THE VARIED PATHOLOGIC BASIS FOR THE
SYMPTOMATOLOGY PRODUCED BY TUMORS
IN THE REGION OF THE PULMONARY
APEX AND UPPER MEDIASTINUM

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INTRODUCTION

In recent years there have appeared in medical literature discussions of a clinical symptom complex characterized essentially by the Horner syndrome, pain in the shoulder and upper extremity, and radiologic evidence of a tumor in the pulmonary apex of the corresponding side. The purpose of this paper is to point out, by means of five illustrative cases, that the symptomatology of malignant tumors located in the region of the pulmonary apex or upper mediastinum furnishes evidence only of the implication of various anatomic structures and is not indicative of the presence of a neoplasm of a particular pathologic nature. We further believe that the grouping, under various captions, of such symptoms as though they constituted a clinical or pathologic entity is undesirable, since the physician is thereby offered a convenient but, at best, a quasi diagnosis.

REPORT OF CASES


W. D., a fifty-seven-year-old building contractor, referred by Dr. Henry Gissel, had been in good health until the beginning of May 1933, when he noticed epigastric heaviness not associated with the intake of food. This discomfort disappeared following medication. In July 1933 there appeared an occasional sharp, shooting pain in the precordial area, with mild radiation into the back. During August, September, and October (1933) this pain gradually increased in severity and frequency until in November it manifested itself by paroxysms beginning as a "pressure about the heart," slowly becoming more intense, involving the entire left upper thorax and left shoulder girdle.
Eight to ten such attacks occurred each day, and each attack lasted from ten to fifteen minutes. In the pain-free intervals the patient felt well, with no shortness of breath or disturbance of the function of the left upper extremity. The pain was partially relieved by medication until the middle of January 1934, when, during a paroxysm, stabbing radiations into the left elbow and hand were experienced. From then until May the attacks became more frequent but of shorter duration. At this time there were also sharp, cutting pains radiating into the left angle of the jaw. The left upper extremity became weak and the ulnar half of the forearm and hand felt numb. The discomfort of the left forearm was somewhat alleviated by carrying it in a sling. During this period of immobilization, edema of the forearm and hand appeared. There was no cough, no loss of weight, no edema of the ankles, nor had anyone noticed any change in the appearance of the face.

On examination by one of us (Browder) on May 16, 1934, a striking Horner syndrome of the left side was noticed. The cranial nerves presented nothing remarkable. There was a fullness of the left supraclavicular fossa, and the left external jugular vein was prominent. The trachea, at the level of the episternal notch, was slightly displaced to the right, but there was no tracheal tug. On palpating the left supraclavicular fossa one could feel, just behind the medial end of the left clavicle, a very firm mass which, when pressed upon, caused pain to radiate along the ulnar aspect of the left forearm. In the supraclavicular fossa one could feel, also, a soft, subcutaneous mass which could be collapsed easily and was interpreted as a strikingly dilated venous channel. By percussion, increased retromanubrial dullness was demonstrated. The left upper extremity was moderately swollen, particularly the forearm and dorsum of the hand. The circumference of the left forearm was 26.5 cm., while that of the right was 25.5 cm. The blood pressure in each arm was 112/82. Over the ulnar half of the left forearm and hand there was a zone of complete anesthesia and analgesia. The tendon responses of the left upper extremity were not elicited, while those on the right were present.

In the course of the examination the patient experienced several attacks of pain in the back, radiating along the inner aspect of the left upper extremity. During each attack there were blanching of the skin of the face, immobilization of the entire body, and apnea. The fullness of the left external jugular vein and the dilated venous channels in the left supraclavicular fossa disappeared, paradoxically, only to return after the pain had ceased.

Roentgen examination, by Dr. Masterson, disclosed a shadow occupying the apex of the left thoracic cavity, interpreted as consolidation due to a malignant tumor.

The patient was given roentgen-ray treatment which brought about partial relief. Toward the latter part of June 1934, however, the pain again became so severe that he was admitted to the Brooklyn Hospital, July 5, 1934.

On July 7, through a left lower cervical incision, the left brachial plexus was explored. A bluish-red, rather vascular tumor mass was uncovered, situated between the medial end of the left clavicle and the scalenus anticus muscle. The clavicle was divided, giving adequate exposure of the brachial plexus. The entire inferior half of the plexus was found to be surrounded by tumor tissue, which was removed in part. The left lateral aspect of the upper thoracic portion of the vertebral column was roughened, presumably by tumor invasion. It was evident that little could be done, since it was the operator's opinion that the pain was due to involvement of the spinal nerves within the intervertebral foramina. The wound was closed with layer silk. For two weeks following the operation there was some relief of pain, and the edema of the forearm and hand became less marked. Throughout August 1934 the patient continued to suffer paroxysms of pain arising in the left chest, radiating into the left arm and medial portion of the left elbow. Large doses of sodium amytal kept him in a drowsy state until death, Sept. 9, 1934. Autopsy was not obtained.

