While biologically cancer represents a single disease without distinction of organ or structure involved, clinically it manifests itself in various ways. Not only does the symptomatology vary from organ to organ, but even in the same organ the manifestations may depend upon the particular area that is involved or upon the stage of the disease. In cancer of the pancreas, for example, the symptomatology will depend on whether the head or the body of the organ is affected. In the cases to be presented, the entire clinical course of the malady was dominated not so much by the malignant disease as by the proximity of the tumor to the brachial plexus, upon which it had encroached, causing a severe neuritis of that structure.

The cases are reported in some detail because the anatomical aspect of this type of tumor has not previously been discussed in the literature, and because clinically they are of decided interest.

REPORT OF CASES

CASE I (HOSPITAL No. 22429): On April 26, 1933, a dentist, aged fifty-four, was admitted to the Medical Service of the Montefiore Hospital, with the diagnosis of arthritis and diabetes mellitus, the latter of about twelve years' duration. His family history, except for the fact that his father had died of carcinoma of the intestines, was irrelevant.

In 1931, while lifting a heavy trunk with his left hand, the patient had felt something snap. The next day his left wrist was swollen and painful, and a few days later the left shoulder became stiff. Gradually pain developed in both the wrist and shoulder joints, and the carpal-metacarpal articulations began to show deformities. The tempera-
ture was elevated. At this time the patient became aware that while the right side of his thorax was perspiring freely, the left was free from perspiration. He felt soreness in the affected side. Following a course of hospital treatment from April to May 1932, there was some improvement, but shortly afterwards the illness recurred, and arthritic changes appeared in the joints of the legs. The patient was again hospitalized in August 1932 and remained in the institution until November, when he was discharged unimproved.

On admission to the Montefiore Hospital, the chief complaint was severe knife-like pain in the region of the left shoulder radiating to the elbow. The patient was emaciated but not cachectic, with a deforming arthritis. There was ptosis of the left lid; both pupils reacted to light and accommodation. Anteriorly there was tenderness over the first and second ribs on the left side. The supraclavicular fossa was "full," containing a small firm lymph node. Posteriorly, the area above the third vertebral space showed dullness to percussion. The laboratory data, except for the presence of sugar and acetone in the urine, were negative.

**Fig. 2. Case I: Histologic Appearance of Tumor Removed Post Mortem. X c. 100**

X-ray examination of the chest (Fig. 1) showed a dense shadow in the left apical region, with evidence of destruction of the second rib over an area of about 4 cm. from the spinal articulation.

While the patient was in the hospital, the diabetes was controlled but the severe pain in the left shoulder and arm grew worse. There occurred, gradually, an atrophy of the muscles of the left arm, resulting in loss of strength and limitation of motion. The Horner's syndrome became accentuated. The patient lost ground rapidly and died about ten weeks after admission to the hospital.

**Necropsy:** The body was markedly emaciated. The right pleural cavity was patent. The apex of the left lung was adherent to the dome of the pleura. The first rib was totally replaced by neoplastic tissue, beginning just beyond the point where the brachial vessels and nerves pass over it. The tumor invaded the vertebral interspace and replaced the mesial aspect of the second and third ribs for about 4 cm., while in the fourth rib the neck only was destroyed. The tumor did not break through the pleura, but had invaded the transverse processes and anterior arches of the first, second, and third thoracic vertebrae.
The stellate ganglion was adherent to the tumor tissue in the region of the neck of the first rib, while the sympathetic chain projected downwards. It was embedded in the neoplastic tissue and could not be discerned. On the right side the sympathetic chain was intact, as was the vagus nerve.

A thorough examination of both lungs revealed no tumor. The tracheobronchial and mediastinal lymph nodes were normal. The thyroid showed no disease. The heart, abdominal viscera, genital organs, and central nervous system were negative.

Microscopic Examination: Microscopically the tumor is a squamous epithelial carcinoma (Fig. 2). The medium-sized cells lie in groups embedded in connective tissue, the density of which varies. In places the cells form rings, imitating adenomatous structures. Sections from the rib show destruction of bone with invasion by neoplastic cells. Mitotic figures are rarely encountered.

Case II (Hospital No. 15355): A man of forty-six entered the hospital complaining of swelling and pain in the left arm, painful swelling in the left side of the neck, and weakness. The onset of his illness dated back about nine months, when he began to feel a slight pain in the left arm. Within two or three weeks there was a steady pain in the left axilla, and shortly afterwards he experienced severe and constant pain in the left shoulder. The pain gradually spread to the left elbow, left hand, and the fingers. On admission to the hospital, the entire left hand was painful. Swelling of the arm occurred about four weeks before hospital admission and was followed by a total paralysis of the extremity.

About two weeks after the onset of his illness, when a tender swelling was found in the left supraclavicular region, the patient entered another hospital, where roentgenographic studies of the chest showed "slight intensification of the bronchial tree throughout the lungs, with a haziness at the left apex," which suggested an "old fibrotic type of tuberculosis." One week later the reading of another film was reported as follows: "The left apex shows some evidence of infiltration probably due to an old tuberculosis." A tumor was looked for but could not be found. As a firm nodule made its appearance in the left infraclavicular region, it was excised and revealed a cancerous growth. Within seven months the patient was admitted to the hospital on five occasions, receiving x-ray treatments to the upper thoracic region.

