

THE SURGICAL TREATMENT OF MEDIASTINAL TUMORS

REMOVAL OF CYSTIC AZYGOS LOBE FROM POSTERIOR MEDIASTINUM

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THE incidence of intrathoracic tumors is probably no greater now than it has ever been, but in recent years they are being recognized more frequently, due to the marked improvement that has been made in methods of thoracic diagnosis, especially since the use of Röntgen-rays. Early diagnosis of these tumors, before the growth has made serious inroads on the patient's general condition, has been the greatest aid to their surgical removal, and study of such proved cases has given a different conception of the type of lesion found in this region as well as of the prognosis. The older belief was that most of these growths were malignant, and that only conservative treatment was justified, because surgical treatment was an extremely hazardous procedure. The lack of response in so many of these cases to conservative treatment has encouraged surgical intervention with the view of complete removal of the growth, and the marked advancement in methods of surgical technic has made operative removal a relatively safe procedure. Microscopical study of the lesions removed has shown that a large percentage of intrathoracic tumors are benign.

A relatively high percentage of intrathoracic growths have their origin in the mediastinum. Because of the many different tissue elements in this space, it has the potential possibility of presenting almost any type of neoplasm. In my experience of thirty-eight cases in which intrathoracic new growths were removed by operation, twenty-three (61 per cent.) were in the anterior or posterior mediastinum. Microscopical study of these twenty-three cases disclosed that eighteen (78 per cent.) were benign tumors of the following types: eight were neurofibromas, in three of which there was lipoid degeneration; two were cellular fibromas; seven were teratomas, one of the dermoid type and one presenting sufficient organoid structure to be designated as a parasitic foetus, and one, the eighteenth, a congenital cyst of the lung. The last case is reported in this paper. The remaining five tumors of the mediastinum (22 per cent.) were malignant, of which one tumor was a squamous-cell epithelioma which probably arose by malignant degeneration of a dermoid tumor of the anterior mediastinum; three tumors were fibrosarcomas, two of which were probably primarily benign tumors, and one, the fifth, was an adeno-carcinoma of intrathoracic thyroid tissue, with erosion of the spine. All mediastinal tumors are potentially malignant. The high percentage of benign tumors in this series is probably due to removal of the growth, before it had undergone malignant change. The clinical history of three of the five patients who had malignant tumors sug-

gested that the tumor had been benign at the onset and had undergone malignant degeneration.

Tumors that remain benign often attain enormous size, and may cause death from mechanical pressure on the numerous important structures in the potential spaces designated as the mediastinum. These structures either control, or are closely associated with, respiration; circulation of arterial and venous blood and lymph; deglutition, and functional innervation of organs lying outside the thorax. Inasmuch as the mediastinum is only a potential space, growths arising in this region will impinge on the anatomically adjacent structures, depending on the situation of the lesion, such as the lungs, vertebræ, diaphragm and structures at the base of the neck. Because of the important structures contained in the mediastinum it is of paramount importance that these tumors be recognized and treatment instituted before the growth has caused serious and permanent injury to these vital structures, as well as disturbing the function of all the viscera within the thorax.

There is great variation in the subjective symptoms produced by mediastinal neoplasms. The symptoms are dependent on the type of growth, but more on the situation than on the size of the tumor. They are due to pressure or infiltration of the involved or surrounding structures in the region invaded, and on the amount and severity of disturbed function of intrathoracic organs. If the symptoms appear early, it may be possible to make a diagnosis by the history and general examination only, but it is extremely rare more than to suspect the presence of a tumor on the basis of these observations. Most cases can be definitely diagnosed only by aid of Röntgen-rays, whether or not they produce symptoms, and regardless of physical findings.

The most common symptoms and signs which cause the patient to consult the physician are as follows: Pain; dyspnoea; cough; various degrees of cyanosis caused by pressure on the lungs, heart, great vessels or nerves; displacement of the heart from pressure; dilatation of the veins over the thorax, and distention of the jugular vein from pressure on the superior vena cava; dysphagia from extrinsic pressure on the œsophagus; changes in the voice from pressure on the recurrent laryngeal nerve; unilateral sweating and flushing of the face associated with enophthalmus, visual disturbance, inequality in the size of the pupils, and ptosis of one eyelid from pressure on the sympathetic nerves; nerve pain, root pain, and herpes from pressure erosion of the spinal column and spinal cord; difference in size of the two sides of the thorax; decrease or absence of motion of one side of the thorax during inspiration; loss of weight; anorexia; pyrexia, and evidence of pleural effusion or empyæma.

Pain is probably the most significant symptom in the clinical distinction between an early malignant lesion and a benign lesion. From malignant growths of small size the pain is often very severe, and may be more or less constant, but with acute exacerbations at irregular times, usually most severe at night.

