STUDY OF SMOKING CESSATION AND ITS INTRA AND POSTOPERATIVE BENEFITS
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ABSTRACT: BACKGROUND: Smokers have a substantially increased risk of intra and postoperative complications. Preoperative smoking cessation intervention may be effective in preventing this incidence. The preoperative period is a well-chosen time to offer smoking cessation interventions due to increased patient motivation. Our aim of the study was to assess whether smoking cessation intervention 48 – 72 hours prior to surgery was effective in preventing postoperative complications and smoking cessation in postoperative period.

METHODS: The present study recruited the male patients and grouped them into smokers and non-smokers group. Smokers prior to surgery were counseled for short term preoperative smoking cessation and measured abstinence from smoking in the preoperative and postoperative period. A total of 83 patients were studied to determine the effect of smoking cessation on the incidence of the postoperative complications.

CONCLUSION: 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.

KEY WORDS: Smoking, post-operative complications.

INTRODUCTION: Smoking of tobacco has been practiced by people all over the world cutting across national and social barriers. The increasing habit of smoking has resulted in a high incidence of tobacco related diseases all over the developing world. Though smoking of tobacco started centuries ago, the health and environmental hazards posed by it was recognized only in 20th century.

The psychological reinforcing effects of nicotine on the CNS encourage the progression from early experimentation of tobacco to chronic exposure, then addiction. Once addicted, the smoker faces an unacceptable risk for a frightening array of neoplastic and cardiovascular disorders. Even without pulmonary symptoms, the smoker has a chronic inflammatory disease of lower airways.

Smokers have a substantially increased risk of intra and postoperative complications. Preoperative smoking cessation intervention may be effective in preventing this incidence. The preoperative period is a well-chosen time to offer smoking cessation interventions due to increased patient motivation.

There is evidence of dramatic drop in complication rate if a smoking cessation intervention is started 6 – 8 weeks ahead of orthopedic surgery. Another random controlled trial evaluates a short term smoking cessation of 2 – 3 weeks prior to colorectal surgery and no differences in complications were found.

Benefits of short-term abstinence from smoking include an immediate reduction of carboxyhaemoglobin and nicotine levels in the blood. Benefits from cessation of smoking 48 hours before surgery include an expected reduction in cough, reduction in lower airway pathogens, decreases carboxyhaemoglobin levels to normal, abolished stimulant effects of nicotine on CVS and
improved respiratory ciliary beating. A 2005 research study conducted by Malhotra et al. recommends that smokers should abstain from smoking the morning of surgery, if not longer, because of the hemodynamic effects of smoking.¹

There is insufficient evidence concerning minimum recommended preoperative smoke free interval for patients who have failed to achieve longer period of smoking abstinence.

This study was an assessment whether smoking cessation intervention 48 – 72 hours prior to surgery were effective in preventing postoperative complications and smoking cessation in postoperative period.

OBJECTIVES:
- To assess the effect of short-term preoperative intervention on smoking cessation in the postoperative period.
- To determine the effect of smoking cessation on the incidence of postoperative complications.

MATERIALS AND METHODS: The present study recruited the male patients admitted in Sree Siddhartha Medical College and Hospital, Tumkur for elective abdominal operations. Smokers prior to surgery were counseled for short term preoperative smoking cessation and measured abstinence from smoking in the preoperative and postoperative period.

These patients were grouped into
  a) nonsmokers
  b) smokers
  - current smokers (who smoked within 2 weeks prior to surgery)
  - recent smokers (whose duration of abstinence from smoking is 2-4 weeks prior to surgery)
  - ex-smokers (whose duration of abstinence from smoking is > 4 weeks prior to surgery)

Current smokers were offered a smoking cessation intervention and those who agreed for cessation were considered in short term abstinence group (48-72 hours prior to surgery)

Patients were categorized according to pack years and clinically evaluated for postoperative complications.

Total number of patients studied was 83. All the cases were evaluated by taking detailed history and by carrying out thorough clinical examination. The findings were recorded in a clinical proforma. Informed consent was obtained from each patient before any investigations / interventions.

Routine investigations of the blood, urine, ECG and chest X-ray were done, to rule out associated disease or any contraindications for surgery. Other investigations like culture sensitivity, spirometry, and pulse oximetry were done whenever required.