Examination of the tissue removed at operation showed a malignant epithelial tumor of medullary type with extensive necrosis. There was a slight tendency to the formation of gland-like structures. The growth was interpreted as metastatic carcinoma. The possibility of bronchiogenic origin could not be excluded.
TUMORS OF THE PULMONARY APEX AND UPPER MEDIASTINUM

COMMENT: The early symptoms, as far as pain and its radiations were concerned, suggested coronary disease; in fact the first investigations had been directed along this line. With the appearance of the left Horner syndrome and the disability of the left hand, it was evident that the lesion was so situated as to implicate the left cervical sympathetic trunk and the inferior part of the brachial plexus. The extensive tumor invasion in this region, as visualized at operation, clearly demonstrated the futility of local surgical measures for relief of the pain. Vascular disturbances were rather marked in this case as shown by dilatation of the veins of the neck as well as edema of the forearm and hand. These findings indicated not only pulmonary apical but also upper mediastinal involvement. The circulatory disturbances as significant physical findings have not been stressed in cases previously recorded.

FIG. 1. CASE 1: ROENTGENOGRAM SHOWING AN ABNORMAL SHADOW IN THE LEFT PULMONARY APEX AND OVERLYING TISSUE; PHOTOMICROGRAPH OF A PORTION OF THE TUMOR FOUND AT OPERATION


J. M., a sixty-two-year-old clerk, was referred to the neurosurgical service of the Kings County Hospital on Oct. 11, 1933, by Dr. I. Mostkowitz, complaining of pain in the right shoulder and back. For five years he had been experiencing epigastric fullness and what he described as "hunger pains," for which sodium bicarbonate had been taken with considerable relief. Several gastro-intestinal x-ray examinations had been made during this period, each disclosing findings consistent with a duodenal ulcer. Otherwise the patient had been in fairly good health. During February 1933 he noticed for the first time a dull aching pain in the region of the right shoulder, which would, at times, radiate to the medial border of the right scapula. This pain was not constant; on some days it totally incapacitated the patient for work; at other times the discomfort was mild. Throughout March and April there was little change in the character
or severity of the pain, but in May (1933) there appeared paroxysms of pain arising in
the posterior aspect of the right shoulder and radiating with great intensity along the
dorsal aspect of the right upper extremity into the middle and ring fingers. Each
paroxysm would begin mildly, reaching its maximum intensity in about two minutes,
then gradually subsiding, the entire episode covering from five to six minutes. Between
these severe attacks there was an unrelenting dull ache in the region of the shoulder.
During the warm weather of the summer months (1933) the patient experienced slight
relief, but he lost appetite and could not sleep without sedatives. In September the pain
became continuous and of a boring character. The right hand was weak and the little
finger felt numb.

Physical examination revealed a strikingly undernourished and haggard male with
a right Horner syndrome. Nothing abnormal could be palpated in the neck, nor were
the external jugular veins unduly prominent. Slight tenderness was elicited deep in
the medial aspect of the right supraclavicular fossa. No increase in retromanubrial
dullness was demonstrated, nor was there any reduction in the right apical pulmonary
resonance. The right upper extremity was slightly smaller than the left, and the power
of the right hand was half that of the left. The blood pressure was the same in each
arm. Over the ulnar aspect of the right hand light touch could not be appreciated as
accurately as over the corresponding part of the left hand, but the exact outline of this
area of sensory disturbance could not be determined. Aside from the general emaciation
the remainder of the physical findings were unimportant. The blood count indicated
a mild degree of secondary anemia. Examination of the thorax by roentgen ray revealed
a moderately dense right apical shadow, the interpretation of which was indefinite. It
was thought, however, that the lesion might be a metastatic new growth. Another
roentgen-ray examination of the gastro-intestinal tract failed to disclose any abnormali-
ties. The sputum was negative for tubercle bacilli. There was continued pain in the
right shoulder, forearm, and hand, which became progressively worse during the follow-
ing two months. Surgical relief was then attempted. Through a right lower cervical
incision the brachial plexus was explored. No tumor was visualized, but the inferior
portion of the plexus seemed to be very firmly pressed against the tendinous portion of

FIG. 2. CASE 2: ROENTGENOGRAM SHOWING AN ABNORMAL SHADOW IN THE RIGHT PUL-
MONARY Apex AND THoracic Outlet WITH EROSION OF RIBS, TRANSVERSE PROCESSES, AND
VERTEBRAL BODIES IN THIS REGION; PHOTOMICROGRAPH OF TUMOR FROM THE LUNG
the scalenus anticus muscle by an underlying mass. This muscle was divided and the
wound closed.

