

at essentially the same conclusions. There are only a few points in which my observations are at variance with those of Professor Sata. In the first place, he does not seem to have found pure cultures of tubercle bacilli so frequently in open cavities as I have. When he finds in his specimens almost exclusively what he calls "mischpneumonie," that is, lesions partly due to tubercle bacilli, partly to infection with other bacteria, whereas, according to my statements, it is not so unusual to find pneumonic lesions in which we find tubercle bacilli only. This apparent discrepancy may be due largely to his not having separated so strictly as I have the results of mixed infection and those of apparently simple infection with tubercle bacilli which often occur in immediate proximity to one another in one and the same specimen. However that may be, we both agree in regard to the main point—i. e., the importance of mixed and secondary infections in the development of the destructive process in phthisical lungs.

BIBLIOGRAPHY.

- Koch. Mittheilungen aus dem Kaiserlichen Gesundheitsamt, 1884, II.
 Orb. Über Käsige Pneumonie. Virchow's Festschrift, Berlin, 1891.
 Ormer. Die Lungentuberculose als Mischinfection, Wien and Leipzig, 1893.
 Fränkel and Troje. Über die pneumonische Form der acuten Lungentuberculose. Ztschr. f. klin. Medicin, 1894, xxiv.
 Spengler. Über Lungentuberculose und bei ihr vorkommende Mischinfection. Ztschr. f. Hygiene, 1894, xviii. 2.
 Prudden and Hadenpyl. Studies from the Department of Pathology, College of Physicians and Surgeons, New York, II.
 Falk, O. Exsudative Vorgänge in Tuberkeln. Virch. Arch., cxxxix., 319.
 Kitasato. Ztschr. f. Hyg., 1892, xi.
 Sata. Über die Bedeutung der Mischinfection bei Lungenschwindsucht. Ziegler's Beiträge, 3, supplement, 1899.

A CASE OF DERMOID CYST OF THE MEDIASTINUM,

WITH REMARKS UPON THE ETIOLOGY AND EMBRYOLOGY, AND A SURVEY OF RECENT CASES.

By F. S. MANDLEBAUM, M.D.,

PATHOLOGIST TO THE MOUNT SINAI HOSPITAL, NEW YORK.

A BRIEF pathological account of the following case was published in the *Mount Sinai Hospital Reports*, 1898, vol. i., but a minute description has purposely been delayed in the expectation that another instance of this rare disease might present itself. In this report no cognizance has been taken of differential diagnosis, nor has a detailed account been given of the cases hitherto tabulated by previous writers on the subject. The history of the case follows:

Fanny G., aged thirty years, a native of Russia, was admitted to the hospital on January 24, 1898. Her family history was entirely negative.

She had been married seven years, and was the mother of three children, the youngest of which was five weeks old. She gave no history of any previous acute illness, or of rheumatism, syphilis or tuberculosis. She had never suffered any injury. Ten months before admission she noticed a small swelling on the right side of the chest anteriorly, above the breast, and at the level of the third rib. The swelling was not tender to the touch nor red in color, but it occasionally caused slight pain. The tumor did not increase in size until four months ago, when it began to grow suddenly, and one month ago attained its present size. She had not noticed any glandular swelling or any disturbance in lactation, and had continued to nurse her infant. Aside from the presence of the tumor, she considered herself in perfect health, being free from all febrile disturbance or other symptoms.

Status Præsens. The patient is tolerably well nourished, and a physical examination of the internal organs fails to reveal the presence of any organic disease. Opposite the third rib on the right side of the chest anteriorly is a tumor the size of an orange, the skin over it being freely movable. The mass is evidently adherent to the underlying tissues, and the tissues at its base appear to be somewhat indurated. The tumor is neither tender nor sensitive, and it gives no distinct sense of fluctuation. Aspiration by means of a small trocar reveals the presence of thick, yellowish fluid of a honey-like consistency. There are no physical signs referable to compression of bloodvessels, nerves, or any of the mediastinal contents. Cough and expectoration are absent, and no pulsation of the tumor is noticeable.