RESULTS OF THE STUDY: A total of 83 cases were studied from September 2011 to August 2013.

Smoking status: In the present study out of 83 patients 44 (53%) were smokers and 39 (47%) were non-smokers. Among smokers 32 patients were current smokers, 11 were ex-smokers and 1 patient was a recent smoker. As all current smokers agreed for cessation all were in the cessation group.
Pack years: 34 patients (41%) belongs to 0-5 pack years group, 7 patients (8%) to 5-10 pack years, and 3 patients (4%) to >10 pack year.

DIAGNOSIS: Maximum number of patients belonged to inguinal hernia group (53; 64%) and together with recurrent appendicitis they constituted about 86%. Remaining 14% cases include Para umbilical hernia, incisional hernia, epigastric hernia, gastric outlet obstruction and calculous cholecystitis.

INCISIONS: Inguinal, Grid iron and Lanz incisions together constitute about 75%. Other incisions were midline (4%), Para median (4%), Kocher (2%), supraumbilical & infraumbilical transverse (3%). One case was incisional hernia in Right iliac fossa and a transverse incision was put in that region.

POSTOPERATIVE COMPLICATIONS: In the present study 16 smokers and 3 non-smokers developed postoperative complications (Odd's ratio = 6.8).

Regarding age group, 17.2% of 20-30y, 13.6% of 31-40y, 26.7%of 41-50y, 16.7% of 51-60y, and 54.5% of >60y developed postoperative complications.

According to smoking habit, 36.4% of smokers and 7.7% of non-smokers developed postoperative complications.

According to smoking status, 40.6% of current smokers (smoking cessation group), and 27.3% of Ex-smokers developed postoperative complications. Present study included one recent smoker who did not develop any postoperative complications.

According to pack years, 35.3% of 0-5py, 42.9% of 5-10py, 33.3% of >10py developed postoperative complications.

According to type of anesthesia, 21.1% of SA, 25% of GA, 28.6% of EA developed complications. One surgery was performed under LA and the patient developed complication.

Complications and Smoking status

Current Smokers (Smoking cessation group): All wound related complications and majority of respiratory complications (6 out of 9) occurred in smoking cessation group. Only one patient developed cardiovascular complication (hypertension) in the present study and belongs to smoking cessation group. Regarding postoperative fever cases 7 (77%) cases observed in smoking cessation group. Other complications include a case of constipation.
**Ex-smokers and Recent Smoker:** Two ex-smokers developed respiratory complications and one patient developed postoperative fever. Present study included only one recent smoker and no complications seen in postoperative period.

**Non Smokers:** Three non-smokers developed postoperative complications, one respiratory complication, one fever and one postoperative headache.

**Complications and Pack years:** Out of 2 wound related complications one occurred in 0-5 pack year group and another in 5-10 pack year group. Respiratory complications observed in 0-5 pack year were 5 cases, in 5-10 pack year 3 cases and in non-smokers 1 case. One patient developed cardiovascular complication (hypertension) in the present study and he belonged to >10 pack year group. Majority of fever cases occurred in 0-5 pack year group (7 out of 9). Other cases included a case of constipation (0-5 pack year) and a case of headache (non-smoker).

<table>
<thead>
<tr>
<th></th>
<th>Smokers (44)</th>
<th>Non-smokers (39)</th>
<th>Odd’s Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wound related</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>8</td>
<td>1</td>
<td>8.44</td>
</tr>
<tr>
<td>Hypertension</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Fever</td>
<td>8</td>
<td>1</td>
<td>8.44</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total patients developing complications</strong></td>
<td><strong>16</strong></td>
<td><strong>3</strong></td>
<td><strong>6.8</strong></td>
</tr>
</tbody>
</table>

OVERALL COMPLICATIONS AMONG SMOKERS AND NONSMOKERS

All wound related complications occurred in smokers. Majority of respiratory complications occurred in smokers than non-smokers (OR - 8.44). Only one cardiovascular complication (hypertension) observed in the present study belongs to smokers group. Postoperative fever cases observed mainly in smokers (OR – 8.44).