There was considerable although not complete relief of pain during the next three
months. The power in the right hand became progressively reduced and edema of the
entire upper extremity appeared. No inequality of the radial pulses could be detected.
The patient gradually lost ground, becoming quite emaciated, and died on June 10, 1934.

Autopsy disclosed a solid grayish-brown tumor mass situated in the apex of the
right lung with extension through the adjacent parietal pleura into neighboring tissues.
The brachial plexus itself was not implicated in the tumor. There was partial destruc-
tion of the posterior portions of the first and second ribs and the right lateral aspect
of the bodies of the seventh cervical and first thoracic vertebrae. Bordering on the
tumor in the apex of the lung was a zone of hyperemic lung tissue with scattered patches
of bronchopneumonia. Careful search failed to reveal metastases in any other organs,
including the brain. There was no ulceration or scarring of the stomach or duodenum.

Microscopic examination of the pulmonary tumor revealed a squamous-cell carcino-
ma, the cells of which were extremely anaplastic. Evidence of secondary infection in
and about the tumor was a striking feature of the sections. There was little tendency
toward cornification and pearl formation.

COMMENT: The relief of pain by division of the scalenus anticus
muscle indicates that at the time of operation the pain was probably
due to pressure on the inferior portion of the brachial plexus. The re-
turn of the pain three months later is best explained by the finding at
autopsy of tumor tissue invading the intervertebral foramina. In this
instance great emaciation and death were brought about by a relatively
small tumor without demonstrable metastases. As in Case I, it is in-
teresting to note that the radiating pain was of greatest intensity in the
middle and ring fingers of the involved extremity.

CASE 3. Pain in left shoulder, radiating along left upper extremity; cough; anhi-
drosis of left face and neck; unequal radial and carotid pulses; palpable supraclavicular
mass; consolidation demonstrated by roentgen ray and physical signs in left apex.
Operation with relief of pain. Death following pulmonary hemorrhage. No autopsy.  
Histologic diagnosis: Carcinoma, probably metastatic. 
J. K., a sixty-year-old male, was referred to the Long Island College Hospital by
Dr. John D'Albora, on June 7, 1932, complaining of pain in the left arm and sweating
of the entire body with the exception of the left side of the face and neck. Aside from
occasional minor ailments and a non-productive cough for the previous twenty years, he
had always enjoyed good health.

During December 1931, while going about his work as a city tax collector, the pa-
tient began to experience a deep-seated pain in the region of the left shoulder girdle.
This pain came in paroxysms, unassociated with physical exertion, and lasted for only
a minute or two. From two to ten such attacks were experienced daily, and they finally
became so annoying that the patient resorted to proprietary remedies with some relief.
Toward the end of December 1931, this burning type of pain assumed a sharper char-
acter and radiated along the inner aspect of the left arm and forearm into the ulnar
half of the hand. The paroxysms became more severe and frequent, leaving the ex-
tremity weak and tender. In February 1932 the patient began to notice shortness of
breath on exertion, and his appetite began to fail; the cough, which had been present
for twenty years, was no worse nor was there any pain in the chest. During March he
noticed that he was sweating a great deal, especially at night, and that the left side of
the neck and face remained dry while the remainder of the body was bathed in per-
spiration. No change in the appearance of the eyes had been noticed. The condition
became progressively worse during April and May, the paroxysmal pain in the left upper
extremity increased in frequency and severity, there was a rapid loss of weight (36
pounds in four months), and shortness of breath was pronounced.
Physical examination disclosed a man of large frame with evident loss of weight and secondary anemia. The pupils were equal in size, but the skin over the left half of the face and the left side of the neck was dry and warm as compared to the moist skin on the right side. No note was made regarding perspiration of the upper extremity. The carotid artery pulsation could not be seen on the left side, but was easily visible on the right. Both were palpable, but the pulsation on the left side was greatly reduced in volume. The left radial pulse was also much weaker than the right. The blood pressure in the right arm was 100/60, while no definite reading could be obtained for the left. The skin surface along the mesial half of the left arm and forearm was tender, but no gross changes in sensation could be demonstrated by ordinary tests. The motor power of the left upper extremity was about half that of the right. Active or passive motion of the left upper extremity precipitated paroxysms of pain which appeared to be agonizing. Dullness and distant breath sounds were present over the left pulmonary apex. The left supraclavicular fossa was full, the left external jugular vein was prominent, and an ill-defined tender mass could be palpated deep behind the medial end of the left clavicle. A firm, smooth liver edge could be felt three fingers' breadth below the costal margin. The other physical findings were unimportant. The blood count indicated a secondary anemia with a hemoglobin of 59 per cent (Sahli). The blood serum gave a negative Wassermann reaction. The nitrogenous products in the blood were within normal limits. Urinalysis was normal.