Operation. Three days after admission Dr. Gerster decided to explore the tumor, and the patient being anesthetized by Schleich's mixture No. 3, an incision four inches long was made over the long axis of the mass. The pectoralis major and minor muscles were divided parallel to their fibres, and the cyst was exposed. It was so firmly attached to the pectoralis minor muscle that upon dividing the fibres of the latter, the cyst was ruptured and a thick, brownish fluid containing small particles of gritty matter was evacuated. The wall of the tumor was more widely opened, and there was exposed to view a multilocular cyst, one small pocket after the other containing a similar fluid. The last pocket incised was found to lead from the thoracic cavity by an extension of the cyst through an opening between the third and fourth costal cartilages. More fluid welled up through this opening, which was found, on probing, to lead deeply into the thorax. Through the enlarged opening, by means of a scoop, a considerable amount of thick fluid, gritty, calcareous matter and strands of hair were removed from the intrathoracic portion of the cyst. In order to expose the latter, two inches of the third rib near its costal end were resected. The patient was turned upon her side and the contents of the cyst thoroughly washed out. This exposed to view a large cavity occupying nearly the entire anterior mediastinum, the cyst wall being attached to the pericardium, diaphragm, and right pleura. The extra-thoracic portion of the cyst wall was dissected away, several large drainage-tubes were introduced into the cavity, and the wound was packed with gauze.

During the division of the intercostal muscles the right pleural cavity was accidentally opened, on account of the dense adhesions, and to avoid any possible subsequent involvement this opening was carefully sutured and two inches of the ninth rib in the posterior axillary line

were resected, and a drainage-tube was inserted. After the operation the patient's temperature was 102.4° F., pulse 120, and the respirations 50. Her general condition was fair.

For the next four days a profuse discharge from the wound necessitated a frequent change of dressings and irrigation of the cavity. On the fifth day signs of consolidation appeared over the base of the right lung, and the temperature rose to 103.4° F., pulse 100 to 128, respirations 28 to 36.

February 2d. The cyst cavity still contains much fluid and detritus. Pulsation of the heart can distinctly be seen along the median line as well as the rising and falling of the diaphragm with each respiration. Dulness, bronchial voice and breathing, and extensive râles are still present over the right lower lobe. The provisional drainage-tube that had been inserted in the ninth intercostal space has been removed, and the pleural opening is healing. The patient's general condition is decidedly worse.

10th. Although signs of resolution have been present for four days, and the temperature is now 100.6° to 102° F., the patient's condition has not improved. The urine to-day contains a trace of albumin.

13th. On account of the difficulty in keeping the cavity properly drained, a siphon arrangement for continuous irrigation is applied. The morning temperature is now 99.6° F., and the evening temperature is 102.2° F., and the patient is suffering from pronounced toxæmia, with marked cerebral excitement and involuntary evacuations.

25th. The cyst cavity is growing smaller in size, and the discharge is of a more solid consistency.

March 9th. The patient is rapidly emaciating, and an extensive bed-sore has developed. The mental condition is unchanged.

17th. The patient has failed slowly, and died at 9 o'clock A.M.

Post-mortem Examination. The body was examined fourteen hours after death. Marked emaciation and a moderate amount of rigor mortis are present. In the second intercostal space on the right side of the sternum is an oblique incision 5 cm. long, leading to a cavity about 8 cm. x 6 cm. in size, bounded by the pleura covering the inner surface of the right lung, and by the pericardium. The wall of this cavity varies from 4 mm. to 1 cm. in thickness, is of a firm, fibrous nature, and is more or less covered by fatty, granular detritus, in which are seen numerous bits of light-colored hair. Here and there are several firm polypoid excrescences springing from the cyst wall, and varying in size from a bean to a large walnut. These are also covered with fine, short hairs. The sac wall is firmly attached to the lung, from which it cannot be separated. A section made through the wall at this site shows that it is firmly united to the parenchyma of the lung, and several minute fibrous septa seem to extend slightly into the pulmonary tissue which appears somewhat compressed at this point. The outer surface of the cyst wall is also attached to the large vessels in the mediastinum by fibrous bands. Several smaller cysts presenting the same general characteristics are seen springing from the large cyst. In one of these is a large polypus measuring 3 cm. x 2 cm.