Benign tumors may often attain great size without producing pain other

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than a dull ache or a sense of pressure accompanied by dyspnoea on exertion. Benign, anterior mediastinal tumors usually present more subjective symptoms than benign posterior tumors because of the limited space anteriorly, and these tumors are usually fixed to the heart and great vessels. The most common benign anterior mediastinal tumors are teratomas, which often produce pain as a result of inflammatory irritation associated with respiratory infections; the diagnosis commonly is pleurisy or pneumonia. The most common growths in the posterior mediastinum are neurofibromas and cellular fibromas, which may attain considerable size without causing pain unless the tumor is of the dumb-bell type, causing erosion of the spinal column with associated root pain and symptoms referable to the spinal cord, depending on the portion of the spine involved.

Dyspnoea is one of the most common symptoms of benign or malignant tumors, is usually present with early lesions, and is most noticeable on exertion. It is caused by pressure on the lungs, particularly at the hilum, also by pressure on the heart, great vessels, and nerves. It may be constant or paroxysmal, and is often the only subjective symptom.

Cough is a frequent early symptom of malignant lesions, and it is often paroxysmal and of a hoarse or brassy type. It may be nonproductive, but usually is associated with expectoration of mucus or blood. The type of expectoration may be of great diagnostic importance, as in the presence of dermoid or teratoid growths which have ruptured into a bronchus, with expectoration of sebaceous material, hair, and occasionally tumor tissue and pus from secondary infection. Expectoration of this material often occurs at night, and may be associated with violent attacks of coughing and pain simulating attacks of strangulation.

Horner's ocular syndrome was noted in three cases, in all of which the growths were malignant, which would suggest that the syndrome was due to malignant infiltration rather than to pressure on the sympathetic nerves. I have removed several benign tumors of much larger size from the same region in cases in which Horner's syndrome was not present.

The physical signs are often helpful in determining the presence of a lesion but are unreliable as to its extent or character. Vocal fremitus will usually be increased over the tumor, and with this there is usually an area of definite dullness and absence of breath sounds. In the presence of anterior mediastinal tumors the heart is often displaced and the sounds are transmitted over a wide area. All of the usual physical signs of regions of consolidation in the thorax may be absent and a tumor of considerable size may be present but produce no evidence either by symptoms or on general examination.

In most instances, the greatest amount of information that can be expected to be obtained from the clinical history and the physical signs is that of the probable presence of a mediastinal tumor, and its approximate situation. In order to determine accurately the position and size of the growth and its relation to the normal content of the mediastinum and thorax, resort must be had to other methods of examination. The most

important of these is röntgenological examination of the thorax. This should be made in the anteroposterior, oblique, and true lateral positions, and its value is greatly enhanced by stereoscopic films. In certain cases, additional information can be obtained from röntgenological examination after establishment of artificial pneumothorax, after injection of the bronchial tree with iodized oil, or after introduction into the œsophagus of a preparation of barium. Fluoroscopical examination is of value in determining the relation of the tumor to the surrounding normal structures, and in determining whether it is encroaching on, or is causing, impairment of function of these structures. It is also of importance in the differential diagnosis of tumors and aneurism.

Bronchoscopical examination is of value in ruling out the presence of a primary intrabronchial lesion, or in determining whether there is encroachment of an extrinsic growth on the lung. Cœsophagoscopical examination is of value in ruling out the presence of a primary lesion of the œsophagus, or in determining if there is encroachment of an extrinsic lesion on the œsophagus.

Thoracoscopical examination may be advisable in selected cases of posterior mediastinal tumor in which the growth projects well into the thoracic cavity. In this way, the situation of the tumor can be determined, and in some instances a specimen of the tumor may be removed for microscopical examination. However, in most of these cases, I prefer to perform exploratory thoracotomy. In cases of anterior mediastinal tumor, it is rarely, if ever, advisable. Diagnostic thoracentesis, with an aspirating needle, may be justified in certain rare cases, such as when the available evidence is that of a cyst adherent to the thoracic wall, or to aid in distinguishing between such a cyst and an encapsulated accumulation of fluid in the pleural cavity. This procedure is rarely, if ever, advisable in cases of anterior mediastinal tumor, because of the danger of mediastinal infection entailed, in any case, at inserting a needle into the mediastinum, and especially because of the possible risk of injury to an aneurism of the arch of the aorta.

In some cases, differential diagnosis of malignant and benign disease remains in doubt after all of the armamentarium of modern thoracic diagnosis has been exhausted. In some cases of malignant disease there may be involvement of the regional superficial lymph-nodes, and one of these can be removed for microscopical examination to establish the correct diagnosis, but in many cases there is no enlargement of regional lymph-nodes. In some cases of this latter group, in which the tumor is unilateral and the available evidence is more characteristic of a malignant growth of the type of lymphoblastoma, treatment of the growth with Röntgen-rays is often of diagnostic value, for these tumors are radiosensitive and will appreciably diminish in size from a week to ten days after irradiation. In cases of benign tumor there will be no appreciable change in the size or contour of the tumor following irradiation. The differential diagnosis of mediastinal tumor and aneurism of the aorta usually can be made on the basis of the clinical symp-

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toms which are associated with aneurism, and by means of fluoroscopical examination of the thorax. In fluoroscopical examination, care must be exercised not to confuse the pulsation of an aneurism with that of the transmitted pulsation from the arch of the aorta onto the tumor. In those cases in which the diagnosis cannot be established even after all available methods have been utilized, exploratory thoracotomy is indicated, depending on the patient's general condition.