Radiologic examination (film and fluoroscopy) of the chest disclosed partial destruction of the left first and second ribs and a dense, almost homogeneous shadow extending from the apex of the left lung field down to the level of the second rib. This shadow merged with the upper mediastinal shadow and its inferior border presented a lobulated appearance. There was no evidence of expansile pulsation of the apical mass. Electrocardiographic tracings gave no indication of myocardial disease.

On June 29, 1932, the left supraclavicular fossa was explored. Upon exposure of the brachial plexus there was found a very edematous scalenus medius muscle which was pressing the inferior part of the plexus against the tendinous portion of the scalenus anticus. The latter muscle was divided to relieve this pressure. The edematous scalenus medius was then incised in the course of its fibers, and a cavity was entered which contained approximately 40 c.c. of serosanguineous fluid and cellular débris. A partially destroyed first rib could be felt. A portion of the wall of the cavity was removed for histologic study and the wound was closed.

The specimen removed at operation was soft and friable and of a ground-glass
opacity. Histologically it was composed of broad sheets of large, clear epithelial cells arranged in a mosaic pattern without alveolar formation. The stroma was very scanty. The picture strongly resembled that of the so-called hypernephroma. This lesion was considered a metastatic carcinoma, probably from the kidney or the adrenal.

Following operation the pain in the left upper extremity was relieved. On one occasion the patient coughed up some blood-streaked sputum; otherwise the remainder of his course in the hospital was uneventful. He was discharged on July 13, 1932, and returned to his home feeling slightly improved in that his appetite was better and his sleep was not disturbed by pain. On August 2, 1932, he had a sudden profuse pulmonary hemorrhage and died. Autopsy was not obtained.

COMMENT: In this instance, as in Cases I and II, there was agonizing, paroxysmal pain which later in the course of the disease became more or less continuous. The presence of unilateral anhidrosis indicated a partial lesion of the cervical sympathetic trunk, whereas the other cases of this series showed the classical Horner syndrome. The relief of pain by operation was probably due to relief of pressure by evacuation of the fluid contained within the cystic portion of the tumor. The source of the tumor must be considered as undetermined, although the gross and histological features suggest origin in the kidney or adrenal gland.

**FIG. 4. CASE 4: ROENTGENOGRAM SHOWING AN ABNORMAL SHADOW IN THE RIGHT PULMONARY APEX; PHOTOMICROGRAPH OF THE TUMOR IN THE LUNG**

Case 4. Pain in right upper back, right shoulder and upper extremity; cough; Horner syndrome; abnormal radiologic shadow in right pulmonary apex; progressive emaciation. Death. Autopsy: Epidermoid carcinoma of apex of right lung with metastases.

J. G., a forty-six-year-old laborer, was admitted to the medical service of Dr. Goodwin Distler at the Mary Immaculate Hospital on Feb. 5, 1934, complaining of pain in the right scapular area. In October 1933 he had for the first time felt an occasional sharp pain in the right scapular area without any noticeable radiation. During the early part of November (1933) a productive cough developed, accompanied by thoracic pain, which
now radiated into the right arm. In December (1933) the patient had an acute illness which was diagnosed as pneumonia, following which the cough became much worse. He lost weight and the pain in the right upper thorax became more severe, at times radiating with great intensity into the medial aspect of the right arm and forearm. The ulnar aspect of the right hand became numb and weak. Throughout January 1934 this right upper thoracic and right shoulder pain became a boring, agonizing discomfort with occasional sharp radiations into the right forearm and hand. Night sweats were marked. Repeated sputum examinations in the laboratories of the Department of Health failed to show the presence of the tubercle bacillus.