Examination at the Montefiore Hospital showed a decidedly under-nourished individual (Fig. 3). The left lid was ptotic and the left pupil was much smaller than the right. There was, then, a typical Horner's syndrome. A tender nodular swelling was present in the left supraclavicular fossa. There was some asymmetry of the thorax, the right side being somewhat larger than the left. Anteriorly, the percussion note on the left side was dull to the level of the third rib, and posteriorly dullness was elicited down to the fifth rib. The breath sounds over the left apex were bronchial and distant. The left arm was completely paralyzed, and swollen to twice its normal size. The radial pulse on this side was considerably smaller than on the right.

The course in the hospital was steadily downward. The swelling in the left supraclavicular fossa grew larger. Pain in the arm increased in severity, involving also the mid-dorsal region. Decubitus ulcers developed and death occurred about eleven weeks after admission.

The impression was that an intrathoracic neoplasm infiltrated the infraclavicular region, compressing the brachial vessels, brachial nerves, and the superior cervical sympathetic.

Necropsy: The body was emaciated. The left arm was swollen, the skin was thickened and the tissue edematous from shoulder to finger tips. A mass was found in the left supraclavicular and infraclavicular fossae. It was firmly attached to the clavicle and underlying ribs, extending down to the third rib. The right lung was normal. The upper lobe of the left lung was considerably compressed from above and was detached from the tumor with difficulty. The pleura distinctly separated the lung from the new growth, which had filled the apical region of the thoracic cavity. There was a large, moderately firm mass involving the entire length of the clavicle, extending to the vertebral column posteriorly, invading the first, second, and third thoracic vertebrae, to which it adhered firmly. The clavicle was embedded in the tumor, which had destroyed most of
the bone. The second and third ribs were not invaded beyond the periosteum. The left axillary region was filled with tumor which encircled the axillary artery and vein and the brachial plexus. The left carotid, subclavian and axillary arteries were compressed by tumor, but in each the lumen was patent. The recurrent laryngeal, internal jugular, and vagus nerves were compressed but not obliterated. The thyroid, the uvula, tonsils, esophagus, pharynx, and larynx were normal. No tumor could be found in any other part of the body.

Microscopically the tumor is a squamous epithelial carcinoma composed of irregular cords and islands of polygonal and cuboidal cells surrounded by a loose connective tissue. Mitoses are extremely rare. There are very close similarities between the histologic appearance of the tumor in this case and that in Case I.

COMMENT

It may be seen that in these cases the primary tumor was situated neither in the lungs nor the pleura. Since a thorough search of other organs and systems failed to disclose the presence of a neoplasm, it is obvious that the new growth originated in situ.

Pathologists of the past century were not aware of the fact that different varieties of neoplasms may originate in the region of the neck. Reports of the period, up to about the eighties, speak of primary carcinoma of the "cervical nodes" and "blood vessels" (1).

At present, different varieties of epithelial tumors are recognized in the region of the neck: tumors of the thyroid and of the parotid gland and finally branchial carcinoma. The last named tumor originates from epithelial rests of the branchial apparatus. Meyer (2) and Hyndman and Light (3) have recently described this structure in great detail. In the first few weeks of the life of the embryo, five bars or branchial arches are present in the region of the neck. The depres-
sions between the bars are defined as branchial grooves. While the grooves usually disappear, any one of them may persist with its normal embryologic origin on the pharyngeal side and by continuation in the cervical sinuses have its extreme opening anywhere between the tip of the styloid process and the sternoclavicular junction. In instances when a groove persists by failure to occlude or by inclusion of epithelial remnants, it serves as a point of departure for pathologic processes in that particular region of the neck. Branchial carcinomas, called also by Crile and Kearns (4) "lateral cervical neoplasms," are situated high in the neck, below the angle of the mandible, in close proximity to the ear, near the sternocleidomastoid muscle. They grow around the larger cervical vessels and nerves, leading to circulatory and neurogenic disturbances. Microscopically they are squamous epithelial carcinomas. It is interesting that of 28 patients observed by Crile and Kearns, one showed a Horner's syndrome on the side of the tumor. That the neoplasm is derived from epithelial rests in the upper segment of the branchial apparatus is no longer disputed.

There is no easy way of tracing the histogenesis of a malignant new growth. The source of a cancer is usually based on the type of the cells and their arrangement, on the nature of the supporting stroma, and sometimes also on the tinctorial properties of the cells. It is often ascertained by exclusion. In the cases here described the study of the histogenesis of the tumors is complicated because it was made in an advanced stage of the disease. However, as fistulae and cysts may develop from any of the clefts, including the lower, it should be conceded that tumors, too, may originate from the lower cleft, in the region of the sternoclavicular articulation. The fact that the primary seat of the neoplasms was found in an area where there are normally no epithelial elements is good evidence that they originated from epithelial remnants of the lower cleft of the branchial apparatus. Moreover, the appearance of the tumor in Case II and the mode of its spread along vessels and nerves closely paralleled that of the upper branchial carcinomas. Thus it would appear that the cancers found in these patients were none other than branchiomas which had their point of departure in epithelial rests embedded in the region of the sternoclavicular articulation.

