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Effect of Cigarette Smoke on the Cardiovascular System in Dogs (35707)

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Small amounts of nicotine (5–20 μg/kg), the active ingredient in tobacco smoke, when injected into the femoral vein or pulmonary artery of cats anesthetized with chloralose caused a fall in blood pressure within a few seconds (1). It is controversial as to whether a similar effect can be produced as the result of inhalation of cigarette smoke.

The present study was undertaken to examine the effect of inhalation of cigarette smoke on the hemodynamics of the dog. Various known pharmacological agents, *e.g.*, tyramine, propranolol, were used to modify the evoked response of tobacco smoke in an attempt to gain insight into the mechanism involved in that effect.

Methods. A total of 15 healthy male mongrel dogs ranging in weight from 19.6 to 25.0 kg were used in this study. The dogs were anesthetized with pentobarbital sodium (25 mg/kg; iv). Breathing in all the experiments was assisted by means of a respirator-smoking apparatus supplying the animal through a tracheal cannula. Renal artery flow was obtained by means of a square-wave electromagnetic flowmeter (North Carolina Medical Electronics); and a corresponding acute probe was placed around the left renal artery, which was exposed by means of a retroperitoneal incision. The central venous pressure and the arterial pressure were obtained by passing polyethylene catheters through the external jugular vein and the common carotid artery, respectively. Intravenous injections were made through the venous catheter. Heparin was used as an anticoagulant in the arterial and venous catheters as required. The pressures were measured by means of Statham transducers, and a Sanborn recorder (7700 Series) was used for the continuous monitoring of central venous pressure, aortic pressure, and renal artery flow. The details of further surgical procedures are given in the Results and Discussion.

Cigarette smoke was administered in the same metered dose (one puff of 100-cc volume and 2.5 sec duration) throughout this series of experiments. The cigarettes used contained 22 mg of tar and 1.3 mg of nicotine. The dog smoked one cigarette per 10 min. The exact amount of nicotine reaching the blood is uncertain. The respirator-smoking apparatus contained a Harvard Apparatus Company respirator pump drawing puffs of smoke regulated in size, duration, and frequency. The puffs were passed to a reservoir from which a second Harvard pump drew the cigarette smoke and fresh air to respirate the dog at its tidal volume. Cardiac output was determined by the dye-dilution method of Hamilton and Stewart. Dilution data from the arterial catheter were obtained by continuous sampling through a cuvette densitometer (Gilson Medical Electronics, Inc.) which was connected to a direct-reading cardiac output computer (Lexington Instruments Corp.). The computer was calibrated and programmed to read out cardiac output directly from the densitometer and reject all curves not arithmetically valid.

The following drugs were used: nicotine (expressed as a base), tyramine hydrochloride, propranolol, and chlorisondamine. Student's *t* test was used for the evaluation of statistical significance (7). Details of dosage of drugs and schedule and route of administration are given in appropriate places under Results and Discussion.

Results and Discussion. Cigarette smoke was administered to five dogs for a period of 90 min. Smoke caused a significant drop in systolic blood pressure ($p < .05$), and lower diastolic pressure, heart rate, and slightly increased renal blood flow; however, these later effects were not statistically significant