Physical examination showed a weak, emaciated male with occasional cough. A typical, well established right Horner syndrome was present. The right supracavicular fossa showed moderate increase in depth and there was dullness to percussion on this side to the third rib anteriorly and the mid-scapular area posteriorly. Bronchial breathing and râles were present over this zone. The motor power in the right upper extremity was less than that of the left, and there was inability to abduct and adduct the fingers of the right hand. Subjectively there were cutaneous sensory disturbances over the ulnar aspect of the right forearm and hand, but the outline of this cutaneous zone could not be demonstrated. Except for marked emaciation, the remainder of the examination revealed nothing of importance. A polymorphonuclear leucocytosis of 17,800 was present, and the hemoglobin was 70 per cent. Further examination of sputum failed to show the presence of tubercle bacilli. Radiographic examination of the thorax disclosed an abnormal shadow in the apex of the right lung which was interpreted as a chronic fibrotic tuberculous lesion.

When the patient was first seen by one of us (Browder), on Feb. 25, 1934, it was the impression that the lesion was a malignant tumor of the apex of the right lung. Until death on March 17, 1934, the pain in the right shoulder and upper extremity was controlled by medication.

The autopsy, performed by Dr. Emil Koch, disclosed a large tumor occupying the apex of the right lung and invading the overlying pleura and neighboring tissues, producing erosion of the first and second ribs anteriorly and laterally, and surrounding the inferior cervical and upper thoracic spinal nerves as they emerged from the intervertebral foramina. On section of the pulmonary portion of the tumor there were found extensive central cavitation and a communication with the bronchus of the right upper lobe. Both the tumor cavity and the bronchial tree contained foul-smelling necrotic material. Small metastatic tumor nodules were scattered throughout both lungs. One of these nodules had extended into the dome of the diaphragm on the right side, and a similar nodule was found in the right kidney. In addition, there was a confluent bronchopneumonia of the left lower lobe, a fibrinopurulent pleurisy, and a pericarditis. Histologically the tumor of the apex of the lung was composed of cords, islands, and sheets of large squamous epithelial cells. There was marked pearl formation with calcification of many of the pearls. We consider the tumor to be a squamous-cell carcinoma originating in the right upper lobe of the lung.

COMMENT: It is of interest that in this case productive cough and night sweats strongly suggested that the demonstrable right pulmonary lesion was due to tuberculosis. The presence of the Horner syndrome and evidence of brachial plexus involvement, indicating extrapleural extension of the lesion, were of assistance in arriving at a correct diagnosis. Furthermore, we would stress these findings as a valuable aid in differentiating a malignant tumor in this anatomic situation from pulmonary tuberculosis.
Case 5. Pain in the shoulder radiating into right upper extremity; Horner syndrome; aphonia; palpable mass in right supraclavicular fossa; radiologic evidence of mass in right pulmonary apex and mediastinum and paralysis of right half of diaphragm; marked circulatory disturbances in head and upper extremities. Death from bronchopneumonia. Autopsy: Carcinoma of the thymus.

E. C., a thirty-five-year-old carpenter, was admitted to the service of Dr. Luther Warren at the Long Island College Hospital, on April 19, 1934, complaining of a small lump in the right side of his neck and pain in the right arm. He had been in good health until the early part of February 1934, when he noticed an occasional dry, hacking cough. In March he began to have a dull aching pain in the right arm, unassociated with and not aggravated by motion. At first this pain was mild, coming and going at irregular intervals, but about the beginning of April it became more intense, disturbing sleep. Several small painless nodules were then felt in the lower aspect of the right side of the neck. From this time until admission the pain in the right arm continued, varying in severity but never occurring in paroxysms. The cough also persisted, but at no time was it productive of more than a small amount of mucus.

Physical examination disclosed a well developed and well nourished man who appeared to be in fairly good health. The face was symmetrical and the pupils were considered normal. In the medial aspect of the right supraclavicular fossa several discrete painless nodules could be palpated. The lymph nodes in the axillae and the inguinal regions were palpable, although very small and firm. The thoracic findings were within normal limits. The upper extremities were symmetrical and showed no abnormalities of function. The blood count, urinalysis, Wassermann test (blood serum) and radio-

