SMOKING AND THE CARDIOVASCULAR SYSTEM

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"God made good things lawful for them and made bad things prohibited (al-Khabais)" Sura-al-Airaf 7th Sura Verse 157 Al-Qur'an

INTRODUCTION

TOBACCO: Name given to the plant and cured leaves of *NOCOTIANA.*

TOBACUM, which can be smoked, chewed, snuffed and used for nicotine extraction. Nicotine and related alkaloids furnish habit forming and narcotic effects.

The cultivation of tobacco plant goes back some centuries in history. In the recent past, it was used by American Indians in the "peace pipe". Various explorers introduced it in Europe and England. Presently 10 billion pounds of tobacco are produced in 90 different countries — of these, U.S., China, India, U.S.S.R., Japan, Turkey, Pakistan and Brazil head the list. Only 17% of all tobacco enters world market, and the rest is smoked in the country growing it. Tobacco consumption has risen faster in less developed countries than the advanced countries.

The Chemistry and Pharmacology of Tobacco Smoke

Tobacco smoke is a mixture of gases and minute tarry droplets in which nearly one thousand compounds have been identified. Its composition varies with the type of tobacco plant from which the leaf is gathered, the way it is cured, and the way it is smoked. The smoke in each puff becomes more concentrated as smoking continues. The cigarette smoke is faintly acidic, while that of cigars and pipes are mostly alkaline.

The pharmacological effects of tobacco smoke are due to the irritant substances known as the tar (the carcinogens), and the effects of nicotine on the nerve cells (causing dependence), on the heart and blood vessels (by releasing vaso-active amines), activating factor XII thus increasing the liability of blood platelets to adhere to each other and to the walls of blood vessels, and due to high concentration of carbon monoxide in cigarette smoke.

Pathogenesis

There is no longer any room whatsoever for doubt that smoking is a major cause of disease and death. Apart from the known relationship of chronic obstructive airway disease and lung cancer to smoking (familiar to the public), it is important to stress the relationship of smoking to death from athero-sclerosis (i.e. hardening of the arteries), which in the form of strokes and heart attacks is the leading cause of death in our society. Physiologic studies and animal experiments have indicated several mechanisms whereby these effects can take place.

The mechanism by which smoking aggraates atherosclerosis is thought to be by damaging the inner lining of the arteries by the carbon monoxide (CO) in the smoke. Carbon monoxide, which has long been recognized as a dangerous gas, is present in concentrations of 1 to 5% of the gaseous phase of tobacco smoke. The amount of CO produced increases as the cigarette burns down. Carbon monoxide, which has 230 times the affinity of Oxygen (O2) for hemoglobin (Hb) impairs O2 transportation in at least two ways: first, it competes with O2 for Hb binding sites;

second, it eventually lowers the tissue PO2. The significance of this binding is unclear, but may be important in tissues, such as the heart muscle, which have both high O2 requirements and large amounts of myoglobin.

The studies done during cardiac catheterisations by Anderson, Aronow and others have shown that CO has a negative ionotropic effect on myocardial tissue resulting in the decrease in contractility and stroke index. The net result is an increased cardiac work for the same cardiac output. Smoking increases the heart rate by about 40%. In the heart with coronary artery disease there is a greatly restricted capacity to increase blood in response to this increase in cardiac work. The result is early cardiac decompensation manifested by elevation in left ventricular end diastolic pressure and angina pectoris.

Several studies have contributed to our understanding of the role of smoking in thrombogenesis. Levine, in a controlled, double blind study, showed that smoking a single cigarette increased the platelet response to a standard aggregating stimulus (ADP). His observations led him to postulate that this may be due to increase in epinephrine levels. Doctors Becker and Dubin of Cornell University have identified a glyco-protein — TGP — in tobacco leaves and tobacco smoke. This protein when injected showed antigenic properties in allergic individuals. It also activates factor XII which in turn triggers the release of thrombin and later platelets thus forming blood clots. The fact that TGP can activate factor XII and is a potent allergen may be the basis of the relationship between cigarette smoking and cardiovascular and pulmonary diseases. (Fig. 1) When inhaled the relatively small size of TGP may permit easy access to the circulating blood.

