonged to 31-40 years of age . In non-smokers, majority of the patients were younger between 41 - 60 years of age. Mean value of age was 43.10±12.58 in smokers and 40.33 ± 12.51in non smokers which is statistically matching. Since smoking habit among females is still not very much common in our part of the country, most of the smokers were males (76 %). In non smokers 46% of the patients were females as compared to 24% among smokers.

ASA grade was statistically similar between smokers and no smokers with p value > 0.05. But 46% of the smokers were ASA II patients when

compared to 48% in non smokers. Chronic smoking with its associated complications would have increased the risk in these patients. Regarding type of procedures in each patient; surgeries on upper abdomen were very well matched in both the groups.

When individual peri-operative events were compared, oxygen desaturation was found be significantly high in the smoker group with p value 0.0271.

Incidence of laryngospasm and bronchospasm were also more in smokers group but the values were found statistically not insignificant. Bronchospasm occurred in 2 of non smokers. None of our patient in either of the groups had laryngospasm. Incidence of oral secretion during recovery were seperately analysed in 4 grades.

There was no incidence of the re-intubation after planned extubation or naloxone use in the recovery or pulmonary edema in both the groups.

When total adverse pulmonary events in the peri operative period were considered it was found that such events were 6.78 times more significant in smokers when compared to non smokers, with p value <0.001.

DISCUSSION:

The main difference in the results is that smokers did not show any increased incidence of arterial oxygen desaturation in the operating room or in the recovery room in the reference study. But most of the other similar studies recorded higher incidence of arterial oxygen desaturation in smokers. [1][2][3]

The explanation given by the author Paul S. Myles [4][5] is that immediate expert attention by the anesthesiologist and PACU staff was available in those areas, who were able to avoid more serious morbidity. Supplemental oxygen was administered immediately. In another study conducted considering the risk of desaturation during recovery in smokers from general anaesthesia by Rao M et al. in 2002 [7], it was found that smokers have significantly greater desaturation (p <0.001) during transport of patients from the operating room to recovery room. The incidence of severe hypoxemia (SpO2 <85%) was limited entirely to smoking group We have considered desaturation occurring anytime during induction or maintenance or recovery. We found that desaturation is more common in smokers with p value 0.0231. They have found that upper abdominal surgery was associated with a greater degree of desaturation which is holding well in this study also. Out of total 13 cases of desaturation in smokers, 9 cases were laparotomies. In non smoker group also out of 4 cases of desaturation, 2 were undergoing surgeries on chest or upper abdomen. Desaturation below 90% was recorded in 57% of the patients in that particular study by Madhusudhan Rao et al. in 2002 [7] when compared to 9% in non smokers. In present study we considered desaturation below 92% and the values were 14% and 2% respectively.

In most of the non smokers (90%) oral secretions at the time of extubation after giving reversal agent neostigmine 50 µg/kg along with glycopyrrolalate 10µg/kg were mild to moderate which became dry by 2-3 suctioning (Grade II).Grade II oral secretions were seen in 40 % of non smokers. In smokers, most of them (20%) had copious amount of oral secretions at the time of extubation which required suctioning of more than 3 times to get dried(GradeIII).4% of smokers had thick thready secretions (Grade IV) which was 2 % of non smokers. We did not restrict the patients' smoking habit pre operatively. In the present study, we have observed that as the chronicity of smoking habit is increased, incidence of complications is also increased. Extubation after anesthesia was always a chanllenge among smokers. As the chronicity of the smoking habit increases, the severity of changes occurring in the respiratory tract and lung also increases. This predisposes to higher incidence of complications. [6]

Smoking is definitely a risk factor for adverse pulmonary events in patients having surgery under general anesthesia. Regarding measures to minimize such adverse events in smokers, it would be advisable to consider the following steps in the light of our study.

1. Proper pre anaesthetic checkup among smokers to rule out any eventful out comes.
2. Pre medication with anti secretory and judicious use of opioids.
3. Pre oxygenation and supplemental oxygen after extubation and during transport of patients to post anaesthesia care unit (PACU) and during the stay in PACU is a must for smokers.
4. Meticulous oral suctioning should be done before extubation of the patients as there is definitely increase in the amount of oral secretions during recovery in smokers.
5. Avoidance of instrumentation of airway would contribute towards a safer perioperative period in these patients.
6. Last but not the least, all current smokers should be counseled and treated with appropriate techniques to quit smoking not only in the peri operative period but also for their entire lifetime as surgery is a special occasion to do so.

CONCLUSION

Much less is known of the effects of stopping smoking than of continuing to smoke, and many of the studies on smoking cessation are concerned with long-term effects rather than effects within 48 hr. Studies concerned with this period are required, especially in terms of postoperative respiratory morbidity, before an authoritative assessment can be made of the benefits and risks of stopping smoking in the short period before operation.

Present studies are convincing that great benefit will accrue in the cardiovascular system, mainly from carbon monoxide and nicotine elimination, after 12-24 h. A few days may greatly improve ciliary beating and 1-2 weeks provide a significant reduction in sputum volume. However, a minimum period of 4-6 weeks would seem appropriate to greatly influence postoperative respiratory morbidity, although the statement that "one needs 4-6 weeks to influence postoperative respiratory morbidity" must not be misapplied and become "there is no point in giving up smoking unless it is 4-6 weeks prior to operation." There are no proven disadvantages to the respiratory system from stopping smoking in the short term, and it seems unwise to sacrifice proven advantages for a theoretic consideration that sputum may become "stickier" and more difficult to clear.

Less is known with regard to the time course of offset of smoking effects on drug metabolism and the immune system, although 6-8 weeks would be expected to produce some benefit.

Positive benefits of continuing to smoke would seem to be a decreased incidence of DVT, although this must be confirmed on postoperative patients, the occasional patient who will start wheezing if he stops smoking and possibly some psychologic effects. We would contend that these effects can be reduced by nonsmoking mean anticoagulants, bronchodilators, and anxiolytics and do not provide sufficient reason to continue smoking.

In view of the present study and comparing with other studies we can conclude that:

1. Adverse peri operative cardio pulmonary events were found to be 6.681 times significantly more in smokers group when compared to non smokers with chi square $x2 = 17.361$ and $p << 0.05$.
2. The patients who were at more risk were found to be those who smoked more number of cigarettes per day than those who had the habit of smoking for more number of years.
3. Those who undergo upper abdominal surgeries where incision marked above the level of umbilicus had greater complication rates.
4. Apart from any standard anesthesia technique, anticipation of adverse events and measures to prevent them will definitely reduce the incidence of pulmonary complications in smokers undergoing general anesthesia. Regional anesthesia, whenever possible, should be the technique of choice in smokers, after proper counseling with regard to the higher incidence of complications in the perioperative period.

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