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graphic examination of the thorax disclosed no abnormal findings. Histologic examination of a lymph node removed from the cervical region on March 25, 1934, was reported as showing metastatic carcinoma, probably epidermoid. Throughout May the patient was up and about without complaint except for a mild degree of dull aching in the right arm. A lymph node from the right axilla, excised on May 25, 1934, showed chronic lymphadenitis but contained no tumor. The patient was discharged from the hospital on June 12, 1934, with a diagnosis of carcinoma, origin unknown. On June 18, 1934, he was readmitted because of a painful swelling of the left thigh. This swelling had appeared two days before the second admission, and during the twenty-four hours prior to entry had become painful on standing or walking. Physical examination at this time disclosed a small right pupil, narrowing of the interpupillary fissure, and slight enophthalmos of the right eye. It was thought that the palpable nodules in the right side of the neck had become larger. There was impaired resonance at the right pulmonary apex which extended down to the second rib anteriorly, and over this area distant, harsh breath sounds could be heard. The retrosternal dullness was increased beyond the normal, and the voice had a hoarse quality. The upper extremities showed no demonstrable abnormalities. Over the antero-medial aspect of the left thigh one could see an ill-defined prominence with normal overlying skin. This seemed to represent a tense mass about the size of a fist, situated beneath the deep fascia within the muscles. Radiographic examination disclosed an abnormal shadow in the right pulmonary apex, interpreted as consolidation from a new growth. The mediastinal shadow was broader than that observed on the first x-ray examination. On July 13, the swollen area of the left thigh was explored surgically. A cavity was entered and approximately 50 c.c. of serosanguineous fluid evacuated. The wall of this cavity consisted of a grayish tissue which invaded the surrounding muscles. Portions were taken which on histologic examination were diagnosed as metastatic carcinoma.

Treatment by roentgen rays was given over the right upper thoracic area, but the pain in the right shoulder and right upper extremity was not relieved. Following several of these treatments there was transitory cyanosis of the face and neck, with considerable increase in hoarseness. The right supraclavicular mass increased in size, the cya-
nosis of the face became constant, the external jugular and superficial thoracic veins were prominent, but there was no appreciable edema of the upper extremities. During August and September (1934) large doses of morphine were necessary to control the pain. The patient slowly lost ground and died on Oct. 11, 1934.

The autopsy findings, in summary, were as follows. The upper anterior mediastinum was occupied by a tumor of very firm consistency which partially surrounded the trachea, compressed the great vessels, extending downward, invading the pericardium, and upward over the apex of the right lung. A discrete tumor nodule, evidently metastatic tumor in a lymph node, was firmly pressed against the inferior part of the brachial plexus. The stellate ganglion was surrounded by tumor, as were the right recurrent laryngeal and phrenic nerves. Both right and left innominate veins were completely thrombosed. Tumor metastases were also found in the kidneys, adrenals, liver, mesenteric and retroperitoneal lymph nodes, the left thigh, and the subcutaneous tissues of the thorax and abdomen. There was, in addition, an extensive confluent bronchopneumonia.

Histologically, the tumor tissue from the mediastinum and pleura was of a dense, scirrhous nature. It was composed of cords and small groups of flat, polyhedral tumor cells separated by dense bands of connective tissue. The more cellular metastatic foci showed alveolar groups of cells of epithelial type with occasional evidence of mucin formation. The tumor was considered a thymic carcinoma.

COMMENT: While the mediastinal growth in this instance was obviously of long standing, the abnormal mediastinal shadow was not recognized until late in the course of the disease and had been thought to be due to a metastatic focus. The extreme compression of the mediastinal structures is typical of the hard thymic tumors.

DISCUSSION

Almost a hundred years ago (1838) Edward Selleck Hare (1), a young house surgeon in an English hospital, reported a case of rapidly growing tumor in the "inferior triangular space" of the left side of the neck. The initial complaint had been of pain in the shoulder and along the course of the ulnar nerve of the left arm, with tingling and numbness over this area. Some months later there had developed contraction of the left pupil and the "levator palpebrae ceased to perform its office." The patient died about four months after the onset of symptoms. At autopsy, a hard, nodular tumor mass was found to involve the large arteries and veins of the left side of the neck, extending upward as far as the origin of the brachial plexus. The phrenic and pneumogastric nerves and the sympathetic with its lowest cervical ganglion were surrounded by tumor and "transformed into the diseased structure." The tumor extended also under the clavicle, surrounding the subclavian artery and vein and destroying most of the anterior scalenus muscle. The case was considered an instance of "glandular scirrhus."

In the intervening years it seems beyond doubt that the symptomatology produced by tumors involving portions of the brachial plexus and cervical sympathetic has been frequently observed. Interest in this

1 Reference to this report and an interesting biographic note concerning Hare are found in an article entitled "Horner and the Syndrome of Paralysis of the Cervical Sympathetic," by Fulton (2).
subject, however, has been stimulated by a number of recent articles giving various interpretations to the symptom complex.

