

PULMONARY ABSCESS AND BRONCHIECTASIS.*

A CLINICAL REPORT.

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SINCE the application of intratracheal anæsthesia to the human being early in 1910, with the simplification of differential pressure methods in endothoracic operative work, I have been greatly interested in the new possibilities of lung surgery. Believing that there is a peculiar interest and value in studying the methods and results of an individual surgeon, I venture to offer a series of histories and notes representing my own work since 1910 in cases of lung abscess and bronchiectasis.

There have been a number of other thoracic cases, but I have limited this paper to a consideration of the suppurative non-tuberculous lung infections.

There were fourteen operations on eleven patients, and there were but three actually "*cured*." Two cases are still unfinished and cannot be included in my table, though I present abstracts of their histories. One patient was not operated upon.

Five operations were followed by visible improvement, and there were four deaths.

Two of the fatal cases (VI and VII) I consider to have been hopeless. One of the other two might have survived for a time (Case II) had I been satisfied with a mere "*operative*" recovery. Case VII might perhaps have recovered with better technic.

Of the eleven patients operated upon five had bronchiectases and of these one patient died in the hospital. The others were more or less improved. One died about a year later of hemorrhage.

* Read before the American Surgical Association, April 10, 1914.

There were three cases of acute abscess and two of the patients recovered.

One of chronic abscess recovered.

One of acute extensive gangrene died.

One of fetid bronchitis with minute abscesses died.

Hemorrhage (hæmoptysis) was prominent in four of the bronchiectatic cases, and in these resections of the thorax certainly did result in benefit, in two of them the tendency to hemorrhage having been temporarily checked. Indeed, obviously insufficient operative attempts were several times followed by decided improvement, both subjective and objective (lessening of the amount of expectoration).

Clubbing of the fingers was a prominent phenomenon in the chronic cases, the appearance even in little children being most striking (see Fig. 1).

In trying to arrive at an exact differential diagnosis of chronic intrapulmonic suppurations it must be remembered that as a working rule all may be regarded as "lung abscesses." A lung abscess may begin outside the lung itself, as, for example, in an empyema, and the secondary abscess may even drain itself through a bronchus. Occasionally the radiograph may show a level liquid surface-line with clear space above and opacity below (see Fig. 2). But when it comes to the operation we must be prepared for surprises.

The surgeon must possess that quality of mind known as *imagination*. He must have the faculty of producing a distinct mental image showing, as it were, the physical characteristics of the object with which he has to deal. He must have in his mind a picture of the morbid part formed with the help of all the diagnostic aids at his command—and at the same time he must keep an open mind and change his preconceived idea and also his plan of action as the progress of the operation or of the disease indicates previous error.

Although bronchoscopy was practised in but two of the cases in this list, I have had the advantage of this important diagnostic aid in several other cases and shall employ it when feasible whenever a pulmonary operation is contemplated.

In addition to the possibility of finding an unsuspected foreign body some points of pathological anatomy can be cleared up with a certainty at least as great as that achieved in urological cases by cystoscopy.

My attempts at cure by operation were: Thoracotomy and drainage.

Thoracoplasty for reducing the capacity of the affected side. Extrapleural tamponade (Tuffier).

Extirpation of the affected part of the lung.

I have been surprised in some of my cases, especially those of bronchiectasis, at the tremendous toughness, thickness and rigidity of the inflammatory tissues surrounding the diseased focus. This point alone is enough to convince one of the futility of treating these cases by artificial pneumothorax and to make one doubt the efficiency in indurated bronchiectasis of Tuffier's method of extrapleural plugging, which he has so successfully employed in apical tuberculosis.

Briefly, this operation consists in the careful digital dissection of the unopened apical pleura from the endothoracic fascia through an intercostal incision; the forcing downward of the entire apex compressing the lung tissue so as to leave a great hollow where the apex was; then the implantation of living tissue, either fat or benign tumor substance, so as to fill completely the dead space; finally, the closure of the wound by suture. I would suggest as a name for this ingenious operation biotamponade—or if fat is used, lipotamponade.

In old cases of fetid bronchiectasis with the usual mixture of bacterial strains and with intimate adhesion between the visceral and parietal pleuræ, there is a very real danger of infecting the tissues surrounding the newly made extrapleural cavity even without breaking into the septic focus. This danger is obviously less when we are dealing with a pure tuberculosis.

The two-stage operation in certain forms of true lung abscess may be an advantage. At first the free pleural cavity is opened, inspected and palpated, and the extent and character of the disease ascertained. A few days later the drainage

operation may be undertaken with increased accuracy and better chances of success. The general pleural cavity can be well protected, even in the neighborhood of suppuration (see Case VIII and Case IX).

If the operation is to be performed with a view to resection of the diseased lung, however, one sitting is best.

Differential pressure, however attained, is a valuable aid in chest surgery, but it must be understood that most of the commoner operations upon one lung can be done with anæsthesia managed in the ordinary way.

No major work through the thoracic cavity should be undertaken without full narcosis.

Anæsthesia by intratracheal insufflation has been a great comfort in many of these cases and its application tends to become simpler. Still, in spite of the beautiful, almost automatic, character of this method of anæsthesia it is far from "fool-proof," and there should be the most scrupulous attention to details. The apparatus must be tested immediately before using it. A supplementary bellows must be at hand in case the electricity fails, a woven trachea tube of proper size ($\frac{1}{3}$ to $\frac{1}{2}$ the calibre of the trachea) must be selected and inserted under the guidance of the eye. During the entire operation the air pressure and the strength of ether mixture must be carefully observed. Even when everything is running smoothly and the patient's color is good the pressure should be completely shut off for a few seconds every minute. And there are a number of other points which it is not necessary to mention here. However, the technic is not difficult to acquire and it can be well studied by experiment in the ordinary run of surgical cases in which the differential pressure element is not an essential factor.

REPORTS OF CASES WITH CRITICAL REMARKS.

CASE I.—*Bronchiectasis*. B. F. Exploratory thoracotomy in intratracheal anæsthesia.

The history of this patient has been reported and may be found in the ANNALS OF SURGERY for July, 1910. It was the first

case in which thoracotomy in a human being had been performed with the aid of intratracheal anæsthesia. The disease had been characterized by the usual profuse expectoration and by severe attacks of pulmonary hemorrhage. The operation was an exploration which revealed the site of the tough adhesions in the right subscapular region (indurative bronchiectasis—Hoffmann). The hand within the thorax, aspiration through the sound chest wall was practised but the abscess could not be found by this means. For some reason improvement followed this insufficient operation but the patient died of a hemorrhage a few months later.

CASE II.—*Bronchiectatic abscess; thoracoplasty; infection of opposite lung. Death.*

I. B., a boy of nineteen was referred to me on August 11, 1911, by Dr. James A. Miller, from his service at Bellevue Hospital.

Eight months before his illness had begun with pain in the right chest, cough and fever. No tuberculosis.

When he came to me he was in good general condition though there was some cyanosis. His breath was very fetid and there was a daily expectoration of eight ounces, the patient often vomiting from his cough.

The pulse was normal, the temperature rising at times to 100°. Over both chests were numerous moist râles but the right base appeared to be most involved. Below the tenth rib posteriorly on the *left* side there was impaired resonance.

A radiograph by Dr. Hirsch disclosed a shadow representing the diseased area in the right chest.

Operation.—On August 17, 1911, at Bellevue Hospital, the patient in ether anæsthesia, I resected two inches or more from the seventh, eighth, ninth, and tenth ribs, my incision being parallel with the border of the latissimus dorsi muscle. The pleura was not violated.

While this operation did not diminish the quantity of sputum, its character changed and became non-odorous and more mucoid. The temperatures ranged about 99° F.

In March, 1912, the patient entered Mt. Sinai Hospital for further treatment because of repeated severe hemorrhages.