The chief problems associated with surgical removal of mediastinal tumors are concerned with the danger of pulmonary collapse, with mediastinal flutter resulting from open pneumothorax, and the difficulty of access through the bony encasement of the thorax. The first of these hazards has been greatly diminished by the use of differential air-pressure during the operation. The second is entirely a technical problem, and methods of approach are continually being improved and perfected.

Surgical indications depend on the findings in each case. Patients who are selected for surgical intervention should be placed in the hospital under observation and pre-operative preparation for approximately one week before operation. After bronchoscopical or thoracoscopical examination has been made, the operation should be delayed for at least three to five days. I believe that the operative risk is decreased by establishment of artificial pneumothorax approximately five days before operation, to permit the patient to become accustomed to unilateral partial pulmonary collapse, and decreased vital capacity. In my series of twenty-three cases, including anterior and posterior mediastinal tumors, preliminary artificial pneumothorax was established in eleven. In some instances it will be impossible to establish artificial pneumothorax because of adhesion of the lung to the tumor, or to the thoracic wall, which will prevent collapse of the lung. In the pre-operative period the patient should be given at least 3,000 cubic centimetres of fluid daily.

I prefer to use intratracheal anæsthesia under positive pressure. I have operated with intrapharyngeal anæsthesia, with the closed mask, and without positive pressure of the anæsthetic agent, without harmful results. It is probable that intrapharyngeal anæsthesia would be satisfactory in most cases in which one pleural cavity is opened, but it is never possible to determine before operation what emergency may arise, or when the opposite pleural cavity may be opened unavoidably. I believe that anæsthesia by intratracheal insufflation, and administered with apparatus for positive pressure, is the safest method in most cases; this method was used in most of the twenty-three cases mentioned. The anæsthetic agents were ethylene and ether or ethylene alone, in all cases. Many of these operations are long and tedious, and it is important to ventilate and reestablish circulation by fully expanding the lung every three to five minutes during the operation. The amount of pressure used is gauged by a water manometer on the positive-pressure apparatus. The lung is fully inflated at the completion of the operation. A

suction pump is applied to the intratracheal catheter during its withdrawal to remove any mucus which may have accumulated in the trachea.

The surgical approach through the thoracic bony cage depends on the site and size of the tumor. To reach anterior mediastinal tumors, it may be through the anterior or posterior thoracic wall. Nine of the twenty-three mediastinal tumors in my experience were in the anterior mediastinum. In two of these cases the tumor was approached through the anterior thoracic wall, and in one of them the clavicle was cut in order to approach the tumor at the apex. In the remaining seven cases, the approach was made through the posterior thoracic wall through a posterolateral incision around the vertebral border of the scapula, and entering the pleural cavity through the deep layer of periosteum after resecting one rib. The vertical level of the incision in the pleura depends on the situation of the tumor; that is, whether it is high or low in the mediastinum. If more exposure is necessary in order to remove the tumor, the ribs can be cut close to the spinal column, both above and below the resected rib, together with the intercostal muscles, until sufficient exposure has been obtained to remove the growth from its attachment and to deliver the tumor through the wound. At completion of the operation the cut ends of the ribs are sutured by drilling through them and suturing them together with chromic catgut. In all of the fourteen cases in which the tumor was in the posterior mediastinum, the posterior approach was used. I prefer this method of approach in all cases of mediastinal tumor, unless the tumor causes so much pressure in the anterior mediastinum that the growth is firmly fixed to and has caused marked deformity of the thoracic wall. In some of these cases it may be advisable to make the incision over the site of the tumor. In nineteen cases the tumor was removed by transpleural operation. In four cases it was removed by extrapleural operation; two of these tumors were removed through an anterior incision, and two through a posterior incision. A posterior, extrapleural operation was attempted in several other cases, but such an operation is rarely possible because of adhesions of the pleura to the tumor; these were usually so firm that the pleura was ultimately entered before the tumor could be completely removed, thus subjecting the patient to all of the dangers of open pneumothorax, and in addition to the probability of extensive pleural effusion due to the wide separation of the pleura from the thoracic wall. I believe that there is less risk in performing an initial transpleural operation in most cases. In all cases, the tumor was completely removed in a one-stage operation. This I believe to be the operation of choice, for the technical difficulties are usually increased by operations in multiple stages, which increase the danger of the operative procedure.

The blood-pressure should be taken every five minutes during the operation. When there has been a fall of ten millimetres of mercury in the pulse-pressure, physiological solution of sodium chloride or solution of acacia is given intravenously. If the pulse-pressure drops twenty to thirty millimetres of mercury, transfusion of blood is given.

