

poisoning who usually show a favorable response to steroid therapy.²⁹

Two further aspects of this case merit more detailed consideration and analysis: (1) the pulmonary function and cardiac catheterization studies; and (2) the significance of the superimposed bronchogenic carcinoma.

PULMONARY FUNCTION AND CARDIAC CATHETERIZATION STUDIES

Table I indicates, as one might expect, that the patient had a reduction in vital and maximum breathing capacities. However, the finding of an alveolar-arterial oxygen gradient of 27 mm. Hg demonstrates that one of the disturbances in pulmonary function was a defect in the diffusion of oxygen from the alveoli of the lungs to the capillaries. This corresponds to the syndrome of "alveolar-capillary block" described by Baldwin, Cournand and Richards^{31,32} and again by Austrian et al.³³ This diffusion defect is not surprising when one recalls the fibrosis about the alveoli, alveolar ducts, capillaries and bronchioles that occurs in asbestosis. In order for the patient to maintain a near normal arterial oxygen saturation, a high alveolar oxygen was necessary; and this apparently was accomplished in part by hyperventilation. The patient had an average respiratory rate of 40 per minute at rest. This compensatory mechanism apparently was not adequate during stress or exercise for under those conditions the arterial oxygen saturation fell. There was a considerable degree of pulmonary hypertension and, as in the cases of pulmonary fibrosis studied by Cournand and his associates, a rise in the pulmonary artery pressure occurred with exercise. (Table II.) The partial pressure of carbon dioxide in the blood (36 mm. Hg) was low normal rather than elevated. Had there been a defect in alveolar ventilation, the $p\text{CO}_2$ would probably have been higher. As Arnot emphasized in discussing this case¹⁶ carbon dioxide is not impaired in its transfer from the blood to the alveoli because of its great diffusion capacity. This speed of diffusion plus the increased alveolar ventilation no doubt accounted for the lowered $p\text{CO}_2$ value.

ASBESTOSIS AND CARCINOMA OF THE LUNG

The association of asbestosis and carcinoma of the lung has been mentioned frequently in the literature.^{1-3,34-53} Heretofore some authors have believed that the cases were too few in

number to be of significance; others, especially Vorwald and Karr, have stated that "inhaled dusts, except those containing recognized carcinogenic substances (as radium and tar) cannot in general be considered as etiologic factors in the development of primary pulmonary carci-

TABLE III
INCIDENCE OF ASBESTOSIS AND CARCINOMA OF LUNG

Author	No. of Deaths with Asbestosis	No. Due to Cancer of Lung	Incidence (%)
Merewether ¹	235	31	13.2
Wedler ⁴⁶	92	15	16.3
Wyers ³	115	17	14.8
Lynch, Cannon ⁴⁷ ..	40	3	7.5
Gloyne ³	121	17	14.1
Total.....	603	83	13.8

noma."⁴ Our conclusion at present is in favor of the concept that the association of bronchogenic carcinoma with asbestosis is more than coincidence. That there is a significant incidence of bronchogenic carcinoma in asbestosis is apparent from Table III.

Merewether has cited the largest series—of 235 cases of asbestosis there were thirty-one with bronchogenic carcinoma, or 13.2 per cent.¹ An average of the five analyses recorded in the literature is 13.8 per cent. This is considerably higher than the incidence of lung carcinoma in routine necropsies, which in a comparable period (1935–1948) ranged from 0.8 to 2.4 per cent.^{9,47,54}

In contrast to asbestosis the incidence of bronchogenic carcinoma in silicosis as recorded in the two largest series has been similar to what might be expected in the general population. The data compiled by Merewether¹ and the Miner's Phthisis Medical Bureau of South Africa⁵⁵ are based on a total of 6,884 and 1,438 autopsied cases of silicosis respectively, and disclose an incidence of lung carcinoma of 1.32 and 0.70 per cent. Vorwald and Karr found two lung carcinomas in 136 silicotics (1.47 per cent). Klotz⁵⁶ noted an incidence of 8 per cent, but his series of fifty cases does not seem large enough to be statistically significant. However Gloyne³ in reviewing necropsy material from 1929 to 1949 (796 cases) also described the surprisingly high incidence of lung carcinoma in silicosis of 6.9 per cent, and 7.7 per cent in