An X-ray picture at this time showed some clearing of the former shadow but there was opacity in the right base up to the ninth vertebra. The general condition and weight had improved

greatly after the operation but had then deteriorated. Expectoration about four ounces a day.

On April 12, 1912, I removed large sections of the second, third, fourth and fifth ribs in the axillary line, the anæsthetic being ether administered by intratracheal insufflation. The patient's color remained excellent during the anæsthesia, but directly afterward there was deep cyanosis continuing for some hours. For about two weeks there seemed to be improvement but the left lung became acutely infected and he died on May 16. Unfortunately no autopsy.

Critical Note.—Another discouraging case. The question comes up as to the possible influence of the intratracheal insufflation in the appearance of the acute process in the left lung, although it must be borne in mind that this lung was far from normal from the beginning. Still, the second operation under the insufflation was no more severe than the first in ordinary anæsthesia. Perhaps the tube was too large in spite of its careful selection. That injury to the lung can occur from intratracheal insufflation is well known, though a proper sized tube and attention to details of pressure with periodic collapse of the lungs should make the accident a rare one.

CASE III.—Bronchiectatic lung abscess; resection of ribs and attempted drainage. G. R., thirty years old, had been sick for nine weeks with pain in the right upper chest, cough, profuse and extremely fetid expectoration, fever, vomiting, one chill, and night sweats. There had been much loss of weight and three slight hæmoptyses.

He was referred to me by Dr. James A. Miller, who stated that the case was very probably non-tuberculous, a number of sputum examinations having been negative.

The blood showed 18,000 leucocytes with 90 per cent. polymorphonuclears.

On February 6, 1912, he was admitted to Mt. Sinai Hospital.

There was fetid expectoration amounting to about 200 c.c. in twenty-four hours. Cough and expectoration occurred at once when the patient lay upon his left side. There was dulness in the right posterior chest from about two finger breadths below the angle of the scapula. Prolonged expiration at the upper level of the dulness with harsh breathing and coarse sonorous and sibilant râles below this point.

Radiography showed an opacity in the right upper chest reaching almost to the apex of the right lung but not entirely obliterating the normal transparency at this point. The opacity was as large as an adult human palm.

Dr. Miller stated that he had aspirated the suspected area and had secured a few drops of thick mucopurulent material.

On February 16, in intratracheal anæsthesia with ether, an incision was made along the border of the latissimus dorsi, beginning almost at the apex of the axilla. Sections of the third, fourth and fifth ribs were removed here and the chest opened. The pleura was free everywhere except posteriorly and the area above indicated where there were dense adhesions. The lung and parietal pleura were united by a running catgut suture, except posteriorly where the adhesions existed. A large aspirating needle was then plunged repeatedly into the indurated mass but failed to reach a pus cavity.

About six days after this operation I punctured the site of the supposed abscess a number of times through the wound. The result was persistently negative. The patient, however, continued to improve, expectoration amounting to less than 200 cubic centimetres in twenty-four hours and there was an increase of seven pounds in weight. On March 20 he was discharged from the hospital, the wound healed. His sputum then amounted to 100 cubic centimetres in the day. He was subjectively and objectively improved.

Note.—There is nothing remarkable about this case unless it be the fact that as in Case I an insufficient operation was followed by unexpected improvement. I proposed further surgery to this patient but he regarded his condition as tolerable and therefore he refused.

CASE IV.—*Bronchiectatic abscess; thoracotomy and drainage; multiple rib resection.* On December 17, 1912, this patient, Harry G., twenty-three years old, was transferred from the medical service of Dr. Manges at Mt. Sinai Hospital. He had been ill for six months with cough and profuse foul expectoration—always more abundant in the morning. There had been eight hæmoptyses, much blood being lost each time. There were occasional slight attacks of fever.

On physical examination, there was dulness with hard breathing and inconstant "sticky" râles in the right axilla. The patient

had clubbed fingers. His general condition, however, was excellent as to nutrition and musculature.

The temperature was normal, the pulse 80 and the respiration rate 24.

A radiograph made by Dr. Jaches, on December 7, 1912, revealed a sharply defined, oblong shadow opposite the base of the heart, with a prolongation upward and outward. There was also a narrow shadow passing downward and outward (see Fig. 3).

Operation.—On December 20, 1912, in intratracheal anaesthesia, an incision was made parallel to the fibres of the latissimus dorsi muscle in the right posterior axilla. A four inch section of the fifth rib was removed and an attempt was made to enter the pleural cavity. Adhesions all about, however, showed a complete walling off. A section of the fourth rib was removed, also without entering the general pleural cavity, and a needle puncture withdrew a small quantity of fetid pus. A narrow opening was made with the scalpel and then with dressing forceps the extremely tough and dense membrane surrounding the abscess itself was torn apart, the dressing forceps on withdrawal widening the opening into the cavity. Explored with the finger there were evidently many loculi and the case one of bronchiectatic abscess. But little pus escaped at this time. The abscess was very deep and lay next to the anterior chest wall. The entire wound was now packed with gauze and the patient sent back to bed with the intention of subjecting him to further operation at another time. The anaesthesia had been excellent throughout, although some blood and pus had appeared at the patient's mouth during the operation.

Ten days later the patient was anaesthetized in the usual manner with nitrous oxide and oxygen and, in the hope of reaching the bronchiectasis more directly, about two inches of the fourth rib were resected at its anterior inner portion. To my surprise, upon incising the chest at this point I found that I had invaded the free pleural cavity. It was quite clear that the former operation had drained the abscess as far as was possible, so the opening in the pleura was packed and the remainder of the wound was sutured. A tube was later placed in the abscess cavity and suction maintained with the apparatus referred to in Case IX. The patient's condition now improved every day but he still daily

expectorated from three to five ounces, the only difference noted being that the discharge was less purulent and more mucoid than it had formerly been.

The wound healed and the patient was sent to a convalescent home. His general health was good but the cough and expectoration for which he sought relief had been influenced but little.

Nearly a year after the first operation this man presented himself again, saying that he was unable to work and that the foul discharge from his lungs made him so miserable that he was willing to submit to anything rather than continue as he was.

On November 21, 1913, in ether anæsthesia by inhalation, I removed sections from the fourth, fifth, sixth, seventh, eighth and ninth ribs through a long posterior incision. The inner bone-sections were made just to the spinal side of the costal angle and the amount resected was about two and one-half inches from each rib. The pleura was not injured. The wound was closed by suture with tube drainage above and below. While hemorrhage had been free it was not near the danger line. The chest wall was thoroughly strapped so as to approximate the cut ends of the ribs and reduce the size of the thoracic cavity.

Another examination of the sputum was negative for tubercle bacilli. A culture by Dr. H. Plotz, of the Pathological Laboratory, showed *bacillus mucosus capsulatus* and from this a vaccine was prepared and given. Highest dose one billion. The patient thought he noted improvement following this therapy. There was now steady progress but by no means a cure. The patient's general condition was very good and his "emptyings" occurred usually but once a day—in the morning. The discharge was not as foul as it had been and the quantity was seldom more than three and one-half ounces.

The case is not yet finished and I hope to improve his condition still further, perhaps by completing the Wilms's operation, resecting the ribs anteriorly, or possibly by attempting the extirpation of the well localized lung infection.

Because of recent published experiences and because Dr. Yankauer had found and removed an unsuspected foreign body from the bronchiectatic cavity of an old man in one of the medical services at Mt. Sinai, H. G. was bronchoscoped before his discharge from the hospital but nothing was found. The diagnosis of bronchiectasis was, however, confirmed.

A glance at the photograph (Fig. 4) gives an idea of the man's general condition and also shows the degree of deformity produced by the operation. The X-ray (Fig. 5) shows the collapse which was attained.

Note.—I am by no means proud of this result even though it compares favorably with many of those reported in recent literature. If we ever are to accomplish anything like an actual cure in these almost hopeless cases it will be by means of direct surgical attack with the actual removal of the bronchiectatic mass.

