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POST-IRRADIATION FIBROSIS OF THE LUNG AND ITS SURGICAL TREATMENT

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The effect on the lungs of large doses of roentgen rays has been recognized for many years. In 1921, Groover, Christie and Merritt reported in the congress of the Southern Medical Association that in a considerable number of cases of mammary cancer treated by irradiation, a non-productive, irritating cough appeared coincidentally with the cutaneous reaction. Shortly thereafter, changes appeared in the roentgenograms of the lungs. Infiltration was visible in the hilar region which spread to most of the involved lung in a period of three or four weeks. Dyspnea and cough became severe. In some instances, the lesion regressed considerably after reaching its maximum but in others, there was residual difficulty.

Since the original report, other authors have presented series of cases of post-irradiation damage to the lung. The extensive review of Desjardins has references to 298 articles.

The nature of the lesion and the possibilities of surgical treatment are evident from the following two case reports.

Case 1—E.M., a 54-year-old white woman, was first seen in the Henry Ford Hospital in September, 1945. Six years before, a radical mastectomy had been performed for cancer of the left breast and this had been followed by radiation therapy. Details of dosage and method of treatment are not available. Pain in the chest and cough which was productive of small amounts of sputum appeared promptly. During the six years, these symptoms gradually became worse. Roentgenogram of the chest showed that extensive damage had been done to the left Lung.

Fig. 1—Roentgenogram of chest. Case 1, showing extensive destruction of left lung by irradiation.

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lung (Fig. 1). It appeared to be extensively involved with fibrous tissue, cystic spaces and atelectasis. There was marked deviation of the trachea. Symptomatic treatment for the cough was prescribed and the patient was discharged from the hospital.

Three months later, she was readmitted because of the increasing severity of symptoms. Coughing occurred more frequently and in paroxysms which terminated in nausea. At this time it was noted that the vital capacity was 1135 cubic centimeters. The patient left the hospital unimproved and was admitted again two months later. She was very short of breath and cyanotic, even in oxygen. After two days, there was a precipitous fall in blood pressure; this appeared to be due to gastrointestinal bleeding because she vomited material resembling coffee grounds. Death followed in a few hours. At autopsy, it was found that the left lung consisted almost entirely of dense fibrous tissue separated by cystic spaces. The pericardial space was obliterated. There were several acute ulcers in the stomach and duodenum. One could theorize that these were due to “stress.” Residual carcinoma could not be demonstrated.

Case 2—W.W. was a 57-year-old white woman, on whom a radical mastectomy was performed elsewhere in June 1951 for carcinoma of the right breast. Two weeks after the operation, radiation treatment of the operative area was begun. Treatments were given six times weekly for 6 weeks. The roentgen doses were summarized as follows:

- 690 R to the neck through a 15 x 15 cm. port.
- 2390 R to the right chest and supraclavicular area through 15 x 15 cm. port.
- 1890 R to the anterior right axillary region through 10 x 15 cm. port.
- 1560 R to the right posterior axillary region through a 15 x 15 cm. port.

Ten days after the last deep therapy treatment, the patient was admitted to another hospital because of fever and cough. The roentgenogram of the chest showed infiltration of the upper part of the right lung (Fig. 2a). The presumptive
diagnosis was a typical primary pneumonia with incomplete resolution and atelectasis. In spite of intensive treatment with antibiotics, there was extension of the process in the right lung during the next two weeks (Fig. 2b). The sputum was negative for tubercle bacilli and neoplastic cells. Bronchoscopy showed nothing except deviation of the trachea to the right. Roentgenogram of the chest early in September revealed more involvement of the right lung and more shift of the mediastinum. The diagnosis of post-irradiation fibrosis of the lung was made at this time (Fig. 3a).

During the next eight months, the patient became increasingly short of breath. Sleep was difficult because of an irritating, almost non-productive cough. It was necessary to administer antibiotics continually to avoid secondary infection in the lung. In May, 1952, the x-ray picture of the lung was similar to that of the previous September (Fig. 3b).

The patient was admitted to the Henry Ford Hospital in June, 1952. Because of the favorable results obtained in two cases treated by pneumonectomy, reported by Bergman and Graham, the operation was recommended as the only solution for her problem.

The operation was carried out on July 2, 1952. The lung was exposed through a right postero-lateral incision through the fifth interspace. Extensive pleural adhesions had been expected, but they were not present. There was a small amount of fluid in the pleural cavity. The lung was small and fibrotic; it was air-containing only in a portion of the lower lobe. The pulmonary vessels were small and the pneumonectomy was technically easy to perform.

The pathologists’ description of the excised lung (Fig. 4) was as follows: “The specimen consists of a lung which weighs 167 grams and which measures 16 by 8 by 3.5 centimeters. The lung barely floats in water. The external surface is light gray, mottled with a moderate amount of black pigment. There is a plaque of light gray fibrosis over the medial portion of the lower lobe. The mucosa of
Fig. 4—Photograph of right lung (Case 2). The smooth pleural surface is striking.

the bronchus is smooth. Upon cut section, the parenchyma of the upper lobe is deep gray and very solid in consistency. That of the lower lobe is only slightly less dense.

"Microscopic examination (Fig. 5): Sections through the pulmonary tissue show extensive changes characterized by the following features. There is an ex-

Fig. 5—Photomicrograph of lung tissue (Case 2). There is almost no alveolar structure. Near the center of the section in an arteriole with its lumen almost obliterated.
tensive, diffuse fibrosis with thickening of alveolar septa. Most of the alveolar spaces are relatively airless and are filled with moderately large numbers of macrophages. These frequently show a brownish discoloration of their cytoplasm. In some places, the macrophages have fused to form multinucleated giant cells. The second prominent change consists of intimal thickening and fibrosis of most of the smaller and medium sized arterial channels. Several of the smaller respiratory bronchioles show squamous metaplasia of their lining epithelium, and many of these are filled with mucinous material. Some of this material is also found in dilated alveolar spaces adjacent to these structures. There are moderate numbers of chronic inflammatory cells scattered about diffusely throughout the tissues. Pathologic diagnosis: Post-irradiation fibrosis of the lung (Dr. Henry Tesluk)

The patient's postoperative course was satisfactory. The cough which had been so distressing before operation was not present afterward. Postoperative roentgenogram of the chest showed that the trachea was in the midline. She was discharged from the hospital four weeks after the operation. A report from the patient's physician nine months later indicates that she continues to be greatly improved. Her only complaint is of mild dyspnea with exertion.

**SUMMARY**

Two cases of extensive fibrosis of the lung following radiation treatment for carcinoma of the breast have been presented. One of the patients died of this complication, while the other is in relatively good health following pneumonectomy.

**REFERENCES**