The lungs are slightly oedematous, and a few pleural adhesions are present on both sides. The heart presents a slight dilatation of the right auricle and a moderate concentric hypertrophy of the left ventricle. The liver is congested and somewhat fatty. The spleen is moderately enlarged, amyloid in character, and presents a slight increase

in the amount of its connective tissue stroma. A few small hemorrhagic areas are also seen. All of the other organs examined appear normal. No trace of thymus gland can be found.

Microscopical Examination. Specimens from various parts of the cyst wall were hardened, cut, and stained, and the following appearances noted.

The cyst wall is firmly united to the pericardium, pleura, and diaphragm by dense fibrous connective tissue. This is especially marked at its connection with the pleura, where no definite demarcation is observed, and small offshoots of fibrous tissue can be seen catering the pulmonary tissue proper. At this situation the substance of the lung shows evidence of compression. Beneath this dense fibrous layer is a fine loose meshwork of connective tissue rich in bloodvessels. Many of the smaller arteries show a marked obliterating endarteritis, and here and there are small areas of round-celled infiltration principally about the bloodvessels. A layer rich in cells and vessels is next seen, and it is in this portion of the wall that the skin elements are found. These elements consist of numerous hairs, many of which appear as regularly formed as in normal skin; others again show marked cystic dilatation at their roots. In addition to this, several small bundles of smooth muscle fibre, seemingly, from their size and position with reference to the hairs, erector pili muscles, were observed. Sebaceous glands are present in the greatest abundance, and in most situations are perfectly normal in their general appearance and formation. Only a very few sudoriferous glands are encountered. It is upon the surface of the polypoid excrescences described above that the skin formation is most plainly noted. Here, also, are large portions of adipose tissue. In a few places are small areas of mucous glands with a connective tissue matrix between the alveoli, and their lumen filled with mucus. In one situation a group of spherical vesicles, each vesicle being lined with a single layer of columnar epithelial cells, with oval nuclei, is seen. These vesicles are filled with homogeneous contents that take the usual staining reaction for colloid, and so closely resemble thyroid glandular tissue that any distinction is impossible. Here and there, on the free margin of the cyst wall, are small patches of stratified epithelium, and upon all of the nipple-like polypi the epithelial cells take the distinct appearance of the rete Malpighii, and are covered with the usual corneal layer of the epidermis. In some places the surface of the cyst wall is necrotic, the cells do not take the stain well, and a granular appearance is noted. No attempt at a formation of bone tissue is observed in any of the sections, nor is any ciliated epithelium present, but in some of the sections, mainly in those cut through the polypoid excrescences, several areas of cartilage cells are seen.

REMARKS. Dermoid cysts of the mediastinum are of such rare occurrence that a glance at the literature of the subject may not be amiss. Hare¹ has collected 520 cases of mediastinal tumors in his monograph, and of this number but eleven were dermoid cysts. In 1800 autopsies made at the Brompton Hospital, mentioned by Fowler and Godlee,² thirty cases of mediastinal tumor were found without a single instance of dermoid cyst. Hoffmann³ has searched the literature on the subject since the year 1825, and has been able to collect but fourteen cases. He suggests dividing these tumors into three classes:

1. True dermoids.
2. Dermoids containing cartilage and cylindrical cells.
3. Dermoids combined with lymphoid tumor.

That a division into these three groups is not a satisfactory classification will presently be shown in discussing the embryology of the subject. In the case just described the cyst was for a time considered to belong to Hoffmann's first group. After making sections from various parts of the cyst walls the presence of cartilage was finally demonstrated. Several authors have reported cases of dermoid cyst in the thoracic cavity, but have failed to mention them as originating in the mediastinum. It is the writer's opinion that in most instances the mediastinum will be found to be the original source of the cyst.

Pflanz⁴ has made a more careful search of the literature and has collected a series of twenty-four cases, to which he has added a personal case. The patient was a man, aged twenty-one years, who presented a cyst in the anterior mediastinum below the right clavicle and bulging forward behind the first and second ribs on the right side. The cyst was opened by an operation and drained. It contained hair, fat, and dermoid detritus, and the patient left the hospital with a narrow fistula remaining. The reader is referred to the original article for a careful description of the twenty-four recorded cases.