CASE V.—Bronchiectatic abscess; transpleural drainage. A. S., a woman of twenty-six, had been well until March, 1912, when she had "pneumonia" followed by left empyema for which she had been operated upon in another hospital. She had been sent home "well" but there was a relapse and a discharging sinus persisted. At the time of her first operation she was coughing up enormous quantities of pus.

She entered Mt. Sinai Hospital on April 19, 1913. The left lung was entirely dull and in its lower third flat. There were bronchial breathing and numerous râles.

There was a deep sinus in the posterior axillary line at the level of the eighth rib and when the patient coughed there was a mucopurulent discharge.

X-ray by Dr. Jaches showed in the left chest one homogeneous shadow, denser below.

On May 26, 1913, in ether intratracheal anæsthesia, I made long resections of the sixth and seventh ribs in the postaxillary region but extending far toward the back. A honeycomb cavity fully as large as a man's fist was exposed, the walls lined with sluggish granulations and showing five separate bronchial fistulæ of various sizes. The tough pleura on the costal side was resected and the huge cavity was packed (see Fig. 6).

The patient made rapid improvement and the wound again shrank to a sinus, which was in truth a mere bronchial fistula discharging opalescent mucus when the patient coughed. She was discharged three months after the operation.

Twelve weeks later, November 15, 1913, there was an infection of the sinus with constitutional symptoms. Under suitable dressings the bronchial fistula regained its "normal" condition.

Critical Note.—This case illustrates the futility of expecting a radical cure of these bronchiectatic cavities by ordinary drainage, no matter how perfect. The walls are rigid and the bronchial openings cannot fall together nor do they granulate. I repeatedly tested the various escharotics and the actual cautery through the ample opening, but with no good effect. In another case—perhaps even later in this one—an attempt might be made to dissect out a stump of each bronchus from the wall of the cavity, crush it and ligate in the hope that granulation tissue might then form and lead to a permanent closure.

CASE VI.—*Diffuse pulmonary gangrene; hamopneumothorax; thoracotomy. Death.* H. A., a man of forty-eight and previously healthy, was seen by me in consultation with Dr. D. H. Davison on October 11, 1913, after two weeks of what had been diagnosed left septic pneumonia. The disease showed no tendency to clear up and the entire left chest was flat to percussion. Aspiration by the attending physician withdrew foul, sanguineous fluid which under the microscope showed no white cells but granular detritus, bacteria and blood pigment with broken down blood-cells. The heart was but little displaced. Patient icteric and septic with pulse 120 and temperature 104°. There was little cough and no foul odor from the mouth.

A few hours later, in local anaesthesia, I resected the eighth rib in the posterior axillary line, evacuating much fluid, clot and fetid gas.

Next day I was able to get a good view of the lung itself which was dry and obviously gangrenous as far as the eye could see. The pleura also was sloughing and a whistling sound within the chest indicated an opening into the lung. The wound remained dry and necrotic, delirium supervened and four days after operation death occurred. No postmortem.

Note.—This case is of interest principally because of the absence of physical signs indicating pneumothorax. The entire chest in all postures was absolutely flat to percussion, yet there was much gas under pressure in the pleural cavity. The character of the aspirated fluid and especially the absence of pus cells led us to diagnose perforation of the lung before operation. I have seen the same noncellular foul sanguinolent fluid in a chest some days after a gunshot injury of the lung. Judging by the great extent of the lung necrosis this case was hopeless from the first.

It was one of those cases, rare on the operating table, in which there was gangrene without suppuration.

CASE VII.—*Acute abscess of the lung; thoracotomy and drainage.* About seven months before admission to Mt. Sinai Hospital, Harry L., forty-one years old, had been seized with a malady accompanied by a severe cough with fetid expectoration, following undue exposure to cold. There was fever and loss of weight. The amount of expectoration was as much as eight ounces in a day. There had been no night sweats.

He was transferred from the medical service of Dr. Alfred Meyer on March 29, 1912, after a residence of several weeks in the hospital. During this time his temperature had rarely risen to more than 100°. Repeated examination of the sputum had failed to disclose tubercle bacilli but there were distinct evidences of pulmonary disease of the upper portion of the left chest.

An X-ray examination on February 7 showed a distinct circular shadow below the left pulmonic apex and apparently nearer the back of the chest than the front (Fig. 7).

About the 22nd or 23rd of March the patient began to have high fever with alternating drops of temperature, but the sputum was still negative for tubercle bacilli and the white blood count was normal. On March 29 Dr. Meyer had aspirated pus through the anterior part of the chest.

The same afternoon under ether administered by the intra-tracheal insufflation method, I made an incision beginning near the apex of the axilla and running parallel to the border of the latissimus dorsi muscle for about six inches. The serratus magnus was divided at this place. Sections of the third, fourth and fifth ribs were removed over an area the size of the palm of the hand. Careful dissection between mouse-tooth forceps showed that the pleura was intimately adherent to the lung. Aspiration of the abscess was followed by a free opening made with the dressing forceps, the general pleural cavity remaining uninvaded. On digital exploration there was thorough walling off, although from the large quantity of pus expectorated it was most probable that an opening into the bronchus existed. The abscess cavity was irrigated, then lined with a pouch of rubber dam which in turn was filled with gauze. Iodoformized gauze was packed into the external part of the wound and a few sutures were placed in its lower part. During the operation there had been a con-

siderable discharge of pus and mucus from the mouth. The patient was sent back to the ward in good condition.

Although during the next 48 hours the temperature came down, the patient was in a very uncomfortable and serious condition, owing to the gathering of large quantities of discharge in his trachea. This he seemed unable to expectorate, although on observation it appeared that he raised and swallowed the discharge. Periodically the foot of the patient's bed was elevated eighteen inches and he was turned upon his face in the hope that this might facilitate the bringing up of the pus.

Four days after the operation the patient died, evidently of a pneumonic process, probably near the site of the abscess. No autopsy was permitted.

Critical Note.—Apparently a serious secondary infection with putrid abscess had begun when the temperature rose just before the operation. The patient's condition then seemed grave.

One technical error was committed—namely, the irrigation of the abscess cavity. It has been pointed out by Garré and Quincke that this procedure is particularly hazardous because of the danger that septic fluids may enter bronchi which until then have escaped or that the infection may even run over into the healthy lung. And it appears to me that even with the advantage of intratracheal anæsthesia fluid introduced in great quantity, as by irrigation, may not be blown out of the mouth quickly enough to prevent extensive septic flooding.

CASE VIII.—Acute abscess of the lung; thoracotomy and drainage. Miss E. B., twenty-four years old, had been well until September 24, 1912, when she had an attack of what was called "la grippe." The most annoying symptom was pain in the external anterior part of the right chest at about the level of the third or fourth rib, and this point was also very tender to the touch. For four weeks the patient ran an irregular temperature, the pain and tenderness persisting.

I saw her with her physician, Dr. Manges, on October 12, in the Private Pavilion of Mt. Sinai Hospital. Aspiration had been performed a few days before when a little slightly clouded serum had been withdrawn. Subsequent aspiration was, however, negative. A Röntgen picture suggested fluid to the level of the seventh or eighth rib in the right chest (Fig. 8). The patient's condition

was wretched. There was mucopurulent, blood-tinged expectoration, cyanosis and dyspnoea.

In nitrous oxide and oxygen anæsthesia, I aspirated repeatedly in the posterior axillary region but with negative result. I then made an incision parallel to the border of the latissimus dorsi muscle and removed generous sections of the eighth and ninth ribs, opening the pleural cavity for inspection. There was no fluid and there was but one firm, dense adhesion binding the lower lobe anteriorly to the chest wall. Otherwise, although the right lung appeared to be covered with a rather thin layer of greyish membrane, there were no adhesions.