The symptomaticity of the tumor is of great interest. The clinical course in the two cases studied may be divided arbitrarily into three stages: (1) the "silent" stage; (2) the stage of transitory or fugitive reactive neuritis; (3) the stage of outward swelling, accompanied by a constant neuritis of the brachial plexus with Horner's syndrome.

In these cases advice was sought in the third stage, for swelling in the supraclavicular fossa accompanied by neuralgic pain in the region of the shoulder girdle. Obviously the early symptoms had been neglected by the patients. In Case I, the malignant disease was complicated by a generalized, painful deforming arthritis which obscured the main issue. In Case II, the finding of an apical shadow by the roentgenologist at first suggested a tuberculous infection but the biopsy
of a nodule found in the sternoclavicular region showed a carcinoma, thought to be metastatic. In Case I, also, x-ray films of the chest showed invasion of the clavicle by tumor, involving the adjacent upper ribs by continuity. In the course of its advance it reached the brachial plexus (Fig. 4), producing a reactive neuritis which was at first fugitive but soon became severe and constant, culminating in a monoplegic atrophy.

The brachial plexus is made up of the anterior primary divisions of the four (5th, 6th, 7th, 8th) lower cervical nerves and the greater part of the first thoracic nerve. After emerging from their respective intervertebral foramina, they converge towards the upper border of the first rib, uniting to form three trunks which give rise to the cords from which the nerves of the upper extremity are derived. In instances of involvement of the trunks the symptoms are radicular, while derangement of the cords simulates lesions of the peripheral nerves.

Two types of paralysis are distinguished (5). One is the Duchenne-Erb or upper arm type, where there is involvement of the fifth and sixth cervical roots. There occurs compression of roots and trunks between the first rib or clavicle and the transverse process of the vertebrae. The Dejerine-Klumpke or lower arm type of paralysis results from involvement of the nerves derived from the eighth cervical and first dorsal roots. If the lesion is close to the vertebral foramina and the sympathetic rami which leave the first dorsal root are injured, a Horner’s syndrome develops.
Thus it may be seen that the symptomatology of the disease at this stage was due not to the tumor proper, but was "borrowed" from its topography. Patients with this disease are probably treated for an indefinite period for neuritis or bursitis while the malignant disease is overlooked. Some "accident," such as a metastatic nodule or a routine roentgenologic examination of the thorax, reveals the true nature of the malady.

As pathologic studies of the tumors indicate that they are probably of a low-grade malignancy, it is imperative to trace the disease at the onset, when it might respond to surgical or x-ray treatment.

![Roentgenogram of Bronchial Cancer Confined to Left Apex](image)

The symptomatology is not specific, contrary to the claims of Pancoast (6) for the apical tumors which he has described. The syndrome is encountered in metastatic lesions found in this area and in carcinoma of the thymus, as stressed in a recent article by Browder and DeVeer (7). While the examples quoted by these authors occur with great rarity, bronchiogenic cancers showing this syndrome have been described many times. In 1932, I observed a patient with primary carcinoma of the lung (Fig. 5) with symptoms exactly resembling those in the cases here presented, and since then two similar cases have been brought to my attention (8). Jacox (9), Steiner and Francis (10), and Browder and DeVeer (7) have made similar observations. Lloyd (11) in a recent study of 31 cases of bronchiogenic cancer found one with an identical syndrome. "So distinctive," wrote Lloyd, "is the clinic of this type of tumor that it almost isolates itself and defies classification with other tumors of the lung."
Indeed, neuritis of the brachial plexus with atrophic monoplegia and Horner’s syndrome is met with in neoplastic, traumatic, and inflammatory conditions. What is most significant is the combination of a dense apical shadow with a homolateral brachial plexus neuritis. In such an eventuality, one should suspect either primary carcinoma of the lung or an extra-pulmonary carcinoma of the type herein described. Although the syndrome of the last-named is not pathognomonic, anatomically the tumor represents a well defined entity for which the name “sternoclavicular branchioma” seems to be appropriate.

**Summary**

Two cases which showed a unilateral neuritis of the brachial plexus, a homolateral Horner’s syndrome, and an atrophic monoplegia of the corresponding arm have been described.

Roentgen examination of the affected side showed a dense shadow confined to the region of the first three ribs.

Post-mortem examination revealed a squamous epithelial cancer originating in the region of the left sternoclavicular articulation, ultimately invading the infraclavicular and supraclavicular fossae, the clavicle, and the upper three ribs. The pleura, the lungs, and other viscera were free from tumor.

The clinical aspect of the cases has been analyzed in detail. The probable origin of the tumors from epithelial rests of the lower cleft of the branchial apparatus is discussed, and in accordance with their origin they are designated as “sternoclavicular branchiomas.”

The importance of early recognition of the tumors is emphasized.

**References**