Ekehorn⁵ has reviewed the cases tabulated by Pflanz, and has added to the list five additional cases from the literature and two personal cases. His first case was that of a woman, aged twenty-one years, with a cyst in the lower portion of the right chest attached to the mediastinum. Bone and cartilage were seen, and between some of the small areas of cartilage ganglion cells and nerve fibres were present; ciliated epithelium was also found. The largest single piece of bone was 14 cm. x 2 cm. in size, from which several teeth protruded. Its whole appearance was similar to a portion of the upper jaw. The second case was a patient of Dr. Fogman's, in Stockholm, who presented a cyst to the left of the heart and attached to the left lung. Two teeth protruded from a polypoid growth in the cyst cavity. The author did not have access to the account of Smythe's case, which he mentions only by title, so I shall insert it here.

Smythe⁶ describes the case of an unknown woman, aged thirty years, who died suddenly. The autopsy revealed the presence of a cyst occupying the entire upper lobe of the left lung, and pressing upon the pericardium and mediastinum. The cyst contained dermoid tissue and hair, and in its cavity was found a bony mass weighing eight grammes. The report does not state whether the cyst was a true mediastinal one, but it undoubtedly belongs to this class.

Another case not mentioned by either Pflanz or Ekehorn is that published in 1893 by Kretz.⁷ The patient was a man, aged thirty years, in whom the diagnosis of pulmonary tuberculosis and bronchiectasis in

the left upper lobe was made, and who subsequently expectorated bits of hair. At the autopsy tuberculosis of both upper lobes was found. Besides this in the left upper lobe was a cyst the size of an apple, containing hair, fat, and pus, and to its wall a polyp was attached by a pedicle. The cyst wall contained skin, hair, and sebaceous glands, and a perforation into a bronchus was demonstrated. This specimen was examined by Kuadrat, who agreed that its origin was the anterior mediastinum.

Since the publication of Ekehorn's paper there has been another case reported by Bergmann.⁸ This was a man, aged thirty-eight years, who presented a painful swelling at the junction of the second and third costal cartilages with the sternum on the right side. A fistulous opening was seen, and when this was enlarged by an incision a cyst containing dermoid material, fine hairs, teeth, and polypoid growths was found.

These polypoid or warty excrescences are present in nearly all of the cases, and vary much in general appearance and size. They project into the cyst cavity and are usually supplied with short hairs, most frequently light in color. Occasionally these hairs may be of considerable length. According to Sutton,⁹ these polypi may even be genuine mammary glands, and may secrete colostrum. In the author's case the epidermis over these growths was thrown into manifold rugæ, giving a distinct papillary appearance to the sections.

There still remain two cases that have not been included in the previously mentioned lists. Ogle¹⁰ described an interesting case in which the polypoid growths presented an unusual appearance. The patient was a man, aged twenty-eight years, who died as the result of a profuse hæmoptysis. The sputum was offensive, and there were physical signs of an empyema. A diagnosis of bronchiectasis was made. At the autopsy a cyst was found in the lower lobe of the right lung partly in the mediastinum. Its origin was undoubtedly in the mediastinum, whence it invaded the lung, pressing upon a bronchus. The fluid contents looked like blood mixed with pus. Projecting from the wall of the cyst were five or six cream-colored, pear-shaped bodies, "with the rough aspect of skin, resembling the swollen tongue of a corpse," and covered with hair. A large tooth was also found embedded in the wall. The microscopical examination showed stratified epithelium covering fibrous and fatty tissues, and many sebaceous glands and hairs. Inflammatory tissue was present upon the surface.

The other case is the one reported by W. Hale White,¹¹ of a cyst the size of a large orange attached to the anterior and right surface of the pericardium, and adherent to the right lung. This cyst contained dirty, yellowish fluid, with cholesteria, oil globules, solid sebaceous matter, and some loosely attached hairs.

These cases, together with that of the author's, bring the total number of mediastinal dermoids up to thirty-seven.