Overall 16 smokers and 3 non-smokers developed postoperative complications (OR-6.8,)

**DISCUSSION:** Physicians have unique opportunities and effective tool to promote smoking cessation. Even brief, physician-delivered-stop smoking-messages may double the spontaneous cessation rate. Abstinence from smoking in relation to surgery might further motivate long term cessation. Perioperative period represents a ‘teachable moment’ for smoking cessation, and if patients use this opportunity to give up smoking permanently this will have tremendous benefit for their long term health.

**Postoperative Complications:** In the present study 16 smokers and 3 non-smokers developed postoperative complications (OR 6.8).

**Wound Related Complications:** A well-studied side effect of smoking is poor and delayed wound healing. Smokers were 2.5 times more likely than non-smokers to develop wound related complications. Smoking decreases partial pressure of oxygen by 22-48%, which causes chronic
oxygen deficiency in the peripheral tissue. Carbon monoxide occupies the binding sites of oxygen in the hemoglobin molecule and the extent of this is dependent on the amount of tobacco consumed and the time elapsed since last cigarette. Carbon monoxide also shifts oxygen dissociation curve to the left thereby causing decreased tissue oxygenation. Smokers have a distinctly lowered production of collagen which is of great importance in wound healing.  

Some physicians may question whether giving up smoking, especially if it occurs only a short-time before surgery, will improve outcomes. Although many questions remain unanswered, there is good reason to believe that even a brief abstinence may improve cardiac and wound related outcomes. Half-life of carbon monoxide is about 4-6 hours such that smoke free interval of 12-18 hours should result in substantial decrease in carboxyhaemoglobin levels.

In the present study two patients developed wound related complications, both belonged to current smokers (2 out of 32, 6.3%), one in 0-5 pack years and another in 5-10 pack years group. Both were clean wounds (hernia repair). Compared to the other series (Moller 2002, Sorenson 2003, Sorenson 2008, Lindstrom 2008, and Thomsen 2009), who studied incidence of postoperative wound complications among smokers, the present study is comparable with Sorenson 2008, all other series showed higher incidence.

**Respiratory complications:** Cigarette smoking is a significant preoperative risk factor for postoperative pulmonary complications. This effect is primarily related to the resulting chronic lung disease. Current cigarette smokers have an increased risk for PPCs even in the absence of chronic lung disease. There is six fold increases in the postoperative respiratory morbidity in patients who smoke more than 10 cigarettes per day. The responsible factors include small airway disease, hypersecretion of thick viscid mucus and impairment of tracheobronchial clearance. The effects on immune function include decreased neutrophil activity, immunoglobulin concentration and natural killer activity. These effects take at least 6 weeks of abstinence from smoking to return to normal.

Some physicians expressed concern that brief preoperative abstinence might actually be harmful. The results of some prior studies have been interpreted as showing that pulmonary complications are actually increased in patients who give up smoking within the last few days or weeks before surgery. However, more recent studies have shown that abstinence starting within a few weeks of surgery doesn't significantly increase the rate of complications. In the present study total 9 patients developed respiratory complications (6 current smokers, 2 ex-smokers and 1 non-smoker). Cases observed in >60 years age group and in 41-50 years age group. 43% of complications observed in 5-10 pack years group. Compared to the other series (Moller 2002, Sorenson 2003, Sorenson 2008, Lindstrom 2008, and Thomsen 2009), the present study is comparable with Sorenson 2003 (18.8% and 16% respectively). Moller 2002 and Lindstrom 2008 series showed decreased incidence (2%) whereas Thomsen 2009 series showed increased incidence (34%).

**Cardiovascular complications:** Smoking increases the risk of postoperative cardiovascular complications. Carbon monoxide and nicotine are responsible for the immediate cardiovascular effects. Consequent to the formation of carboxyhaemoglobin, carbon monoxide reduces amount of hemoglobin available for combination with oxygen and alters oxygen dissociation curve, such that affinity of hemoglobin for oxygen enhanced. It also has a weak inotropic action on heart.
being a neurotransmitter at sympathetic ganglia increases heart rate, blood pressure and systemic vascular resistance. Thus it enhances the demand of myocardium for oxygen while carbon monoxide decreases the supply. Elimination of both carbon monoxide and nicotine with improvement in the cardiovascular fitness is complete following 12-24 hour abstinence from smoking.\textsuperscript{12}

In the present study only one patient developed cardiovascular complication (hypertension), belonged to current smoker, 51-60 y age group and >10 pack years group. Compared to the other series (Moller 2002, Sorenson 2003, Sorenson 2008, Lindstrom 2008, and Thomsen 2009), the present study is comparable with Lindstrom 2008 and Thomsen 2009 series (3.1\% and 2\%, 2\% respectively). Moller 2002 series showed increased incidence (10\%)

**Overall complications:** Smokers are at greater risk than non-smokers of postoperative wound healing complications, as well as postoperative pulmonary and cardiovascular complications. Smoking is responsible for broad range of potentially reversible effects that are relevant to perioperative morbidity.

