Cavernous Metastatic Pulmonary Carcinoma
A Report of Two Cases*

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Metastatic carcinoma has been scarcely mentioned as a cause of pulmonary cavitation in the texts and articles on this subject.1,2 The purpose of this report is to review the literature and to describe the clinical, roentgen and pathological findings in two cases of cavernous metastatic carcinoma of the lungs. In one of these, spontaneous pneumothorax was an associated finding.

Articles pertaining to the roentgen diagnosis of pulmonary metastases stress the classical pictures of nodular, miliary, infiltrative, and massive types. In a 10 year survey of 78 autopsied cases of metastatic pulmonary disease, Farrell3 reported one with multiple cavities in the lungs due to metastatic sarcoma. Minor4 reported four with cavernous lesions in a series of 312 cases of metastatic pulmonary carcinoma. The detailed roentgen and pathological findings were not described in these articles. Five cases of spontaneous pneumothorax associated with metastatic sarcoma have been reported; three by Lodmell and Capps,5 and two by Thornton and Bigelow.6

Both of our cases were proved to have rapidly growing carcinomas with widespread metastases. Case 1, a seminoma of the testis, proved at operation, was given x-ray therapy postoperatively. A year later, a chest x-ray film showed solid and cavernous lesions in the lungs. Spontaneous pneumothorax appeared terminally. Metastatic seminoma was found in postmortem aspirations of the pulmonary lesions. Case 2 was found to have solid and cavernous infiltrations in the lungs on admission to the hospital. The lesions in the lungs were suspected to be metastatic on the basis of a Papanicolaou smear of the bronchial secretions. At necropsy, the pancreas was the site of a primary carcinoma and widespread metastases were found in the lungs and elsewhere.

The metastatic pulmonary lesions appeared similar radiographically in both of our cases and consisted of sharply and poorly circumscribed nodular and irregularly shaped densities and cavities (Figures 1-8). The nodules, in general, were rapidly growing. A nodule in the left lower lobe of Case 1 increased in diameter from 1.0 cm. to 2.5 cm. in about five weeks (Figures 1 and 2). Many of the nodules appeared solid on the initial examinations and apparently excavated into bronchi to form air filled cavities as seen on subsequent examinations (Figures 1-8). This sequence of events is illustrated in Case 1 (Figures 1-4). A nodule behind the heart (Figure 1) excavated to form a cavity (Figure 2) which markedly increased in size.

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(Figures 3 and 4). The cavities were generally round, ranging from 1 to 3 cm. in diameter, and the wall thickness from 1 to 4 mm. The lining of the cavities appeared smooth. Several of the rounded thin walled cavities rapidly increased in diameter (Figure 4) resembling tension cavities. A number of nodular metastases, however, increased in diameter similarly, suggesting that the rapid growth of the cavities was due to erosion of the wall by tumor rather than to a bronchial ball-valve mechanism. A cavity in the left upper lobe of one case (Figure 3) showed a fluid level. Spontaneous pneumothorax appeared in the left pleural space with a small amount of fluid. Since an autopsy was not performed on this patient, the mechanism of formation of the pneumothorax could not be determined. The rupture of a subpleural cavity into the pleural space with fistula formation would appear likely.

A host of conditions may cause pulmonary cavitation including tuberculosis, bronchogenic carcinoma, lung abscess, fungus disease, bronchiectasis, cystic disease, infarction, lymphoma and pneumoconiosis. The presence of sharply circumscribed nodular lesions in association with multiple cavities on x-ray of the lungs should suggest the possibility of metastatic disease. Such a diagnosis is supported by the finding of a primary malignant tumor. This form of metastatic disease probably results in extensive erosion of bronchial mucosa so that the Papanicolau smear of the bronchial secretions should reveal malignant cells in a high percentage of cases. The Papanicolau smear was highly suspicious of malignant cells in our second case.