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Post-operative care is very important. Maintenance of bodily heat is essential, both when the patient is on the operating table, and after operation. The most significant immediate complication is dyspnoea with cyanosis. If this occurs, the patient is placed immediately in the oxygen chamber. This often proves to be a life-saving procedure, for it tides the patient over the critical period of decreased vital capacity of the lungs. This was particularly exemplified in one case, in which a large teratoma was removed from the anterior mediastinum; the growth had extended into the right thoracic cavity, causing almost complete collapse of the right lung and displacement of the heart into the left thoracic cavity from pressure. Because of marked decrease in vital capacity following operation it was necessary to keep the patient in the oxygen chamber for three weeks. Five attempts were made to remove the patient from the oxygen chamber before such removal was finally accomplished after the gradual decrease of the percentage of oxygen over a period of ten days. The oxygen chamber was used in sixteen of my twenty-three cases. Later complications are pleural effusion and empyæma. In practically all cases pleural effusion develops, but in a few of the cases aspiration is not required. In about a third of the cases pleural effusion will disappear after one aspiration, and in the remaining third it will require repeated aspiration. The frequency and persistence of pleural effusion depend on the type of tumor and the amount of trauma to the pleura. In cases of teratoma, pleural effusion is most likely to develop and may result in empyæma. Empyæma complicated the convalescence in five cases of this series of twenty-three; in all five cases drainage was accomplished by the closed method. In one case, subsequent open operation was required. In one case, convalescence was complicated by the development of osteomyelitis of a rib, with formation of a sequestrum, for which further resection of the rib and removal of the sequestrum was required. Convalescence was delayed in these cases, but all the patients recovered.

There were three operative deaths. One patient, who had a neurofibroma, died on the fourth day after operation from pneumonia and an associated bloody pleural effusion. The bloody pleural effusion resulted from diffuse oozing from the bed of the tumor where it had been adherent to the lung. The adhesions were probably the result of extensive Röntgen therapy, to which the patient had been subjected prior to her admission to the clinic because the tumor was thought to be malignant. The tumor did not become smaller, and I believe that any mediastinal tumor which does not undergo some reduction in size within the first week or ten days after irradiation, should not be treated further with Röntgen-ray if surgical intervention is contemplated. The second death occurred six days after operation, as a result of bronchopneumonia and hæmorrhage into the spinal cord. The tumor was a neurofibroma which had been present for more than five years. The patient was practically symptomless until three to six months before admission. A congenital condition of the heart with coarctation of the aorta also was present. At operation it was found that the tumor had eroded

through the vertebræ, causing pressure on the spinal cord, with marked dilatation of the vessels in the spinal cord. This dilatation of vessels was probably primarily due to coarctation of the aorta, and was augmented by pressure from the tumor. Following the operation, hæmorrhage developed from the vessels in the cord, requiring laminectomy in twenty-four hours. The erosion of the spinal column in this case exemplified the serious effect that benign tumors may have on the surrounding structures, which materially increases the operative risk and emphasizes the importance of early removal of the growths. The third death took place on the seventh day after operation, from cerebral embolism. The case was one of malignant degeneration of an anterior mediastinal dermoid. The possibility of malignant degeneration of tumors of this type manifests the importance of early diagnosis and removal.

Twenty patients recovered from operation; three died subsequent to operation; the tumors in these cases were malignant and the patients died from recurrence. One patient, who had a sarcoma which probably originated in the vertebra, died five months after operation from recurrence; two patients who had fibrosarcomas, and whose histories indicated benign tumors at the onset, died of recurrence, one, two and one-half years after operation, and the second, six months after operation. One patient who had a carcinoma of the thyroid gland with metastasis into the mediastinum is living at the present time, two years and four months after operation, but has a recurrence. Sixteen patients, all of whom had benign tumors, are living and completely relieved of symptoms from three months to six years after operation.

Cases of benign tumors are the most gratifying from a surgical standpoint, for the risk is not great if the tumors are removed before they have become so large as to cause pressure on the surrounding structures. If the patient survives the operation, complete cure is obtained. The frequency with which these tumors become malignant is the most significant indication for their early surgical removal. Because of the difficulty in establishing a definite clinical diagnosis, I believe that exploration should be made in all cases, unless the clinical evidence is that a hopeless, inoperable condition exists.

Following is a report of a recent case which is of unusual interest because of the uncommon occurrence of an azygos lobe and the infrequency with which such a lobe is the site of a pathological process. I have been unable to find in the literature a report of a similar case.

REPORT OF CASE.—A woman, aged thirty-seven years, first came to the clinic September 17, 1930, at which time she was found to have a large substernal goitre; this was removed September 23, 1930. In the course of her examination at this time, she complained of an indefinite pain in the upper right posterior portion of the thorax. Röntgenological examination (Figs. 1, 2 and 3) revealed fluid in an azygos lobe, the upper level of which was between the sixth and seventh ribs. There were no other subjective symptoms. She returned for observation December 31, 1931, at which time she stated that she had done very well following thyroidectomy, until April, 1931, which

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was seven months after operation, when severe respiratory infection developed, associated with a sore throat. This was accompanied by increase in temperature and severe cough. She had never entirely recovered from the cough. The expectoration varied in quantity and was of yellowish, pus-like material which was very thick and tenacious. It varied in quantity from two to six ounces (60 to 180 cubic centimetres) daily, and was usually very difficult to raise. Often she coughed for a long period before this material could be expectorated. She believed the difficulty was due to the thick, sticky character of the material. There had never been any hæmorrhage, and only moderate pain, which was in the upper right portion of the thorax and was noted when there was difficulty in expectorating the mucoid material. She had been unable to work since the onset of her cough because of weakness and fatigue. She had lost six and one-half pounds in the previous six months.