The peculiar greyish appearance of the diaphragm was so remarkable that I excised a minute piece of it under the impression that its examination might prove useful. The muscle was, however, so extremely thin that the tiny opening spread until it was fully as large as a dime. I closed this by a single mattress suture. The chest wound was now also closed, a piece of gauze being left as a packing down to the adhesion. At the end of the operation it was found that the patient had had a considerable discharge of blood from the mouth.

There was a decided improvement in the general condition following this merely exploratory procedure and the wound healed kindly without the occurrence of intrapleural suppuration. The pain in the anterior chest, however, did not disappear and cough and expectoration continued. The temperature rarely rose now to a point beyond 101° . There was considerable improvement in nutrition.

About the tenth of November a point of induration was noted just beneath the right mamma, and four days later, in nitrous oxide anæsthesia, a long incision was made in the inframammary fold and pus was encountered here outside of the chest itself. The mamma was turned up off the chest wall and the origin of the flow of pus was found in the nipple line just below the fifth rib. A section of this bone was removed and the finger could easily explore a sponge-like abscess about 30 c.c. in extent. A tube was put in as a drain and the submammary exposed space was lightly packed with gauze.

Convalescence from the operation was rapid and the patient was discharged from the hospital in a month. A few weeks

later healing was complete. The inframammary cicatrix was most unobtrusive.

Note.—In the case just reported the exact diagnosis was in doubt. Referring to the radiograph (Fig. 8.), the straight horizontal limit of the right chest shadow strongly suggested fluid level—yet this appearance must have been caused by something else unless we can imagine that an extremely thin layer of liquid exudate could have caused it. Comparing the density of media in the two "clear" parts of the chest there is no hint of compression on the right side such as we might have expected had fluid forced the lung upward.

My first operation was truly an exploration and it accomplished the localization of the abscess and gave knowledge as to the extent of the adhesions, so that at the second step I resected rib without fear of invading the uninfected part of the pleural cavity. I have since made use of this double operation with success.

CASE IX.—*Abscess of the lung complicating paratyphoid fever; thoracotomy and drainage.* On December 22, 1912, N. S., a man of twenty-two, was transferred from the Rockefeller Hospital to Mt. Sinai Hospital with a diagnosis of empyema in the course of paratyphoid fever.

The history abstract stated that he had also been treated at the Rockefeller Hospital for what appeared to be a complicating lobar pneumonia. He had been aspirated in the seventh interspace at the right scapular line and 20 c.c. of thick, greenish pus had been obtained.

On examination there was dulness below the fourth rib anteriorly and beneath the level of the eighth dorsal spine posteriorly. Breath sounds over the flat area were diminished or absent. Fremitus was increased.

The white blood-cells were but 10,200, the temperature was 101°, the pulse 100 and the respiration 24.

The patient still suffered from his paratyphoid infection and was acutely ill.

On the following day he was anesthetized with nitrous oxide and oxygen and I resected the seventh rib where it crossed the border of the latissimus dorsi muscle. Before making the incision aspiration was practised and only on very deep puncture toward the base of the chest was pus obtained. Entering the chest after the rib resection there was no fluid and there were no

adhesions, except of the right lower pulmonary lobe to the diaphragm and outer chest wall. Under the guidance of the eye an indurated place in the right lower lobe was aspirated and pus obtained. It was then determined not to evacuate the abscess at this sitting. Instead, a portion of the eighth rib was also excised so as to make the opening into the chest ample. Gauze packings were put in so as to cause the formation of adhesions between the parietal and visceral pleuræ above the abscess, with a view to evacuation at a second sitting.

Four days later the patient was again taken to the operating room and without anæsthesia the central packing, which went down to the abscess, was removed, leaving the "walling off" packing undisturbed. The opening was large enough to permit of aspiration with the aid of sight through the very thick firm-walled abscess and pus was again obtained. The scalpel was now carried down to the point where the needle entered the lung and the abscess wall, tough and almost cartilaginous in feel, was incised and the opening enlarged with dressing forceps, but the fluid was evidently not under very great tension and it was not until the patient was turned upon his side that a large quantity of extremely foul and thick pus poured out in a syrupy stream. A large sized drainage tube was carried several inches into the cavity which was irrigated and new packings were placed around that part of the tube between the thoracic wall and the actual opening of the abscess.

The culture from the laboratory was reported "streptococcus" (examined by Dr. P. Aschner).

On January 8, 1913, twelve days after the evacuation of the abscess, the last of the walling-off packing was removed, much force being required to detach it from the pleural adhesions. Now local improvement set in but the constitutional symptoms were still severe, the temperature often reaching 105°. The wound was apparently divided into two parts, the first being virtually an encapsulated empyema, the actual lung abscess being entered by an opening just about large enough to fit the tube and this opening was almost a finger's length from the surface. On account of the very great rigidity of the abscess walls drainage was not easy. The patient was now transferred to a bed on the roof and a suction apparatus was improvised with the aid of a vacuum cleaner and a bottle for collecting the discharge. This

was kept going day and night and I believe contributed greatly to the comfort of the patient and to his convalescence. The wound was healed in the latter part of April and the patient was sent to a convalescent home in the country. He gained rapidly in health and strength, although his cough was slow in disappearing. In June the cicatrix broke down and discharged for a few weeks but closed spontaneously and the man has remained in excellent health ever since.

Note.—In spite of the history of pneumonia and the careful examinations made by the Staff of the Rockefeller Hospital, it appears to have been impossible to make an accurate pre-operative diagnosis in this complicated case. The suspected empyema turned out to be a lower lobe abscess and though there was no sign of subphrenic suppuration before operation it may well be that an infection of this kind existed with slow boring of pus into the chest and into the adherent lung on its way toward a bronchus whence, had the patient's strength held out, evacuation through the mouth might have resulted.

Drainage by the use of the vacuum cleaner surely benefited this man—and for some days the same device with two tubes sufficed to empty the abscess of H. G. (Case IV), the one machine doing double duty. I now make use of a special suction pump devised by an instrument maker. This apparatus consists of an electric pump, a vacuum tank and a gauge for regulating the suction power. The pump acts intermittently, ceasing when the required vacuum in the tank has been secured and starting automatically when necessary to keep up the requisite exhaustion of air. The machine is quiet and requires but little attention.

A case of interest in comparison with that of N. S. is here recorded.

CASE X.—A. M., thirty-five years old, a physician, was referred to me by Dr. James A. Miller, on January 8, 1913.

One year before he had been operated upon for chronic appendicitis. There had been primary union but at the end of a week he had what was called "paralysis of the bowels." He was up and about six weeks after the operation but he walked with his body bent to the right. Suddenly he coughed up a large amount of pus. Ever since then he had had attacks of coughing and raising mucopus sometimes with blood, the whole never amounting to more than four ounces in a day. Occasionally a whole

month would pass without cough. When the abscess filled he had fever.

A radiograph made by Dr. Lewis Gregory Cole is here reproduced (Fig. 10). Quoting in part from Dr. Cole's report, "There is a thickening around both roots and one of the branches of the right descending bronchi. There is consolidation of the lower part of the right lung obliterating the costodiaphragmatic angle, or the lung may be displaced upward by an accumulation of fluid in this region. The thickening along the branch of the right descending bronchus indicates that this is the route by which this abscess cavity empties. The thickening around the root on the opposite side indicates that there is a slight infection in this region. There is no evidence of any other abscess in the parenchyma of the lung."

Considering the patient's condition, which was not bad, and the fact that he would go sometimes as long as a month without a discharge from the abscess and without fever, I suggested that a culture should be made from the sputum with a view to autogenous vaccine therapy. A pure streptococcus strain was found at the Sondern Laboratory in June and fifteen injections were taken. On October 21 the patient presented himself looking well. He stated that there had been but one slight attack in four months.

I believe that the prognosis in this case is favorable for a final complete obliteration and cicatrization of this suppurating cavity.