We have been unable to determine the exact mechanism of cavity formation in metastatic pulmonary disease from our study of the two cases. Features of these cases suggest several factors which probably play a role. In both instances, the metastatic pulmonary tumors were rapidly proliferating. In all likelihood, the blood supply to such lesions becomes inadequate with central tissue softening and necrosis. Central necrosis was observed in the two cases of metastatic pulmonary sarcoma reported by Thornton and Bigelow. Histologically, in Case 2, the central portions of the lung lesions (Figure 11) consisted of necrotic tissue and numerous segmented neutrophils, indicating the presence of infection. Erosion of the bronchial walls by these lesions and discharge of the centrally necrotic tissue into the bronchial tree would appear most likely although the communications between bronchi and cavities could not be demonstrated at autopsy. Such communications may be extremely difficult to show pathologically. The Papanicolau smear of the bronchial secretions in Case 2 was highly suspicious of tumor cells. It would seem unlikely that the radiotherapy administered to Case 2 was a factor in the excavation of the pulmonary metastases because the dose administered was small and many of the cavities were outside the treated fields. Many of the solid nodules increased in size at the same rate as the cavities suggesting that the growth of the cavities was caused by erosion of the walls by tumor. On the other hand, the cavities generally appeared almost perfectly round and cystlike indicating the probable presence of a bronchial ball-valve mechanism.
Figure 1, Case 1: Metastatic seminoma. Multiple nodular and irregular lesions scattered through both lungs. Note solid nodule behind heart and at the 5th rib anteriorly.

Figure 2, Case 1: Five weeks later, solid lesion behind heart was broken down to form relatively thick walled cavity. Marked increase in size of nodule at 5th rib anteriorly. Cavity at 2nd rib anteriorly.

Figure 3, Case 1: Cavity behind heart has become enlarged and thin walled simulating tension cavity. Left hydropneumothorax. Fluid level in left upper lobe cavity.
Case Reports

Case 1: A 47 year old butcher (L.M., Hospital No. 272752) was admitted to Denver General Hospital January 19, 1951 complaining of low back pain and loss of 80 pounds of weight during the previous eight months. In February 1950 a left orchidectomy was performed at a private hospital in Denver for a tumor which had been known to the patient for two months. X-ray films of the chest, pelvis and an intravenous pyelogram were normal. The pathologic diagnosis was seminoma of the testis. From March 3 to April 13, 1950 he was given postoperative deep x-ray therapy (250 K.V.) directed to the pelvic, aortic, mediastinal, and left supraclavicular lymph nodes, 1200r (air) to each field. Since April 1951 he complained of progressive weight loss and increasing left lower back pain. Physical examination failed to reveal any significant abnormal findings aside from slight tenderness of the lower lumbar spine. Laboratory findings: hemoglobin 12.0 gm.; leucocytes 8,100; neutrophils 85 per cent; lymphocytes 10 per cent; monocytes 4 per cent; eosinophiles 1 per cent. Urine: normal. Two sputum specimens were negative for acid fast bacilli. The Friedman test was negative. X-ray films of the chest showed multiple nodular infiltrations in both lungs consistent with metastatic disease (Figure 1). The intravenous pyelogram was normal. X-ray films of lumbar spine were normal. Radiotherapy was directed to the anterior and posterior abdomen (250 K.V.) 1200r (air) to each field, because of the likelihood that the lumbar spine pain was caused by metastatic retroperitoneal lymph nodes. X-ray film of the chest on February 28, 1951 showed increase in the size and number of the nodules in both lungs, several of which had broken down to form thin walled cavities (Figure 2). On March 22, 1951 a chest x-ray film showed increase in size of several cavities. One in the left upper lobe contained a fluid level. Left hydropneumothorax was present (Figure 3). His condition gradually deteriorated and he expired April 1, 1951. Post-mortem aspirations of the lesions in both lungs revealed necrotic malignant tumor. Comparison of the aspirated tumor from the lung with the primary seminoma to the left testis revealed an almost identical histological appearance.

Case 2: A 65 year old male Negro, pensioner (R.M., Hospital No. 275282) was admitted to Denver General Hospital on May 1, 1951 complaining of epigastric pain
**Figure 5, Case 2**: Metastatic adenocarcinoma of pancreas. Multiple irregular, nodular, and cavernous lesions in both lungs. A thin walled cavity in left upper lobe is outlined.—**Figure 6, Case 2**: Increase in extent of infiltrations in both lungs.—**Figure 7, Case 2**: Continued increase in extent of infiltrations in both lungs. Note enlargement of thin walled cavity in left upper lobe.
increasing in severity for 10 months. The pain was aggravated by food and occasionally associated with vomiting. During the week prior to admission, he noted three tarry stools. Physical examination revealed that he was chronically ill. There was no other significant abnormality. The urine was normal. Hemoglobin was 13.5 gm.; leucocytes 13,000; neutrophils 69 per cent; lymphocytes 23 per cent; monocytes 9 per cent. Two sputum specimens were negative for acid fast bacilli. Coccidioidin, histoplasmin and tuberculin skin tests were negative. Gastric analysis revealed no free hydrochloric acid. Bronchoscopy was negative. Papanicolaou smear of bronchial secretions was highly suggestive of malignant cells. X-ray film of the chest revealed numerous nodules scattered throughout both lungs, especially in their mid-portions. In addition, there were numerous round cavities scattered through both lungs up to 1.5 cm. in greatest dimension (Figure 5). A gastrointestinal series revealed a small penetrating ulcer on the vertical portion of the lesser curvature of the stomach which had the appearance of a benign peptic ulcer. The antrum of the stomach was inconstantly narrowed. The appearance was consistent with antral spasm associated with the gastric ulcer rather than tumor. A chest x-ray film on May 15, 1951 showed increase in the size and number of the nodules in both lungs. In the lower halves of both lungs, the nodules were confluent. There was a slight increase in the number and size of the cavities (Figure 6). A chest x-ray film on June 1, 1951 showed further increase in the number and size of the cavities (Figure 7). His condition gradually deteriorated and he died on July 5, 1951.