Examination revealed systolic blood-pressure of 122 millimetres of mercury, and diastolic of 94. The pulse-rate was 104 beats each minute, and the temperature 98.1° F. Repeated examinations of sputum were negative for organisms of tuberculosis and actinomycosis. There was dullness to percussion, and many loud, bubbling râles were heard in the right portion of the thorax, at the level of the third rib anteriorly and from the seventh rib posteriorly to the apex. Röntgenological examination revealed a dense tumor in the upper right mediastinal region, corresponding in situation with the position of an azygos lobe, extending from the seventh to the second rib posteriorly, filling the entire posterior mediastinum and extending across the median line to the left border of the aorta. In the lateral stereoscopic view there was a dense, fusiform shadow in the midst of the upper right portion of the thorax, overlying the shadow of the spinal column. The lower border of the shadow gave evidence of communication between the structure which caused the shadow and a bronchus, at the hilum. A tentative diagnosis of infected congenital cystic tumor of the lung, probably a cystic azygos lobe, was made. Two bronchoscopic examinations were made, and at the first examination, January 5, 1932, a large quantity of pus was found exuding from the bronchus of the right upper lobe. It was impossible to remove all of the pus-like material, for it continued to pour down regardless of continuous aspiration. It apparently came from the posterior division of the bronchus of the right upper lobe. Lipiodol, thirty cubic centimetres, was injected into the bronchus of the upper right lobe. Bronchoscopy was done again January 11; a large amount of pus-like material was found exuding from the bronchus of the right upper lobe, and about 300 cubic centimetres of this material were aspirated and sent for bacteriological examination, culture, and inoculation of guinea-pigs. No organism was found in the stained specimen, nor was any growth obtained from the culture. After a requisite time, the guinea-pig was examined, but no evidence of tuberculosis was found. The patient was partially relieved of cough and expectoration for about twenty-four hours following the bronchoscopic aspiration, after which time the cough was the same as before. She was placed in the hospital under observation for a few days. She had no fever, but the cough and expectoration became gradually worse, and there seemed to be more pain in the upper right portion of the thorax, posteriorly. Surgical intervention was advised.

January 16, 1932, transpleural, posterior mediastinotomy was performed under intra-tracheal anæsthesia with ethylene. The posterior two-thirds of the sixth rib were removed, from the spine of the vertebra laterally, the fifth and fourth ribs were drilled and cut (Figs. 4 and 5), and the right pleural cavity was entered through the inner layer of periosteum of the sixth rib. There was a large cyst in the right lung, in the same relative position as an azygos lobe, involving the upper posterior part of the mediastinum, and involving about two-thirds of the upper right portion of the thorax. There was partial collapse of the upper and posterior parts of the right lung, which were very adherent to this cystic mass, and completely surrounded it laterally. The median portions of the upper and posterior parts of the lung were separated from the tumor, which was firmly adherent to the upper lobe, and had to be cut from it with a