Jain and others have reported a causal relationship between smoking, birth control pills and increased risk of myocardial infarction among women in 30-40 year age group (heavy smokers i.e. more than 15 cigarettes a day incur the greatest risk — 13 per 100,000 as compared to 1.8 per 100,000 among non-smokers).

Effect of Smoking on Skin Temperature, Pulse Rate and Blood Pressure

One of the effects of cigarette smoking is the reduction in the amount of blood that flows through the capillaries in the skin. This effect is most pronounced in the skin of the fingers and toes. Doctor Roth of the section of Physiology at Mayo Clinic conducted very carefully controlled experiments in which measurements of skin temperature of fingers and toes were made by delicate thermocouples. Blood pressure, heart rate and metabolic rate were also measured on each subject.

Her results indicate that during the smoking of two standard cigarettes, the temperature of the skin of the toes decreased an average of 4.5° F for all subjects and the temperature of the skin of the fingers decreased an average of 5.8° F. There is an appreciable increase in the heart rate and blood pressure indicating increased metabolic rate.

The blood pressure and the heart rate returned to normal sooner than the temperature of the fingers and toes, which took from a half hour to an hour to return to normal temperature. Confirmed smokers suffered this change in skin temperature just as readily as those who were not accustomed to smoking.

Smoking and Gangrene

The rare disease of the arteries called Buerger's disease or Thromboangitis obliterans is almost entirely confined to smokers and can be improved only when the patient discontinues smoking. Perhaps the most famous person of recent years to be afflicted with this disease was King George the VI. Although his death was caused by lung cancer (secondary to heavy smoking), a great deal of his suffering was caused by Buerger's disease.

The arteries of the legs are most often attacked, with pain that comes on when the muscles require more blood during walking (intermittent clandication). As a result of lack of proper blood supply to tissues, ulcers develop and eventually gangrene sets in. Some patients even after amputation of extremities had persisted in smoking due to firmly established habit.

The arterial involvement in both male and female smokers is also manifested in the form of

increased liability to strokes in smokers, as reported in American surveys.

Smoking and Heart Disease

The most important specific health consequence of cigarette smoking in terms of the number of people affected is the development of premature coronary heart disease (CHD). Both prospective and retrospective studies clearly established that cigarette smokers have a greater risk of death due to CHD and have a higher prevalence of CHD than non-smokers. Long-term follow-up of healthy populations has confirmed that a cigarette smoker is more likely to have a myocardial infarction and to die from CHD than a non-smoker.

Disease of the heart and blood vessels presently rates as society's number one killer, being responsible for a little more than half the total deaths. In view of this high death rate, it is clear that if smoking causes even a moderate increase in the number of deaths from diseases of the heart and blood vessels, it will kill more people in the long run by this means than by its involvement with lung cancer. Cigarette smoking acts both independently as a risk factor and synergistically with the other CHD risk factors like age, elevated serum cholesterol and hypertension.

Data from autopsy studies have shown coronary atherosclerosis to be more frequent and more extensive in cigarette smokers than in non-smokers. Several mechanisms have been postulated for this change — the formation of carboxy — hemoglobin, release of catecholamines, creation of an imbalance between myocardial oxygen supply and demand, and increased platelet adhesiveness leading to thrombus formation.

In his study of smoking habits and myocardial infarction amongst women in Goteborg, Sweden, Bengtsson found that 80% were smokers.

Tobacco smoking may bring on angina in some patients. Angina also occurs on less effort after smoking presumably owing to the increased amount of work the heart is stimulated to perform through the action of nicotine. The electrocardiogram may undergo changes suggesting reduction in the blood supply of the heart. Hammond and Horn did a prospective forty four months follow up of 187,783 men between 50 and 65 years of age in different states of the U.S.A. The most important finding of this study was the high degree of association between cigarette smoking and the total death rate. Of the 11,870 deaths in the study, 7,523 (63%) were attributed to disease of the heart and circulatory system. Coronary artery disease accounted for 44.6% of all deaths. When the deaths from this cause (3,361) among cigarette smokers is compared with comparable deaths among non-smokers (1,973) the statistical ratio is significant (p 0.001). Death rates due to coronary artery disease increased with the amount of cigarette smoking (Table 1).