Pancoast (3), in 1924, reported four cases in which symptoms similar to those described by Hare had been produced by new growths in the region of a pulmonary apex. The outstanding clinical and radiologic features of these cases were: (a) pain in the shoulder or scapular area radiating along the corresponding upper extremity and associated with varying degrees of motor and sensory disturbance in the extremity, (b) the Horner syndrome, and (c) radiologic evidence of tumor in the pulmonary apex. In each instance pain in the shoulder region had been the earliest symptom. It was described as of a burning, dull aching, or stabbing quality. In two of the cases the pain had at first been intermittent but later became more or less constant. In every instance it had increased in severity during the course of the disease. Case I had at first been considered one of spinal cord or meningeal tumor and a laminectomy had been performed which failed to reveal such a growth. Case II was regarded at first as one of bursitis or brachial neuritis. In Case IV the patient had been referred to the writer for examination for a possible cervical rib. In each instance an abnormal shadow was visible in the apex of the lung, while in three of the cases erosion of one or more of the upper ribs posteriorly and of the corresponding transverse processes of the vertebrae had been demonstrated by roentgen ray. A more or less complete Horner syndrome eventually appeared in three of the cases. Portions of tumor tissue removed at operation in three of the four cases were diagnosed respectively as endothelioma of the pleura, metastatic carcinoma, and primary carcinoma of the lung. The author gave the impression that he believed the symptom complex presented by these cases to be indicative of endothelioma of the pleura.

In discussion of Pancoast's article, Evans (4) mentioned five cases of the same type which he had observed, in each of which there was a different kind of tumor. The first case was one of "recurrent carcinoma secondary to carcinoma of the breast" which had been removed eight years before. The second case was diagnosed on post-mortem examination as "sarcoma originating from remnants of the thymus gland." A third case was one of carcinoma originating in the apex of the left lung, while a fourth was a primary sarcoma in the right pulmonary apex. In a fifth case operation revealed a sarcoma underneath the scapula. Evans remarked that "in these cases the symptoms were essentially those of cervical rib," and further commented that he felt convinced that "any type of growth in this part of the thorax will produce symptoms similar to those described by Dr. Pancoast in his series."

Henderson (5), in 1930, under the title "Roentgen Studies of Apical Chest Tumors," reported eight cases presenting clinical and roentgen findings similar to those in Pancoast's series. This author considered all of these cases as examples of endothelioma of the pleura, although but four had been autopsied. Descriptions of the findings at autopsy were not included. Henderson noted as the chief clinical feature of the
cases in his series, “increasingly severe pain in the shoulder radiating
down the arm,” and further remarked that there was a “surprising
disproportion between the magnitude of the roentgen findings and the
physical signs which can be elicited.” In his series, evidences of
sympathetic trunk involvement were lacking, nor was there any erosion
of ribs or vertebrae, whereas in Pancoast’s report these features had
been stressed.

In a treatise entitled “Sindrome apico-costo-vertebral doloroso por
tumor apexiano” Tobias (6), in 1931, discussed in detail the symptom
complex produced by tumors of the “thoracic apex.” The article was
based on a study of five cases. Of these, four were diagnosed as carci-
noma of the lung while a fifth case was proved at operation to be one of
gastric carcinoma in which the only symptoms, except for anorexia and
wasting, were produced by a metastatic growth in one side of the tho-
racic apex. Two of the four cases of pulmonary carcinoma were aut-
opsied. The first of these was reported as carcinoma of the upper
lobe with metastases in the costovertebral region and the spinal muscles.
The metastases penetrated the intervertebral foramina and invaded the
eighth cervical nerve and destroyed the stellate ganglion and the first
and second dorsal nerves, eroding the corresponding ribs and vertebrae.
The other autopsied case was a peribronchial carcinoma of a large
bronchus of the hilum, with metastases in the costovertebral sinus at
the level of the first and second ribs.

The symptomatology described by Tobias was essentially that pre-
sented in the cases we are reporting. In one of his cases evidence of
paralysis of the sympathetic (the Horner syndrome) had been pre-
ceded by signs of sympathetic irritation (syndrome of Pourfour du
Petit). Tobias pointed out that the syndrome he described differs
from the Klumpke-Déjerine syndrome in being essentially one of pain
and not of paralysis. Only late in the course of the disease paralysis
may appear, as in two of his cases, while in the remaining cases no
paralysis was observed up to the time of death. This author concluded
that the syndrome was produced by tumors primary in the apex of the
lung or by metastases from tumors primary in other parts of the lung
or other organs.

In 1932 Pancoast (7) reviewed his four previously reported cases
and added three presenting similar clinical and radiologic features. In
this paper he advanced the idea that the lesion producing this clinical
syndrome was a new pathologic entity, having for its basis an epi-
dermoid carcinoma derived perhaps from some embryonal rest, and
suggested for it the name “superior pulmonary sulcus tumor.” The
facts that none of the cases was autopsied, that in only three instances
were histologic studies made and, furthermore, that two of the remain-
ing cases were known to have been treated for carcinoma of the cervix,
greatly reduce the value of the above opinion.