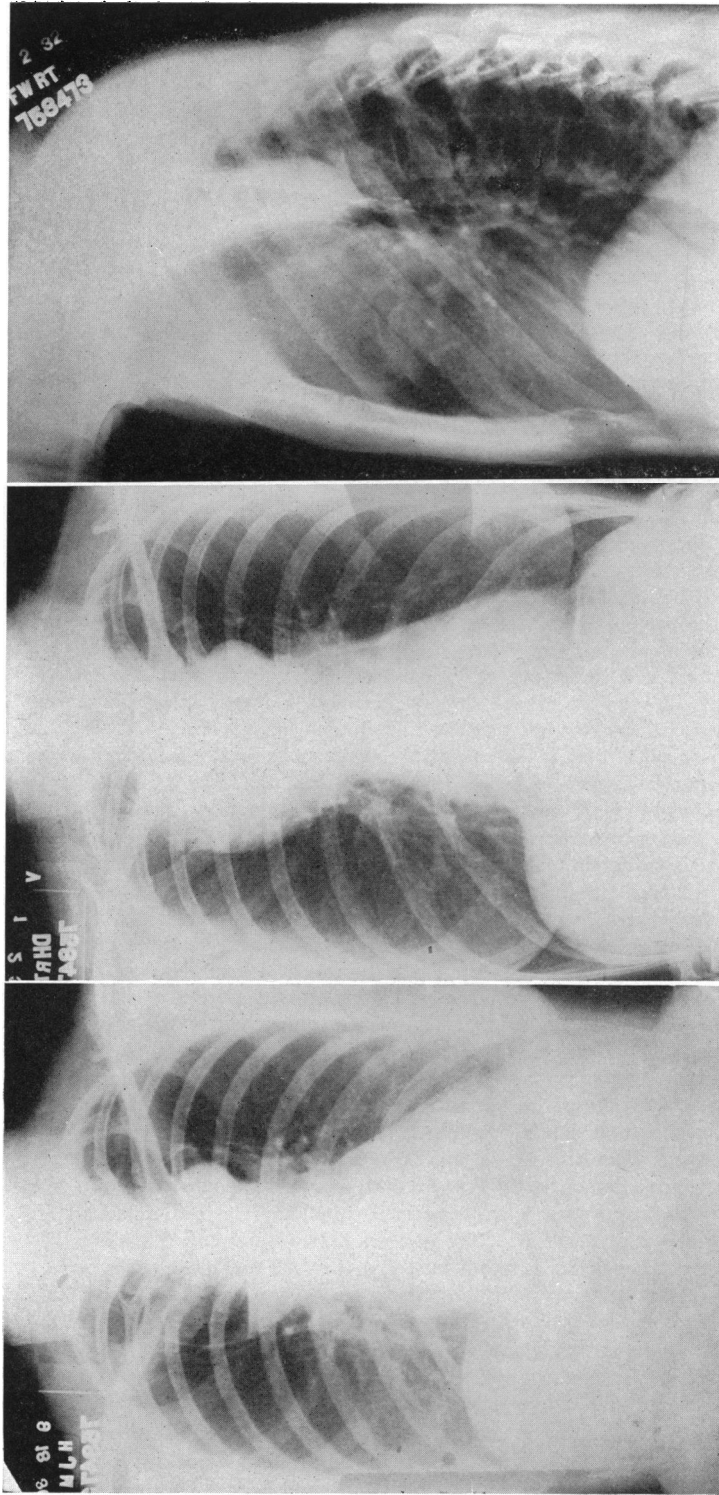


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 1.—Roentgenogram on first admission. Large cystic azygos lobe in right upper portion of thorax, extending across mediastinum to left border of aorta only, and extending across mediastinum to left border of aorta.
 FIG. 2.—Roentgenogram on second admission. Dense tumor in upper, right, posterior mediastinal region, corresponding in situation with the position of an azygos lobe.
 FIG. 3.—Lateral view. Dense fusiform shadow in the midst of the upper right portion of the thorax, overlying the shadow of the spinal column. The lower border of the shadow indicates that the tumor communicates with a bronchus at the hilum.

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knife. In several places the cyst had partially ruptured into the adjacent pulmonary tissue; these perforations were repaired by suture. The lower portion of the tumor, close to the hilum, was not adherent to the lung and was covered with visceral pleura similar to that of the lung. The cyst extended across the median line, into the left part of the mediastinum, and then to the left border of the aorta. It was thick-walled, dense, and contained about 750 cubic centimetres of thick, yellowish, pus-like material which contained a great deal of mucus. There was a large bronchial fistula emptying into the

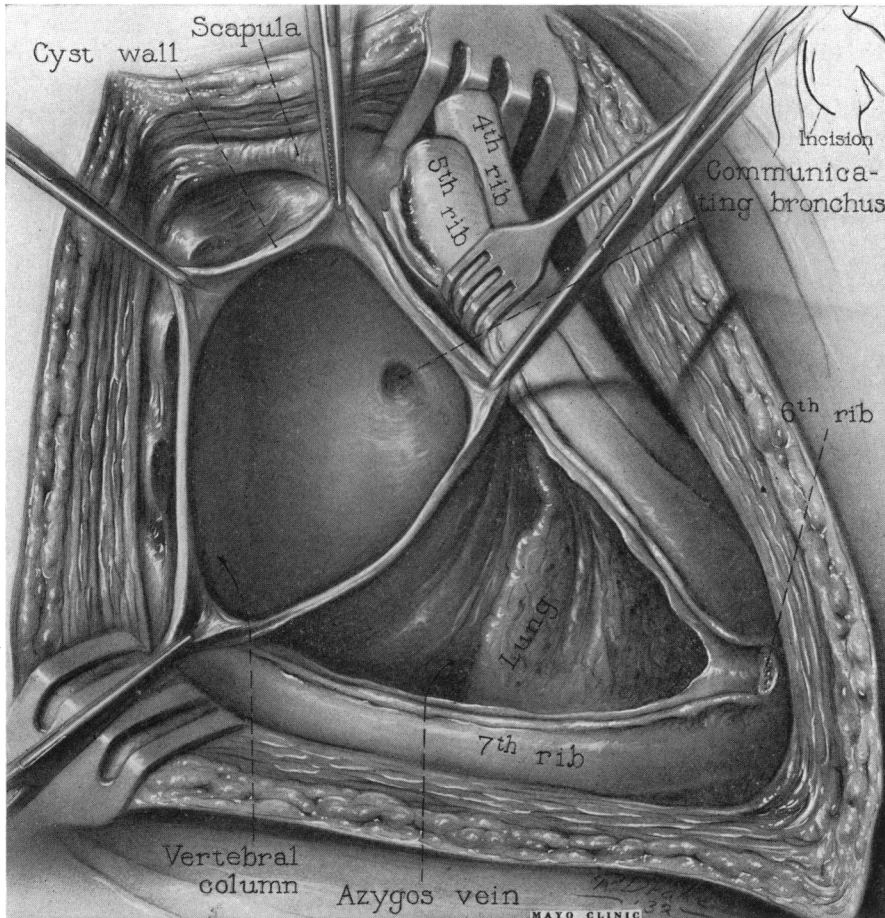


FIG. 4.—Posterior mediastinotomy, with resection of posterior two-thirds of sixth rib, and section of fourth and fifth ribs. Transpleural exposure of cystic azygos lobe in the posterior mediastinum, after it had been dissected free from its attachment to the adjacent lung. The mucoid material of the cyst had been removed, disclosing the large, communicating bronchus in the base of the cyst. The azygos major vein separates the cyst from the adjacent lung.

