

TITLE: ROLE OF PREOPERATIVE CESSATION OF SMOKING AND OTHER FACTORS IN POSTOPERATIVE PULMONARY COMPLICATIONS: A BLINDED PROSPECTIVE STUDY OF CORONARY ARTERY BYPASS PATIENTS

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Introduction. Because smoking-associated pulmonary dysfunction can lead to the development of postoperative pulmonary complications (PPC's), patients are encouraged to stop smoking prior to their surgical procedures. Previous retrospective studies, however, have suggested that cessation of smoking within two months of surgery is not associated with any improvement in respiratory morbidity and may even be associated with a short-term increase in PPC's.^{1,2} Because there are inherent difficulties with retrospective studies without internal controls,³ we prospectively studied patients undergoing elective coronary artery bypass grafting (CABG): 1) to distinguish, on the basis of standard preoperative evaluations, those patients who have an increased risk of developing PPC's, and 2) to quantitate any relationship between time of preoperative cessation of smoking and improvement in postoperative outcome.

Methods. From October 1986 to March 1987, we studied 200 consecutive informed and consenting patients undergoing elective CABG. Data collected included detailed smoking and cardiopulmonary histories. Three preoperative tests were performed: 1) spirometry, 2) arterial blood gases, and 3) urine cotinine analysis. Study patients were followed by a single blinded observer during their intra- and postoperative periods for development of PPC's. Intraoperative management was not randomized and consisted of either narcotic/nitrous oxide/oxygen or a volatile agent supplemented with a narcotic.

Postoperatively, all patients received chest physical therapy every four hours for the first two days, frequent position changes, and early mobilization. All patients received humidified gases and hourly suctioning while intubated. These procedures constitute routine pulmonary care for CABG patients at our institution. PPC's were defined as problems requiring more therapy than usual, including: 1) purulent sputum with oral temperature $> 38.5^{\circ}\text{C}$, 2) secretion retention requiring inhalation and chest physical therapy greater than the routine care, 3) bronchospasm requiring dilator therapy, 4) plural effusions or pneumothoraces requiring drainage, 5) segmental pulmonary collapse, and 6) pneumonia requiring antibiotic therapy.

Urine cotinine, a major breakdown product of nicotine, was analyzed to substantiate smoking history reliability. Levels $> 0.5 \mu\text{g/ml}$ were considered to represent a current smoker. Smoking histories were reported in terms of "smoke free days", representing days since smoking cessation. Data analyses included univariable and multivariable comparisons of patient characteristics between patients with and without PPC's plus logistic regression evaluations of PPC's and smoke free days. Spearman's rank correlation test was used on characteristics associated with the development of PPC's. Logistic modelling was used to construct probability curves. $P < 0.05$ was considered significant.

Results. Of the 200 patients, seven developed angina during spirometry and were disenrolled and one died from massive intraoperative hemorrhage; therefore, data was analyzed for 192 patients. There was a five-fold decrease in the incidence of PPC's in patients who stopped smoking > 2 months (11.6%) compared to patients who stopped < 2 months (57.1%). Figure 1 is a logistic model to predict risk of developing PPC's. The complication rate rises for the first 28 smoke free days and returns to the current smoker rate at nine weeks. By six smoke free months, the complication rate is nearly equal to that of nonsmokers. The most significant predictors of PPC's were: 1) fewer smoke free days, 2) lower FEV₁, and 3) use of the volatile anesthetic enflurane. The association of enflurane with PPC's, when compared to all other volatile agents, was consistent at all levels of preoperative pulmonary dysfunction and durations of smoking cessation. Of the reported nonsmokers or abstainers, 3.7% had urine cotinine $> 0.5 \mu\text{g/ml}$.

Discussion. In general, enflurane, isoflurane, and halothane are bronchodilators and have similar effects on mucociliary function and control and mechanisms of respiration. Nonetheless, the correlation between PPC's and enflurane was suggested by every statistical method used. The etiology of this increase in PPC's with enflurane is unclear and needs further elucidation.

Clinical improvement in pulmonary morbidity does not occur following smoking cessation of less than two months in patients undergoing CABG procedures. To the contrary, cessation of short duration may increase the risk of developing PPC's by 50%. We advise that cigarette smoking should be discontinued for more than two months prior to elective surgery, if any benefit in postoperative pulmonary morbidity is to be expected.

References.

1. Anesthesiology 60:380-383, 1984
2. Am J Med 70:677-680, 1981
3. N Eng J Med 311:156-162, 1984

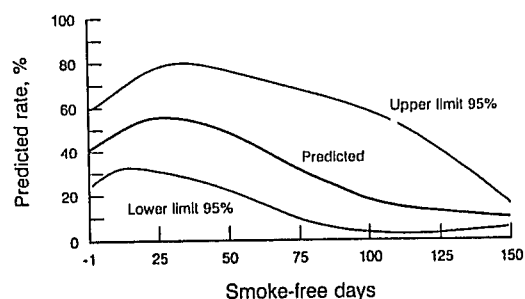


Fig. 1: Probability curve for developing one or more postoperative pulmonary complications by duration of smoking cessation (smoke-free days). Current smoker = -1 smoke-free day. Upper and lower 95% confidence limits are shown.