Jacox (8), in 1934, employing Pancoast’s designation, recorded two
cases of adenocarcinoma of bronchiogenic origin. In this paper, Weller,
who examined the tissue, commented on one of the cases as follows:
"Clinically this tumor falls in the group designated by Pancoast as superior pulmonary sulcus tumor. At present, however, this term does not denote a pathological entity. Since this is an adenocarcinoma, it could not have arisen, so far as we know, in branchial cleft remains." Jacox suggested that the name "primary carcinoma of the pulmonary apex" might be appropriate. In this article the author cited as probably of the same nature, a case (Case 44) recorded by Fried (9) in his monograph on "Primary Carcinoma of the Lung."

An additional case of bronchiogenic carcinoma, primary in the apex of the lung and producing symptoms of brachial plexus and cervical sympathetic involvement, is found in Fried's (10) recent article on "Bronchiogenic Cancer." This author makes the statement that "at the Montefiore Hospital studies of abundant clinical material, substantiated by roentgen-ray and post mortem observations, have revealed that there are various conditions casting a shadow on the apex of the lung similar to those described by Pancoast, which are accompanied by symptoms not unlike those found in his patients. Chief among these are cancers of bronchial origin with an apical localization . . . ."

Steiner and Francis (11) have reported three cases of "primary apical lung carcinoma," two of which presented signs and symptoms of tumor involving the brachial plexus and cervical sympathetic, while in the third case, in which but little history was available, there had been a dull pain in the left shoulder and left side of the back. In two of the cases the diagnosis of carcinoma of the lung was confirmed, or established, by post-mortem examination. In the other case a biopsy specimen was obtained. These authors referred to the papers of Pancoast (7), Jacox (8), and Fried (10), pointing out the clinical resemblance of their cases to Pancoast's and agreeing with Jacox that they were dealing with a symptom complex indicative of primary apical lung tumor.

From our own observations and those previously recorded, notably by Evans (4) and Tobias (6), we are of the opinion that the syndrome under consideration may be produced by a variety of tumors, either primary in the vicinity of one of the pulmonary apices or metastatic from some more or less distant primary focus. While we concede that endotheliomas of the pleura may give rise to such a symptom complex, we cannot agree with Henderson's (5) implication that the clinical picture which he described is pathognomonic of this lesion, and further, we would warn against acceptance of the diagnosis of endothelioma of the pleura on any but the soundest anatomic evidence.

We are forced, also, to take exception to the names suggested by Pancoast and Jacox. The former offered the name "superior pulmonary sulcus tumor" for what he conceived to be a new pathologic entity primary in this region, a concept with which we disagree, as do Weller (12) and Fried (10). We can find no anatomic authority for the employment of the term "superior pulmonary sulcus," with its implication of the existence, also, of inferior, middle, and perhaps other pulmonary sulci, and submit that new anatomic designations should be
scrupulously avoided unless the author can justify their introduction on the basis of real exigency. The designation "primary carcinoma of the pulmonary apex," suggested by Jacox, while applicable to his proved case, is obviously too restrictive to apply to all cases presenting the diagnostic features described in the various reports to which we have referred. One has surely no right to assume that all of Pancoast's cases were primary carcinomas of the pulmonary apex because of their clinical and radiologic resemblance to a proved case (or cases). With better justification we might speculate that two of the cases in Pancoast's series were perhaps metastatic carcinoma arising in the cervix uteri. We can see no advantage, moreover, in applying any name to a variable group of symptoms, physical signs, and radiologic findings which cannot properly be considered a clinical, much less a pathologic entity.

It is conceded that a larger series of cases of this kind, studied clinically and by x-ray and verified by thorough post-mortem examination, might lead us to agree with Fried (10) that the clinical picture under discussion is most frequently produced by "cancer of bronchial origin with an apical localization." At present we are of the opinion that the "syndrome" is one indicative only of malignant tumor, primary or metastatic, in a particular anatomic position.

Conclusions

Five cases have been presented illustrating the symptomatology of malignant tumors located in the region of the pulmonary apex and upper mediastinum. From analysis of these cases, and others cited from the literature, it appears that the symptoms depend upon the implication chiefly of the following structures: portions of the brachial plexus or certain of its component spinal nerves, the cervical sympathetic trunk, and the great vessels in the involved area. To these symptoms are added radiologic and physical signs consistent with the presence of tumor.

We believe that the symptom complex cannot be considered to constitute either a clinical or pathologic entity but serves only to indicate the presence of some malignant tumor in a rather restricted anatomic area.

References