

No doubt there are a number of cases for whom the operations described in the article and performed after confinement, when the vulval varicosities refuse to improve, will mean all the difference between severe handicap and the feeling of wellbeing and strength. The surgical procedures described, undertaken during pregnancy in a very highly vascularized field around the pregnant uterus, would need a very strong and urgent indication indeed.—I am, etc.,

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Smoke Vapours and Carcinogenesis

SIR,—In studies of factors that might give rise to lung cancer, emphasis seems to have been placed hitherto on the particles present in polluted air and in tobacco smoke. This may be due in part to the fact that some aerosol particles are known to cause certain diseases of the lung.

In particular, some evidence suggests that aerosol particles cause cancer of the lung in workers in the chromate, asbestos, and metal industries.¹ Furthermore, there appears to be an increase in the incidence of lung cancer with increase in the mass concentration of particulate atmospheric pollution.² Carcinogenic compounds have been found in the particle phase of general atmospheric pollution,^{3,4,5} and some of these particulate samples have been used to induce skin cancer in mice.⁶ Similar results were obtained with the particulate phase of automobile exhaust fumes.⁶ Carcinogenic compounds have also been found in tobacco smoke condensates collected at about $-80^{\circ}\text{C}.$,⁷ and skin cancer has been induced in laboratory animals by the application of tobacco smoke tars.¹

Although Neve,⁸ Waller,³ Davies,⁹ and Weller¹ have mentioned the possibility of some contribution by the vapours of smokes to carcinogenesis, discussions of the factors involved usually emphasize the importance of the particle phase.^{2,3} However, there is some reason to doubt whether the particle phase of certain smokes is of overriding importance. In discussing the possible effects of tobacco smoke Davies⁹ pointed out that, although lung cancer appears to develop first in the bronchi rather than in the alveoli, it is to be expected on theoretical grounds that tobacco smoke particles, which are about $0.1\ \mu$ radius, are probably deposited less copiously in the bronchi than in the alveoli. Furthermore, it is likely that the percentage retention of particles in the human lung as a whole is minimal, or nearly so, for particles whose radius is about $0.1\ \mu.$ ^{9,10} There appears to have been no systematic study of the relative rates of deposition of the vapours and the tarry particles of tobacco smoke in the human lung. The results of recent studies of physical properties of wood smoke¹¹ might therefore be relevant.

Wood smoke was generated under conditions similar to those obtaining during the generation of tobacco smoke. It was shown¹¹ that, as is the case for tobacco smoke, freshly generated wood smoke contains vapours and gases and tarry droplets of the order $0.1\ \mu$ radius. Measurements were made of the rates of deposition of wood smoke on dry and wet surfaces when the smoke was passed over them. The rate of deposition of wood smoke on dry metal surfaces was determined by weighing. To estimate the quantity of smoke deposited on wet surfaces such as water, the "smoked" water was freeze-dried and the residue taken as an index of the quantity of smoke initially deposited. Some of the deposited matter must have evaporated during the process of freeze-drying, and the figures obtained were therefore possibly lower than the true rates of deposition. The

residues resembled bulk samples of the particle phase of wood smoke, being tarry, dark in colour, and relatively non-volatile.

The rate of deposition of wood smoke on wet surfaces was found to be considerably greater than that on dry surfaces. The rate of deposition on water of smoke containing both particles and vapours was compared with the rate of deposition of the vapours alone, the particles having been removed by means of an electrical precipitator. It was found that the rates of deposition with and without the particles were the same, when the other physical conditions of smoking were equal. Similar results were found for smoke generated in a fluidized bed of wood sawdust using heated air at a constant temperature. This was the case despite the fact that the mass concentration of the vapour phase of this wood smoke (condensed at about $-80^{\circ}\text{C}.$) appeared to be much less than that of the particle phase. It may be concluded, therefore, that the tarry residues obtained by freeze-drying smoked water resulted mainly from the deposition of wood smoke vapours.

From theoretical considerations¹¹ it seems likely that in these experiments particle deposition made very little contribution in the "smoking" of water due to the small size of the particles and to the relatively small area of water surface per unit volume of smoke. The geometry of the wet surfaces in the human lung is different from the system used in the experiments with wood smoke, and the relative contributions of particles and vapours will therefore be different. As already mentioned, the usual site of lung cancer is the bronchi, but this cannot be readily explained from considerations of the mechanism of the deposition of tobacco smoke particles.⁹ However, it is likely that the rate of deposition of the vapours of smokes will be greatest in the wide tubes in the lung, such as the trachea and bronchi, since it is in these regions that the quantity of vapours available per unit area of absorbing surface is greatest. Although it might be argued that certain carcinogens such as 3:4 benzpyrene, being almost insoluble in water, would not be expected to be "scrubbed" from the vapour phase by moist surfaces such as bronchial epithelial tissues,^{12,13} the work of Falk, Miller, and Kotin¹⁴ on the desorption of 3:4 benzpyrene from soots by plasma proteins suggests that tissues may not behave as ideal systems. In view of these results of work on wood smoke and of the above discussion, it is suggested that it might be useful if further consideration were given to the relationship between lung cancer and the absorption by the lung of vapours from tobacco smoke and polluted air.—I am, etc.,

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