CASE XI.—*Abscess of left lung, upper lobe; thoracotomy and drainage.* The unusual case of V. H., a boy of twelve, is interesting. He had been for some weeks under the observation of Dr. Koplik and had entered Mt. Sinai Hospital late in December, 1912. The history was one of left pneumonia in infancy; tonsils and adenoids removed in 1910. A few months prior to admission he had had a pneumonia and this was followed by chronic cough and an occasional hæmoptysis, with pain in the left chest.

The boy looked pale and thin. There was clubbing of the fingers. Physical examination of the lungs showed, posteriorly, dulness at the left apex to a finger's breadth below the spine of the scapula. Anteriorly and in the upper axilla there was dulness.

The dull areas showed bronchial voice and breathing with sub-

crepitant râles over the left supraspinous region. Bronchovesicular breathing over the left interscapular region.

The blood count: white cells, 15,000; polynuclears, 54 per cent.; small lymphocytes, 27 per cent.; large lymphocytes, 16 per cent.; transitionals, 1 per cent.; eosinophiles, 2 per cent.

Neither the sputum nor the Von Pirquet test gave evidence of tuberculosis.

On December 21, 1912, pus was obtained by aspirating in the left armpit, the needle pointing upward and backward.

Operation.—On January 2, 1913, in ether anæsthesia, an incision was made from the middle of the clavicle downward two and a half inches, dividing some of the pectoralis fibres. About three-quarters of an inch of the second rib was resected, the aspirating needle forced through the thick, almost cartilaginous, tissues and the abscess opened widely with director and dressing forceps. About three drachms of thick, foul pus were evacuated and tube drainage instituted.

Below and to the outer side of the abscess walls normal pleura could be seen moving with respiration.

For two weeks the case went smoothly and the patient improved, the cough diminishing. Then came fever and pain in the wound. Aspiration and digital examination failing to disclose the cause of the continued fever, cough and slight hæmoptysis, the patient, on January 24, 1913, was once more anæsthetized and, guided by a finger in the wound, a needle was passed through the posterior wall of the cavity where a few drops of thick foul pus were obtained. A dressing forceps following the needle was pushed through until its blades could be felt beneath the skin just above the scapula and here a second incision was made. A large drainage tube was drawn directly through the apex of the lung, from back to front. Improvement went on from this time, though progress was interrupted by occasional fever. Fifteen days after the last operation the tube was replaced by three strands of thick silk. Ten days later the silk was withdrawn and the tract filled with Mosetig-Moorhof's iodoformized wax. About three months after the first operation the boy was discharged recovered. He has continued in excellent general health, does not cough and has become big and strong. He has even "grown up to" his clubbed fingers, the deformity having almost disappeared (see Fig. 11).

Critical Note.—Surgically speaking, this was a case of lung abscess. Dr. Koplik regarded it as one of apical empyema, but whether or not the case began in the pleura the suppuration was anatomically in the lung, as shown by operation and by the expectoration of pus and by the hæmoptyses. I do not regard it as primarily bronchiectatic but as an abscess caused by pulmonary necrosis in the course of a pneumonia, bronchiectasis perhaps occurring secondarily. The extremely dense, tough wall about the pus sacs—at least two in number—is suggestive of “indurative bronchiectasis.”

CASE XII.—*Fetid bronchitis mistaken for chronic abscess of the lung; extrapleural tamponade with paraffin (Tuffier).* The patient, J. P., was a man forty-two years old. His disease began with cough, slight fever, profuse mucopurulent expectoration and night sweats with loss of weight. Sometimes he vomited after a severe coughing spell. There developed pain in the right chest and the odor of the sputum became foul. The temperature gradually rose until it reached 104° with the pulse rate varying between 96 and 120. Two weeks after the onset he entered Mt. Sinai Hospital on the medical side. This was on August 8, 1913.

The physical examination of the lungs at that time showed dulness with diminished breathing in the right axilla. Posteriorly, on the right side there was dulness from a point two fingers breadth above the angle of the scapula down to the base, with diminished vesicular breathing and diminished fremitus accompanied by noisy crepitant and subcrepitant râles.

The blood count showed 18,800 white blood-cells with 75 per cent. polymorphonuclears, 24 per cent. lymphocytes and 1 per cent. eosinophiles.

The sputum was very abundant, pale yellowish-green and persistently negative for tubercle bacilli.

On August 15, 1913, and again on the 29th an X-ray examination was made by Dr. Jaches. The report stated that the right apex showed slight density with infiltration of the root of the lung and with bronchial nodes. At the right base there was a dense infiltration continuous with that of the right lung. The right diaphragm was high (Fig. 12).

The findings on fluoroscopy indicated the presence of fluid in the right costophrenic space. The diaphragm on that side was fixed.

The patient was kept under observation for a number of weeks, occupying a bed in the open air on the roof and in excellent hygienic surroundings. There was, however, no improvement—rather a retrogression, although the general condition remained good.

There appeared to be two kinds of sputum; the one not foul, the other extremely fetid. The amount gradually increased until on November 6, 750 c.c. in twenty-four hours were discharged.

Early in November, the patient was examined by Professor Tuffier of Paris, and his case was pronounced a suitable one for the operation of extrapleural compression.

Some days later bronchoscopy was performed in local anæsthesia by Dr. Yankauer. At this time there was no sign of bronchial dilatation nor was there at the time of the bronchoscopy any discharge of foul pus. Dr. Yankauer, therefore, concluded that probably there was a parenchymatous lung abscess communicating with a bronchus, and he believed that at the time of the examination this communication must have been plugged.

On November 7, 1913, in ether anæsthesia administered by the intratracheal method, I made an intercostal incision between the eighth and the ninth ribs through the endothoracic fascia to the pleura, which was then separated digitally from the chest wall without opening the sac itself. This peeling away of the pleura was done as Tuffier advises—very slowly and carefully. It was not a difficult procedure. The ribs of this patient, however, were very close together and I wished to avoid the long intercostal incision. In order to gain more space I resected about four inches of the eighth rib. There was finally a cavity formed which I judged to be about 400 c.c. in size. During this procedure there was a discharge of extremely foul pus from the patient's mouth.

Paraffin, with a melting point between 105 and 108° F., was then put in—about 300 c.c. in all. I began with the paraffin in the liquid state but this was unmanageable, since it did not solidify quickly enough to prevent its being expelled and, therefore, pieces of soft solid paraffin were eventually employed. The patient stood this operation well although his pulse rose to 105°. The wound was closed without drainage.

The immediate result of the operation appeared to be favorable. The patient expectorated much less than before, but on

November 10, on examining the wound there was much bulging and on separating the edges a large quantity of turbid serum escaped. The patient then gradually deteriorated and the septic manifestations became progressively worse.

On November 19 I was obliged to reopen the entire wound without anæsthesia and I removed the paraffin, packing the cavity lightly with gauze. Two days later, also without anæsthesia, I aspirated the lung hoping to find the abscess but without success. Death from his septic chest condition occurred on November 28.

An autopsy through the wound was performed by Dr. Bachr and this brought forth some interesting and suggestive disclosures.

At the site of the operation and, in fact, over the entire right base the visceral and parietal pleuræ were densely adherent. There was found not a single large collection of pus in the lung but in each lower lobe there were eight or nine small abscesses, most of them from one to two centimetres in diameter and lined by pyogenic membrane. The bronchi to both lower lobes and some to the upper showed intense congestion of the mucous membrane and in some places hemorrhage. All the bronchi were filled with thick, greyish-white purulent material. In addition to the abscesses there were some small areas of grey hepatization and small areas of gangrene, particularly in the right lower lobe. The latter as well as many of the abscesses were peribronchial in distribution. In the left lower lobe there were numerous small areas of purulent broncho-pneumonia.

I will now quote from the microscopical examination:

"There is a marked thickening of the pleura from which fibrous bands run into the lungs. The walls of some of the bronchi are infiltrated with polynuclear and round-cells. Many of the small abscesses can be definitely seen to have their origin in and about a small bronchus. In addition to the presence of small purulent foci some of the portions of the lung are seen to be completely necrotic."