The presence of bone, cartilage, mucous glands, smooth muscle fibres, connective tissue, and fat, together with thymus and thyroid elements arising from the mesodermal and ectodermal layers, should place many of these cysts in the group of teratomata if a finer distinction is to be attempted. In but two cases have I been able to find thymus gland tissue present. Marchand¹² describes a cyst with two processes extending upward along the trachea to the thyroid gland, containing thymus tissue and Hassall's corpuscles, and Pinders¹³ also describes lymphoid cells and thymus tissue in the first of his two cases.

Thyroid tissue has been described only by Waldeyer,¹⁴ who reports a cyst occupying the lower half of the right chest with a pedicle extending upward to the thyroid gland. This pedicle contained bloodvessels and thyroid tissue. In my case, as described above, there were small vesicles lined with columnar epithelium, which must be considered thyroid gland. Of Hoffmann's third group, dermoids combined with lymphoid tumor, there is but one recorded instance. Pinders describes a cyst occupying the anterior mediastinum from the first to the fifth rib, which contained dermoid elements, and was combined with lymphosarcoma. Metastases were found in the left lung.

The thick, honey-like contents discovered by aspiration in our case has been described by Löwenmeyer,¹⁵ who reports the case of a man dying with severe signs of dyspnea. The left chest was filled with a tumor mass, tightly adherent to the pericardium and diaphragm. Virchow studied this tumor, and found it to be a mixed type of growth, containing spindle and giant cells in parts, elsewhere distinctly striated muscle fibres (myoma striocellulare), and multilocular cysts containing thick, honey-like fluid. The lining of the cysts was partly epidermis and partly ciliated epithelium. Some structures resembled embryonic lung tissue, other parts showed tissue of a carcinomatous nature. This case must then be classed with the teratomata or with this variety associated with malignant tumor.

Belonging to this class is also the case of cystosarcoma of the lung arising from a mediastinal dermoid reported by Jores.¹⁶

ETIOLOGY AND EMBRYOLOGY. For a better comprehension of the etiology of dermoid cysts of the anterior mediastinum it is necessary to glance at the embryology of the branchial clefts, and of the thymus and thyroid glands, from which these cysts are believed to originate. According to Born¹⁷ and Hertwig¹⁸ the thymus gland is derived from the ectodermal lining of the third gill-cleft. In his earlier writings His¹⁹ described its origin from the ectoderm of the cervical sinus; but three years later he published an article in which he withdrew his former opinion and agreed with the observations first made by Born. Some writers suggest that the thyroid gland may be an etiological factor in the production of these cysts. Remak, in 1855, first described the origin of the thyroid from the ectoderm of the pharynx, but it required

the combined work of Wölfler,²⁰ Born and others to show that the median and lateral portions were derived from the floor of the pharynx between the first and second branchial arches, and from the entoderm of the fourth gill-cleft respectively. According to Minot,²¹ as soon as the gill-clefts become open passages the line of demarcation between ectodermal and entodermal lining cannot be distinguished on account of the intimate fusion of their respective cells.

It is known that the third branchial arch may dip downward over the fourth branchial arch, and becoming united to the side of the pharynx, enclose a part of the precervical sinus, forming a small closed pocket lined with ectoderm. The hinder furrow of the third cleft lies in close proximity with the thymus gland, and if from some exciting cause or irritation a growth or proliferation originates in this epithelial remnant it is easily seen that by its extension downward into the thorax a cyst may be formed. This will explain many of the simple dermoid cysts, not, however, those containing elements from all of the three embryonal layers. According to Wilms,²² teratomata may arise from a single sexual cell by a displacement or separation of tissue (mono-germinal implantation); or they may be due to the inclusion of a rudimentary twin (bigeminal implantation). Wilms has concluded to classify many of the dermoid cysts of the ovary and testicle representing all three of the germinal layers with the rudimentary parasites originating from a single sexual cell, and not as a result of the inclusion of a rudimentary twin.