base, in the middle portion of the cyst. This undoubtedly was the bronchus, through which the material was removed by bronchoscopic examination, and through which the expectorated, pus-like material was flowing. The posterior and left walls of the cyst were fused to the hilum of the lung, and the posterior portion was adherent to the vertebræ as well as to the left pleura and aortic wall. The azygos major vein was markedly dilated, and was incorporated in the wall of the base of the cyst. About two-thirds of the wall of the cyst were excised. The cavity of the cyst was lined with epithelium, and its walls were very vascular and contained remnants of pulmonary

tissue. On examination in the laboratory, the walls of the cyst were found to contain cartilage and all types of pulmonary tissue, indicating that this undoubtedly was a congenital cyst of the lung. The bronchial fistula was closed by suture, and the remaining portion of the sac was sutured over the bronchial fistula, after the lining of the sac had been obliterated. It was necessary to repair by suture three areas in the upper, median portion of the right lung, where the tumor had infiltrated into the pulmonary tissue. The right pleural cavity was completely closed without drainage.

Pathological examination of the wall of the cyst disclosed that it was lined with ciliated, columnar epithelium, and that there were other bronchogenic structures in the thickened portion of the wall, at the base of the cyst.

The patient withstood the operation very well. There was a moderate reaction. Temperature was 101° F. and the pulse-rate was 110 on the second day. The pulse-rate gradually dropped to normal on the sixth day, but on this day there was gradual increase in temperature and pulse-rate. Examination of the thorax revealed a pleural

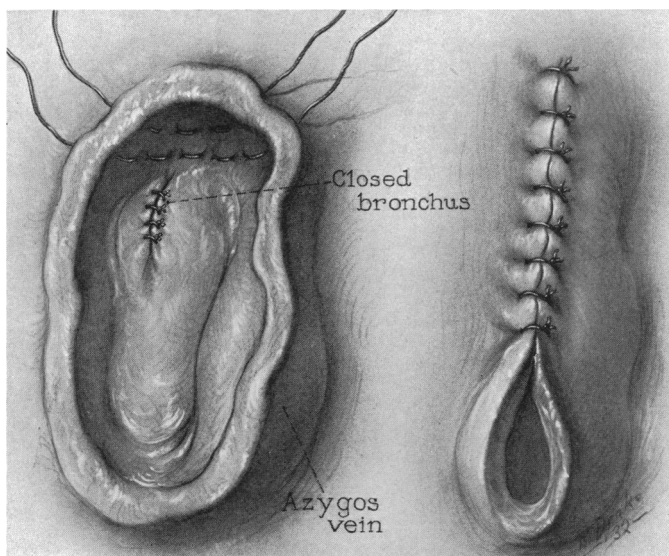


FIG. 5.—Method of closure of a large communicating bronchus with mattress and interrupted sutures of chromic catgut, and also the method of obliteration of the base of the cyst after the ciliated epithelial lining had been completely removed. The lower end of the communicating aperture is left open for drainage.

effusion. About 1,000 cubic centimetres of bloody fluid were removed on one occasion, and found negative to culture. No further aspirations were necessary. The lung remained fully expanded after the pleurocentesis. (Figs. 6 and 7.) The wound healed by primary union. The patient was dismissed from the hospital on the thirty-fourth day, and from my care on the thirty-eighth day after operation.

Comment.—This case is of clinical and surgical interest because of the infrequency of occurrence of single congenital cysts of the lung which do not present symptoms until middle life. The onset of symptoms following a respiratory infection indicated an inflammatory type of lesion, and the persistence of symptoms of infection after the onset indicated inadequate drainage of the cyst. Bronchoscopic examination and aspiration were of little value because of the inaccessibility and tortuous course of the com-

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municating bronchus. None of the lipiodol injected into this bronchus reached the cavity of the cyst because, although 300 cubic centimetres of pus-like material were removed by aspiration, the cyst was only partially drained. The cyst was easily accessible through the posterior mediastinal approach; it was markedly distended from the enormous pressure of the contained mucoid material. It had partially ruptured into the adjacent lung in several places. Adhesions between the cyst and this portion of the lung were so firm, and the cyst had penetrated into the substance of the lung so deeply, that it was opened in the course of dissection from the lung. The cyst was so tense with the mucoid, pus-like material, that the right pleural cavity was partially contaminated with its content. This was washed out