The bacteriology showed the presence of diplococci, probably pneumococci, some streptococci and an abundance of Gram-positive and Gram-negative bacilli.

All the time that we thought we were dealing with a bronchiectatic abscess or some other form of lung abscess the disease was in reality a presumably incurable septic fetid bronchitis with its sequelæ of suppuration and necrosis in the lung itself. And this particular error is one which has often been made. (Garré and Quincke.)

The case just reported was one in which there was a complete agreement in the diagnosis among all those who saw the patient clinically. He was supposed to be suffering from "bronchiectatic abscess of the right lower lobe." Yet the bronchoscopy changed all this, for no bronchiectasis was discovered. The case then, in view of the two kinds of sputum, began to look like one of extrabronchial abscess and, indeed, the post-mortem findings showed this in measure to be true, though there was no actual fistulous connection between one large abscess and a bronchus. The infection of the operative field is also hardly to be wondered at, remembering the close adhesion of the septic lung with the parietal pleura.

The misreading of the X-ray plates is an old story; and nowhere can one be misled more easily than in the diagnosis of intrathoracic conditions.

In a recent case which was in the service of a medical colleague signs pointed to a subdiaphragmatic abscess with lung fistula and the radiograph showed a high right midriff dome. The patient had expectorated eight ounces of foul pus in one gush. His condition was critical. Tenderness and a mass in the right upper abdominal quadrant led me to incise here and I quickly emptied a gangrenous gall-bladder. Still the X-ray would not permit the idea of subphrenic disease to be put aside. At a careful post-mortem examination there was no subphrenic abscess, no liver abscess, no lung abscess! I have, indeed, come to the conclusion that a high diaphragm often signifies a relaxation or paralysis of this muscle in nature's effort to reduce pressure upon inflamed organs, and that its existence is by no means pathognomonic of an exudate beneath.

CASE XIII.—*Suppurative bronchiectasis; removal of right lower pulmonary lobe.* Francis W., at two and three-fourths years of age, had fallen while he was holding some partially masticated nut in his mouth and, in the gasp which followed or accompanied his fall, some of the foreign material was aspirated into the lungs. There developed cough of a spasmodic nature, with the expectoration of much purulent mucus.

With the aid of the bronchoscope, Dr. Yankauer had succeeded in removing much of the foreign matter and was finally unable to discover anything more within the visible part of the lung. Bronchoscopy was performed six or seven times during the following year. Still the cough and expectoration continued and now fever and rapid pulse were also observed, the temperature reaching as high as 105° and fluctuating at this high level for several days at a time with remissions between.

An X-ray picture by Dr. Jaches showed opacity at the right base which extended up to the eighth rib (Fig. 13).

The child now entered the surgical department of Mt. Sinai Hospital. He was well nourished but pale and apathetic. There was very marked clubbing of the fingers and toes (Fig. 1). The usual signs of consolidation were found at the right base. The spasms of coughing with the ejection of large quantities of foul mucopus were most painful to watch.

Three times after admission to the Hospital he was bronchoscoped by Dr. Yankauer, and after each bronchoscopy with the clearing out of the cavity there was a remission in temperature. Judging by the amount of discharge at each emptying I had some hope that a Tuffier extrapleural tamponade might tend to improve the drainage in this case and, therefore, on January 23, 1914, in ether anæsthesia by the intrapharyngeal method managed by Dr. Branower, I made a long incision between the eighth and ninth ribs down to, but not through, the pleura. In order to get more room without making too long an incision I resected a part of the ninth rib and by digital separation I made a cavity about 40 c.c. in size. Into this I placed three pieces of fat from the abdominal wall of another patient and closed the wound without drainage. No improvement followed this procedure, the coughing spells and expectoration remaining about the same. For a few days the temperature remained in the neighborhood of 100° and then there was a sharp rise to 104° with corresponding constitutional symptoms. The wound was slightly infected and slow in healing.

A month later, February 27, 1914, a minute sinus remained. The child's condition, however, was such that something radical had to be done.

Another bronchoscopy by Dr. Yankauer enabled him to see

all the bronchial openings but the picture was practically unchanged. Dr. Branower again managing intrapharyngeal ether anæsthesia, I made a long incision above the eighth rib into the pleural cavity, spreading the ribs wide with retractors. The exposure was perfect. The two upper pulmonary lobes were apparently normal, of the usual yellowish-pink color of a child's lungs. The lower lobe, however, was liver color and of a firm consistency. The piece of implanted fat was in position and apparently alive. There were dense adhesions of the lower lobe to the diaphragm and to the lateral costal pleura. All adhesions were quickly and rather roughly freed with the finger so that it was possible to place a strong double ligature of chromicized catgut completely around the hilum of the lower lobe after having crushed the part with a powerful clamp. The lobe was then cut away. A slight oozing from the stump led me to transfix once more and to ligate again double. The stump was then carbolized, salt solution was placed within the thoracic cavity, a piece of gauze was laid against the raw surface of the stump and led out of the posterior angle of the wound and another little piece of gauze was placed in the original sinus. The ribs were then approximated with chromicized catgut by the pericostal method. A continuous suture of fine chromicized gut was used to hold the intercostal structures together and the cutaneous incision was sutured with fine silk. At the end of the operation the patient's pulse was about 150 but of good quality. The color which had been slightly cyanotic during the greater part of the operation became normal. Reaction was prompt and in less than an hour after the operation the boy was wide awake and crying. The hemorrhage had not been severe, most of it coming from the peeling away of the adhesions.

A careful examination of the lobe which had been removed showed that all the bronchi were dilated and turned into what might be called abscess cavities. There was no trace of a foreign body.

The first twenty-four hours after the operation the temperature did not rise higher than 101° . The patient's condition was good, pulse about 140, very little cough, no expectoration. Then there was a rise to 103° the pulse reaching the alarming rate of 200. The wound was at once dressed, a little superficial sup-

puration found and all skin sutures removed. The gauze at the posterior angle of the wound was loosened and there was a discharge of turbid fluid, probably a mixture of salt solution and pus. A tube was slipped in alongside the gauze and full stimulation was ordered. The hæmoglobin a few days after operation was, to my surprise, 75 per cent. though the little patient looked very anæmic. Very gradually there was improvement, for two weeks, the child being in a serious condition, the pulse causing especial anxiety on account of its great rapidity.

About a week after the operation mechanical suction apparatus was fitted to the tube within the wound and this avoided frequent change of dressing. The patient's appetite remained good throughout.

On March 16, the slough representing the stump of the lung came away.

After this there was steady improvement and the patient, at the present writing, six weeks after the lung resection, is in a satisfactory state of convalescence. A very small opening in the chest is still present but the outlook is most favorable.¹

Note.—This case demonstrates that bronchiectasis originally caused by foreign body aspiration may persist in an apparently incurable state after the removal of the exciting cause.

The amount of fat put in at the time of the Tuffier's lipotamponade, in view of the later findings, was absurdly small. But judging by the appearance and size of the bronchiectasis as seen after the resection I doubt that enough fat could have been transplanted to cure the patient.

The cause of the tachycardia is somewhat obscure. Whether it was a septic phenomenon or whether, perhaps, it had to do with the changed pulmonary circulation it would be hard to say. Dr. Koplik, who saw the case in consultation, advised us to give digitalis and under this drug the pulse rate was certainly favorably influenced.

CASE XIV (Unfinished).—*Bronchiectasis; thoracotomy and drainage.* Louis G., thirty-three years old, was admitted to Mt. Sinai Hospital on February 26, 1914. He had been a patient of Dr. Mannheimer.

Four years before he had had pneumonia followed by empyema for which he had been operated upon. For three years

¹ At the time of proof-reading, May 10, 1914, the boy is perfectly well.

he remained well then began to cough and expectorate large quantities of mucopurulent material. There were occasional marked hæmoptyses. The daily amount of expectoration was eight ounces. The patient was altogether miserable and unable to work. He had lost weight and strength.