5-10\% of the population may annually undergo surgery and anesthesia. Lung or cardiovascular complications occur in up to 10\% of the cases, with people who smoke having a considerably increased risk of intra and postoperative complications.\textsuperscript{12}

Logic supports a strong recommendation to patients to cease cigarette smoking before undergoing elective surgery.

<table>
<thead>
<tr>
<th>Duration</th>
<th>Beneficial effects</th>
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<tbody>
<tr>
<td>12-24 hours</td>
<td>Decreased carbon monoxide and nicotine levels</td>
</tr>
<tr>
<td>48-72 hours</td>
<td>Carboxyhaemoglobin levels normalized. Ciliary function improves</td>
</tr>
<tr>
<td>1-2 weeks</td>
<td>Decreased sputum production</td>
</tr>
<tr>
<td>4-6 weeks</td>
<td>Pulmonary function tests improve</td>
</tr>
<tr>
<td>6-8 weeks</td>
<td>Immune function and metabolism normalized</td>
</tr>
<tr>
<td>8-12 weeks</td>
<td>Decreased overall postoperative morbidity and mortality</td>
</tr>
</tbody>
</table>

To gain all possible benefits in respect of perioperative morbidity, smoking should stop at least 6 weeks before operation. Those who find it impossible to stop smoking for so long will derive some benefit in terms of improved cardiovascular function even from a short period of abstinence (12-24 hours before their operation). Compared to the other studies (Moller 2002, Sorenson 2003, Sorenson 2008, Lindstrom 2008, and Thomsen 2009), regarding overall complications, the present study is comparable with Sorenson 2003 and Lindstrom 2008 (40\%, 43\%, and 41\% respectively). Moller 2002 and Thomsen 2009 studies showed increased incidence (52\%, and 61\% respectively).

**SUMMARY:** A total of 83 cases were studied. The mean age was 40.04 years ± 14.06 years. 39\% were current smokers, 47\% were non-smokers, 13\% ex-smokers and 1\% recent smoker. 41\% belongs to 0-5 pack years, 8\% to 5-10 pack years, and 4\% to > 10 pack years group. 75\% surgeries were clean, 3\% clean contaminated, and 22\% contaminated. Majority of surgeries were done under spinal...
anesthesia (86%), others include general anesthesia (5%), epidural anesthesia (8%), and local anesthesia (1%).

After counseling for short term smoking cessation, 84% of current smoker's maintained abstinence from smoking during their hospital stay and only 16% smoked in the postoperative period.

36% of smokers and 7.7% of non-smokers developed postoperative complications (Odd's ratio 6.8). 6.3% of current smokers (cessation group) developed wound related complications, 18.8% developed respiratory complications, 3.1% developed cardiovascular complications, and 21.9% developed postoperative fever. Overall 40% of current smokers developed postoperative complications.

Compared to other series, current smokers with short term preoperative smoking cessation (48 hours before surgery) derived some benefit regarding cardiovascular and wound related outcomes.

CONCLUSION

- Smokers are at greater risk than non-smokers of postoperative complications. Smoking is responsible for broad range of potentially reversible effects that are relevant to postoperative morbidity.
- Counseling for short term smoking cessation prior to surgery resulted high abstinence frequency in postoperative period.
- Smokers with short period of abstinence from smoking (48 hours prior to surgery) will derive some benefit in terms of improved cardiovascular and wound related outcomes. For this reason, perioperative physician should strongly recommend abstinence and should help their patients to achieve this goal.
- Perioperative period represents a ‘teachable moment’ for smoking cessation, and if patients use this opportunity to give up smoking permanently, this will have tremendous benefit for their long term health. It could be an excellent opportunity for smokers to achieve permanent abstinence.

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