Autopsy: The right lung weighed 1310 gm. and the left 1010 gm. The pleural surface revealed multiple umbilicated lesions with gray borders varying between 0.5 and 1.5 cm. in diameter. On section, the lungs were studded throughout with cavitating lesions measuring up to 5.0 cm. in diameter. The smaller lesions were filled with a soft, dirty gray material, and some of the larger lesions were empty. The walls of the lesions were light gray, well defined, soft and varied in thickness, being 3 mm. thick in the larger lesions. The head of the pancreas was the site of

FIGURE 8, Case 2: Close-up of cavity in left upper lobe as seen in Figure 7.
the primary tumor which obstructed the common bile duct causing distention of the gall-bladder, and partially obstructed the pylorus. The tumor was firm, yellow, rounded, imparted a gritty sensation on section, and measured 5.5 x 4.0 cm. A 0.5 cm. gray plaque was present on the mucosal surface of the lesser curvature of the stomach. The liver weighed 1280 gm. and revealed gray-white soft lesions on the cut surface throughout, measuring up to 4.0 cm. in diameter. The serous membranes had an icteric tinge.

On microscopic inspection the pancreatic tumor was a ductal adenocarcinoma with abundant productive fibrosis (Figures 9 and 10). The ducts were atypical and lined by columnar and cuboidal cells having acidophilic cytoplasm, was with

**FIGURE 9**
*Figure 9: Low power of primary pancreatic tumor (x 35).*

**FIGURE 10**
*Figure 10: High power of primary pancreatic tumor (x 125).*

**FIGURE 11**
*Figure 11: Low power of cavitating lung lesion necrotic center at upper right (x 35).*

**FIGURE 12**
*Figure 12: High power of lung lesion (x 125).*
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hyperchromatic, pheomorphc, and vesicular nuclei. Invasion of blood vessels and perineural lymphatics was noted. The lung lesions revealed the walls to be composed of similar anaplastic ductal structures filling alveoli with central areas of necrosis (Figures 11 and 12). Immediately adjacent to these lesions, the alveoli were stuffed with erythrocytes and groups of tumor cells. Elsewhere the lungs revealed edema, bronchopneumonia, intravascular tumor cells, thrombi, hemorhagic infarcts and alveoli filled with tumor. Other organs revealing metastatic tumor were heart, liver and adrenals. The stomach lesion consisted of a healing peptic ulcer.

SUMMARY

1) Two cases of cavernous metastatic pulmonary carcinoma have been described. Spontaneous pneumothorax was an associated finding in one.
2) A review of the literature indicates that only four similar cases of cavernous pulmonary metastatic carcinoma have been reported.
3) Rapid growth of the metastatic pulmonary lesions with central necrosis infection and bronchial erosion would seem to be important factors in the pathogenesis of cavernous pulmonary metastases.

RESUMEN

1) Se describen dos casos de carcinoma metatásico pulmonar cavernoso. Un hallazgo asociado en uno de ellos fue el neumotorax espontáneo.
2) Un revision de la literatura ha revelado que sólo se han referido cuatro casos similares.
3) En la patogenia de las metástasis cavernosas pulmonares parece importante el crecimiento rápido de las lesiones pulmonares metastáticas con la necrosis central e infección y la erosión bronquial.

RESUME

1) Les auteurs décryptent deux cas de cancer métagstatique du poumon à forme cavitaire; l'un de ces cas s'accompagnait d'un pneumothorax spontané.
2) La revue de la littérature montre que seulement quatre observations similaires ont été jusqu'à présent rapportées.
3) La rapidité du développement des lésions métastatiques avec nécrose centrale infectée et lésions bronchiques paraissent les facteurs importants dans la pathogénie des métastases pulmonaires à forme cavitaire.

REFERENCES