On admission, a cicatrix representing the former operation was seen in the posterior axillary line over the ninth rib which apparently had been resected. The general condition of the patient was good. The lungs anteriorly were negative and the right lung was also negative posteriorly. On the left there were signs representing consolidation from the left scapula to the base. There was clubbing of the fingers.

An X-ray picture showed an infiltration of the left base with what seemed to be a pulling of the cardiac apex to the left by adhesions.

About March 5 the patient was bronchoscoped by Dr. Yankauer. This bronchoscopy was rather unsatisfactory, owing to the extremely poor anæsthesia and the rigidity of the patient's neck which made it difficult to introduce the instrument. Dr. Yankauer failed to demonstrate a bronchiectasis but thought that he saw granulation tissue in the bronchial walls.

On March 11, 1914, in intratracheal ether anæsthesia, I incised one space above the old cicatrix and to my chagrin passed through the diaphragm and into the abdomen. The peritoneal opening was at once sutured and the chest entered in the seventh interspace with wide resection of the seventh and eighth ribs. There was a mass of pleuritic adhesions, the lung also being adherent to the chest wall so that twice it was injured and had to be sutured. A needle puncture now permitted the aspiration of a few drops of foul, thick pus and in the posterior part of the wound near the angle of the rib I opened into the now empty bronchiectatic sponge. The cavity, about 50 c.c. in bulk, was packed with gauze and part of the cutaneous wound closed with drainage. Considerable distress followed the operation, with cough, temperature 103° and bloody expectoration.

To-day, April 10, the patient's condition is improved and the wound is healing rapidly. He still expectorates from one to two ounces daily and his complete cure without further operation is doubtful.

TABLE OF OPERATIVE CASES RECORDED.*

Case No.	Name.	Age.	Sex.	Date.	Disease.	Type of operation.	Anesthesia.	Post-operative days in hospital.	Immediate result.			Remarks.
									Cured.	Improved.	Died.	
1	B. P.	55	M	Feb. 21, 1910	Bronchiectasis	Exploration	Insufflation ether	27	...	I	...	Died one year later of pulmonary hemorrhage.
2	I. B.	19	M	Aug. 17, 1911	Bronchiectasis	Thoracoplasty	Inhalation ether	42	...	I	...	Infection of the other lung.
3	I. B.	20	M	Apr. 12, 1912	Bronchiectasis	Thoracoplasty	Insufflation ether	34	...	...	I	...
3	G. R.	30	M	Feb. 16, 1912	Bronchiectasis	Thoracoplasty	Insufflation ether	32	...	I	...	Opening into bronchiectasis closed spontaneously.
4	H. G.	23	M	Dec. 20, 1912	Bronchiectasis	Thoracoplasty and drainage	Insufflation ether	60	...	I	...	Improvement but condition still unsatisfactory, 3 to 4 ounces of sputum per day.
4	H. G.	24	M	Nov. 21, 1913	Bronchiectasis	Large thoracoplasty (posterior)	Inhalation ether	90?	...	I	...	...
5	A. S.	26	P	May 26, 1913	Bronchiectasis with fistula	Free drainage by rib resection	Insufflation ether	90	...	I	...	...
7	H. L.	41	M	Mar. 29, 1912	Acute abscess	Thoracoplasty and drainage	Insufflation ether	4	...	...	I	...
8	E. B.	24	P	Oct. 12, 1912	Acute abscess	Exploratory thoracotomy	Gas and oxygen by inhalation	...	...	...	...	...
8	E. B.	..	..	Nov. 14, 1912	Acute abscess	Second stage thoracotomy and drainage	Nitrous oxide inhalation	62	I	...	...	Patient remains well to date.
9	N. S.	22	M	Dec. 23, 1912	Acute abscess	Thoracotomy and drainage	Nitrous oxide and oxygen	120	I	...	...	Patient well to date.
6	H. A.	48	M	Oct. 11, 1913	Pulmonary gangrene	Thoracotomy and drainage	Local	4	...	...	I	Hopeless from the beginning.
11	V. H.	12	M	Jan. 2, 1913	Chronic abscess of apex	Thoracotomy and drainage	Ether inhalation	88	I	...	...	Thorough drainage, transparent region to front of chest.
12	J. P.	42	M	Nov. 7, 1913	Fetid bronchitis	Extrapleural tamponade (Tulfer)	Insufflation ether	21	...	...	I	Case mistaken for bronchiectasis.

* CASE XIII, unfinished at time article was read, is now complete and adds one more cure. See history in body of text.

FIG. 4.

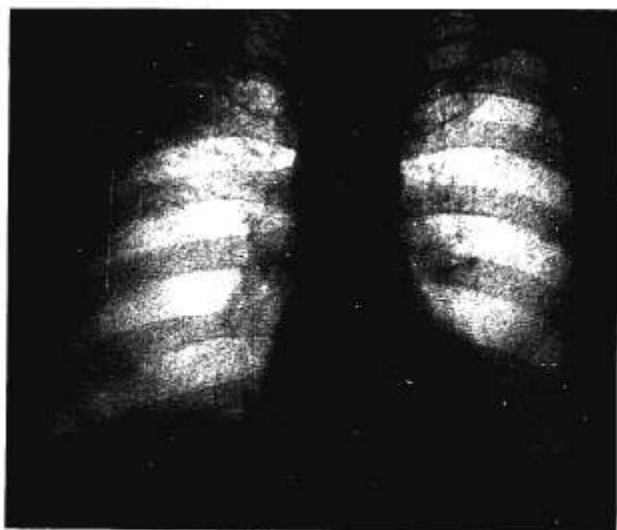


Photograph and radiograph of hand of P. W. Case XIII. (Continued of figures with no visible lesions in the fingers)

d

a

FIG. 2.



Abscess partly filled with fluid. Note line of liquid level. Right upper lobe. (This patient was not operated upon.)

FIG. 4.



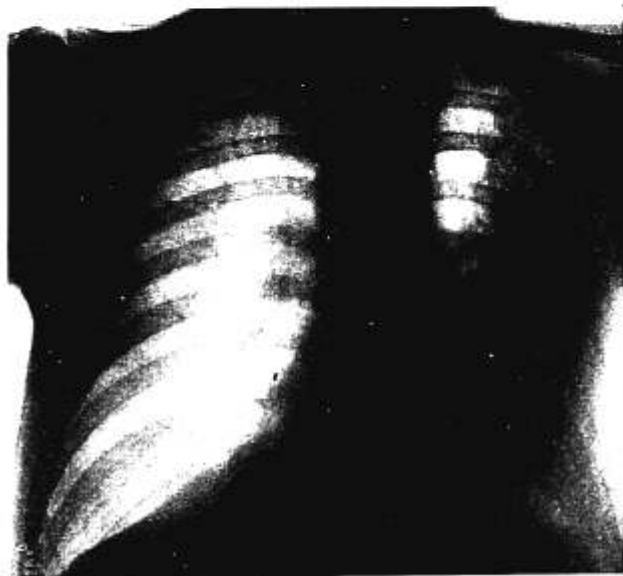
Anteroposterior radiograph demonstrating extent of bronchogenic mass. Compare with Fig. 3.

FIG. 4.



Case IV. Result of posterior thoracoplasty. Compare with Fig. 3.

FIG. 5.