Discussion and Conclusion

The large number of middle-aged men now afflicted by coronary artery disease presents a grave social and economic problem.

At one time tobacco was used as a barter for goods from Europe for the "New World". This situation does not exist any more. Only a fraction of the tobacco grown enters the world market, the rest is consumed inside the country. This means that a valuable piece of land, time, effort and money are spent in growing a crop which is neither food nor fodder. The loss of all these factors in the underdeveloped countries of Asia, Africa and South America are enormous. It is time to put a stop to this waste. Only now the consequences of tobacco smoking are being realized on the present and future generations. Much greater effort, money and research are needed to convince the smokers the futility of their habit. The person who allows himself to be controlled by one bad habit may easily fall victim to another.

It is not that there is any chemical relationship between nicotine, alcohol, marijuana, and morphine. A body's unnatural craving for one of these drugs is not satisfied by another on the list. It is rather a question of personal mastery. Indulgence in one habit known to be harmful conditions the mind to accept other harmful habits. . . "and God made bad things (those that are harmful) prohibited. . ."

TABLE 1

Mortality ratios in coronary artery disease as related to the number of cigarettes smoked per day (from Hammond)

Cigarettes Smoked	No. of Deaths in Category	Expected No. of Deaths	Mortality Ratio
None	709	709	1.00
Less than ½ pack	192	149	1.29
Half to one pack	864	456	1.89
1 to 2 packs	486	226	2.15
more than 2 packs	118	49	2.41

Based on forty-four months of follow up of 187,783 men.

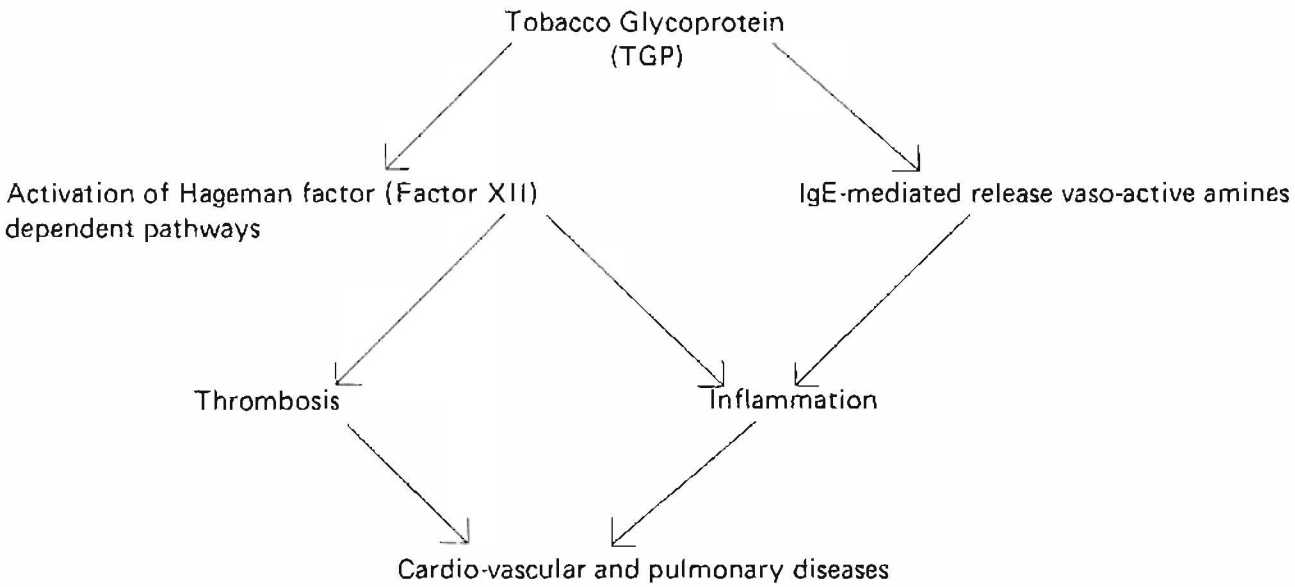

FIGURE 1

Hypothesis concerning the relationship of TGP to the pathogenesis of cardio-vascular and pulmonary disease. (after Becker)

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