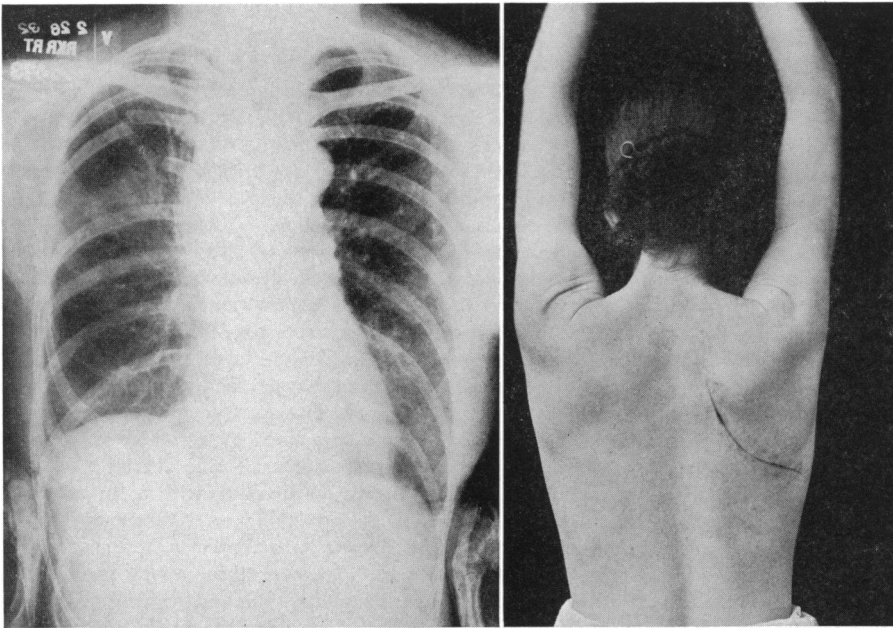


FIG. 6.

FIG. 7.

FIG. 6.—Roentgenogram on dismissal, thirty-four days after operation; the lung is fully expanded.
FIG. 7.—Appearance of the patient, thirty-four days after operation, illustrating the posterolateral paracapsular incision of posterior mediastinotomy. The wound is entirely healed. Function of the arm was good.

with physiological sodium chloride solution, and there was no resulting infection of the pleural cavity.

The most important surgical problems were removal of the cyst with minimal injury to the adjacent lung, and treatment of the bronchial fistula and base of the cyst. The base of the cyst was firmly adherent to the vertebra and aorta posteriorly, and the inferior portion of the cyst communicated with and was incorporated into the lung at the hilum. The large dilated azygos major vein passed between the cyst and the hilum of the lung, and was fused with the wall of the cyst beneath a pleural fold. There were many large vessels in the base of the cyst, which were ligated with mattress sutures.

After the communicating bronchus had been closed, and the greater portion of the cyst had been removed, the lining was removed from the remaining base of the cyst, and the walls were approximated so as completely to obliterate the remaining space, and to aid in sealing off of the bronchus. This proved to be satisfactorily accomplished, for there was no pneumothorax after operation, and although there was considerable pleural irritation, as evidenced by the extensive, bloody, pleural effusion, only one aspiration was necessary, after which the lung remained fully expanded. Complete closure of the thorax, without drainage, contributed a great deal toward absence of serious immediate or delayed post-operative complications, and to rapid, complete recovery.

DISCUSSION.—DR. HOWARD LILIENTHAL (New York City) said as to the approach used by Doctor Harrington that it is a modification of the one which Doctor Lilienthal had devised himself, modeled on the approach of Enderlen, except that Enderlen used to remove a big flap of ribs and made a truly gigantic, troublesome operation on the chest-wall. Doctor Harrington very rarely even divided a rib. He went in between the ribs and it is astonishing to see how extensive the exposure can, in this manner, be made. One can work in the chest with both hands and see exactly what he is doing.

Another point to make is this: That if a rib has been excised—a long piece of rib—it is not always easy to close the pleura after the operation. If one has made a long intercostal incision and has supplemented it by the division of ribs, usually posteriorly, then when it comes time to close the wound by pericostal sutures, one can put the ribs closer than they were in the normal chest; besides, the pleura can be lifted up between the ribs and its edges everted, the ribs crowding the surfaces together.

The author has mentioned malignant degeneration of some of these tumors. Serious attention should be called to the fact that this can happen and that patients with mediastinal tumors—any tumor of the chest, as far as that goes—ought to be operated upon. He had had great trouble in gaining consent in a good many of his cases, until the patient has been suffering from subjective distress of considerable degree. Valuable time has thus been lost. Certainly if one is going to do anything with a tumor which is malignant it must be early, and if you would do something to a tumor which will undoubtedly make trouble, either because of its size or its malignancy, the sooner that tumor is tackled, the safer will be the operation. Some of those cases that Doctor Harrington treated radically are little short of miraculous. I might have been tempted to marsupialize one or two of these. I have succeeded by a comparatively minor operation in doing this and have had the patient remain well for many years without recurrence.

One can find out whether a case is malignant or not by performing an exploratory operation, and one will, in rare cases, perhaps, be astonished to find that a patient whose case seemed hopeless will get well.