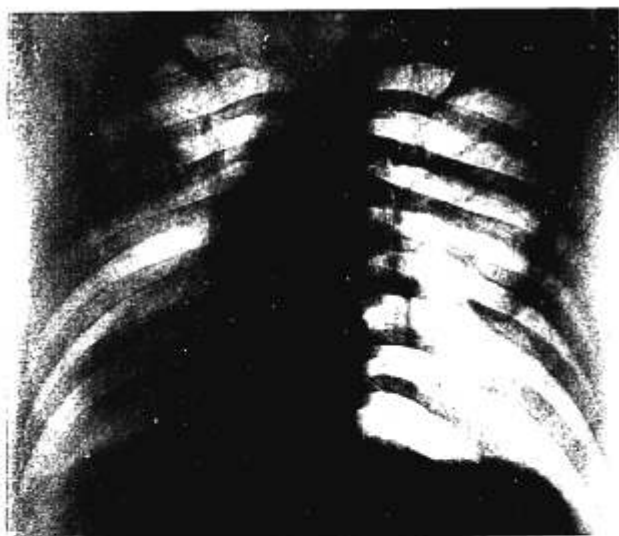
Posterior radiograph showing reduction in the capacity of the right chest following thoracoplasty, Case IV.

FIG. 6.



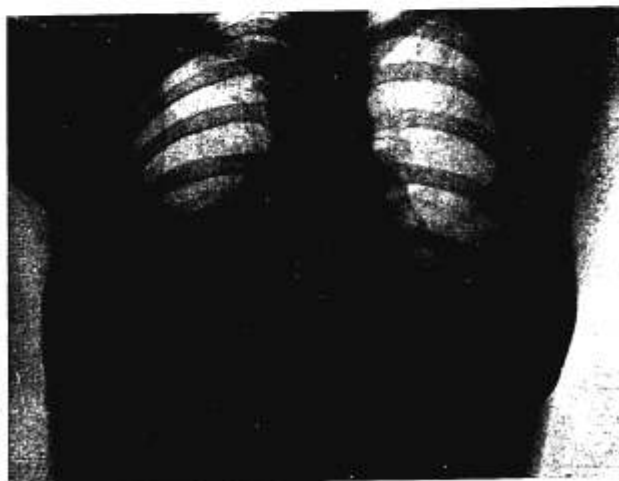
Drawing from sketch (Fig. 5). Note the size of the wound and the five bronchial openings. Even this thorough drainage did not result in cure.

FIG. 7.



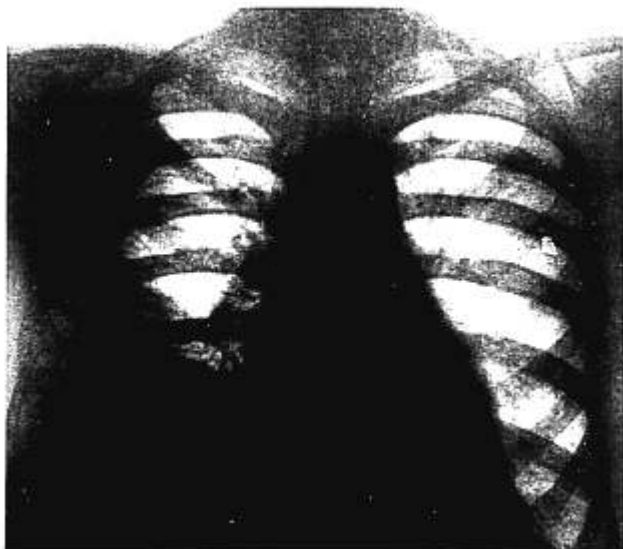
Posterior radiograph. Pyothorax of left upper lobe. Case VII.

FIG. 8.



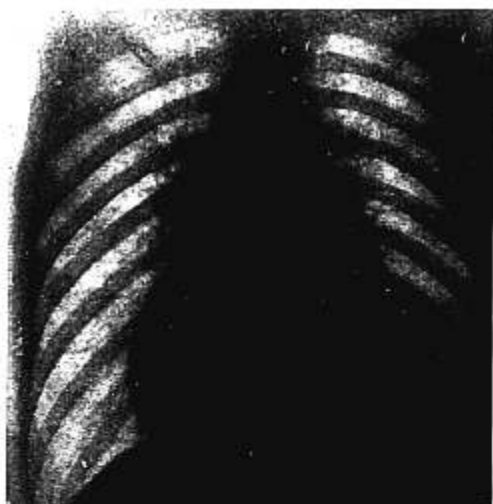
Acute lung abscess. Note pseudo-fluid level. There was no free fluid in this chest. Case VIII. Miss E. B.

FIG. 9.



Case IX. Large purulent abscess right lower lobe. Probably from a subdiaphragmatic source.

FIG. 10.



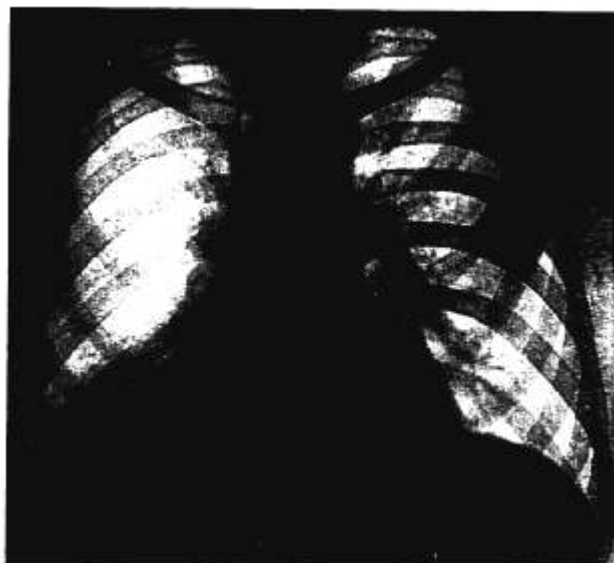
CASE X. Showing opacity in right chest probably indicating course of subdiaphragmatic abscess to a bronchus.

FIG. 11.



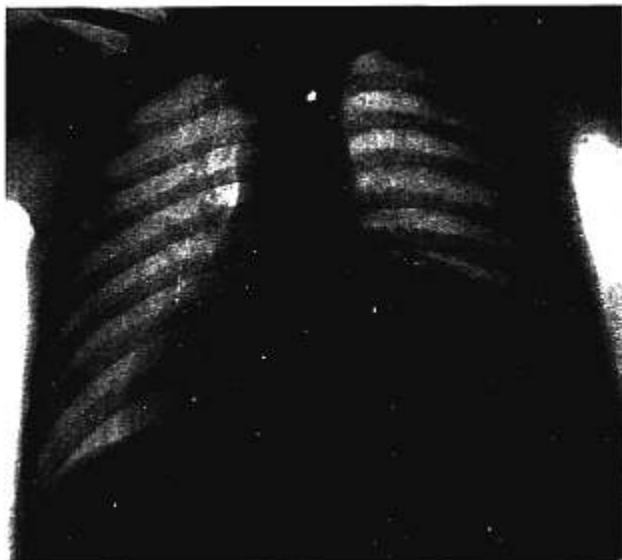
Photograph showing patient recovered after drainage of apical abscess. Clubbing of the fingers no longer present.

FIG. 13.



Case XII. Fetid bronchitis mistaken for right lower lobe bronchiectasis.

FIG. 13.



Case XIII. Case of bronchiectatic infection of entire right lower lobe.

CONCLUSIONS BASED ON OBSERVATIONS IN THE CASES
RECORDED.

1. The differential diagnosis of true lung abscess and suppurative bronchiectasis is important.
2. Radiographic study of each case is essential.
3. Bronchoscopic examination is a valuable procedure, and should not be omitted.
4. Drainage of a lung abscess by thoracotomy is likely to result in cure.
5. Drainage of large infected bronchiectases may be followed by improvement, but complete recovery is unlikely.
6. Extensive thoracoplasty should be reserved for those cases in which other operations have failed.
7. Exploration of the pleural cavity and of the lungs by intercostal thoracotomy is feasible and reasonably safe.
8. Extirpation of a bronchiectasis by removal of the affected portion of lung may lead to complete recovery. The danger of the operation is great.
9. Artificial pneumothorax and Tuffier's extrapleural tamponade should be reserved for cases of pure tuberculosis.
10. Intratracheal insufflation is a simple, accurate and safe method of securing differential pressure.
11. Operations involving one lung can be performed with inhalation anæsthesia.