Ekelhora, stating that whereas double monsters are not uncommonly seen, due to abdominal inclusions, and that union of twins by the chest (thoracopagus) also occurs, believes that, in order to explain the multiplicity of tissues found in some dermoid cysts, we must consider them to be formed by the process of bigeminal implantation, one of the twins remaining as a rudimentary undeveloped embryo. This is certainly a most convenient theory upon which to base our observations concerning those cysts that contain tissues from all of the embryonal layers. That these dermoids should consequently be classified with the teratomata is beyond question, and therefore I would suggest the following division:

1. True dermoids containing only ectodermal structures.
2. Teratomata, or dermoids with the addition of structures from the entoderm and mesoderm.
3. True dermoids or teratomata, with the addition of tumor formation.

This classification, I believe, fulfills all demands made by the histological findings in the cases in the literature more satisfactorily than Hoffmann's division of these rare growths, and is the result of my study of every reported case. It will serve, too, as a basis for grouping future cases, since it is founded on the histological evidence of all published dermoid cysts of the mediastinum.

For the privilege of publishing this case, and for the courtesy in fur-

aiding the clinical data, I am indebted to Dr. A. G. Gerster, attending surgeon to the hospital.

REFERENCES.

1. Hare. Fothergillian Prize Essay, London, 1889.
2. Fowler and Godlee. The Diseases of the Lungs, London, 1898.
3. Hoffmann. Spec. Path. u. Ther., Wien, 1896.
4. Pfanz. Zeitschr. f. Heilkunde, 1896, vol. xvii. p. 173.
5. Ekehorn. Arch. f. klin. Chir., 1893, vol. lvi. p. 107.
6. Smythe. Amer. Pract., Louisville, 1879, vol. xix. p. 313.
7. Kretz. Wien klin. Woch., 1893, Bd. vi. p. 861.
8. Bergmann. Prager med. Woch., 1893, Bd. xxiii. p. 102.
9. Sutton. Berroids or Tumors Containing Skin, Hair, etc., London, 1889.
10. Ogle. Trans. London Path. Soc., 1897.
11. White. Ibid., 1890.
12. Marchand. Bericht. d. oberhess. Ges. f. Natur. u. Heilk., Bd. xxii.
13. Pinders. Dissert., Bonn, 1887.
14. Waldeyer. Arch. f. klin. Chir., Bd. xli. p. 843.
15. Löwenmeyer. Berl. klin. Woch., 1888, No. 7.
16. Jores. Virch. Arch., Bd. cxxxiii. p. 66.
17. Born. Arch. f. mik. Anat., Bd. xxii. p. 271.
18. Hertwig. Entwickl. d. Mensch., 1893.
19. His. Arch. f. Anat. u. Phys., Anat. Abth., 1886.
20. Wüller. Ueber d. Entwickl. u. d. Bau der Schilddrüse, Berlin, 1880.
21. Minot. Human Embryology, New York, 1897.
22. Wilms. Deutsch. Arch. f. klin. Med., 1895, Bd. lv.

A CRITICAL SUMMARY OF THE LITERATURE

ON THE

SERUM DIAGNOSIS OF TUBERCULOSIS.

BY DAVID L. EDSALL, M.D.,

ASSOCIATE OF THE WILLIAM PEPPEY LABORATORY OF CLINICAL MEDICINE AND INSTRUCTOR
IN CLINICAL MEDICINE, UNIVERSITY OF PENNSYLVANIA.

DEMONSTRATION of the presence of tubercle bacilli constitutes practically certain proof of the existence of tuberculosis, but unfortunately tubercle bacilli are often absent from secretions in just the period in which diagnosis is most important, and the disease is frequently so situated that the bacilli do not gain access to secretions that may be examined. Reaction to tuberculin, while almost absolute as an indication of the existence of tuberculosis, is unfortunately a very uncomfortable method for the patient, and one which the majority of the profession still fear to use. While there is no real evidence that such fears are justified, patients are likely to rebel against the discomfort of a reaction to tuberculin, and it is scarcely probable that this method will ever be very freely used outside of hospitals, as tact in the retention of cases will often interfere even when the procedure would be otherwise advantageous. Under these circumstances a method that entails no special distress to the patient, and yet may be considered to give reasonably constant and reliable results, is extremely desirable, and such a method was