shortened and the patient became disappointed. For this and other reasons it is probably best not to offer artificial pneumothorax as a substitute for bed rest but as an adjunct; to stress recovery rather than mere duration of time.

Among other advantages are the following:

As Compared With Bed Rest Alone—In the exudative case, bed rest should be instituted until localization occurs, when pneumothorax can be administered with greater safety. In other cases, pneumothorax may be attempted earlier if toxicity is not too great. If successful, pneumothorax assures a greater degree of healing and therefore a more permanent result. This constitutes the great advantage of this method over bed rest alone.

As Compared With Pneumothorax in Conjunction With Closed Intrapleural Pneumolysis—If adhesions are present and can be gradually stretched so as not to interfere with healing, pneumolysis may not have to be resorted to. In many cases it is surprising how much can be accomplished in the stretching of adhesions. If, on the other hand, adhesions are not too extensive and are favorably located and the sputum remains positive one should not hesitate to perform intrapleural pneumolysis. Great harm can result from continuing a pneumothorax when adhesions are preventing a satisfactory result.

Summary and Conclusions

1) Before contemplating artificial pneumothorax the physician should carefully weigh all the factors making for probable success or failure.
2) Pneumothorax therapy in the exudative case should be preceded by a trial of bed rest of two to three months.
3) Mobile mediastinum accounts for failure of many cases of pneumothorax. In severe cases, withdrawal of the pneumothorax, in whole or in part, may be necessary.
4) Pneumothorax, if successful, offers the expectation of a more permanent result of treatment than bed rest alone.
5) If adhesions can be successfully stretched, closed intrapleural pneumolysis may not be necessary.

References

The Treatment of Lung Abscess

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In common with many other conditions involving the lungs, the treatment of lung abscess has undergone radical changes in the past few years. The handling of cases with tuberculosis by surgery has contributed greatly to our knowledge of the mechanics and physiology of respiration and has given us more confidence in attempting surgical procedures on the lungs which in the past were considered extremely hazardous.

It is not intended to go into a lengthy discussion in this paper of the etiology or symptomatology of pulmonary suppuration. Some authors state that lung abscesses occur by aspiration of infected material by means of the bronchogenic route, while there are others who disagree with this and feel that the disease is embolic in origin. This author, however, is inclined to feel that the majority of the abscesses we see occur by aspiration and that a small minority are hematogenous in origin. An interesting question that has been brought up in connection with the two theories is, "If the aspiration theory is correct, why should so great many abscesses be found in the upper lobes?" An answer to this may lie in the fact that when a person is in the horizontal position, as while sleeping or lying on an operating table, the bronchi leading to the upper lobes are directed downwards, thus making it very easy for aspirated material to enter those lobes.

As for the bacteriology of this disease, almost any and every organism has been found in connection with lung abscesses. An important fact, though, is that approximately eighty per cent of all pulmonary abscesses contain anaerobic organisms and twenty pe...
cent contain aerobic organisms. This has been shown in the writings of Allen and Blackman, Coryllos, Ornstein, Stern, Cutler, and others. These facts, together with the evidence that anaerobic organisms are inhibited by the presence of oxygen, make a good argument in favor of open drainage.

Ten years ago many forms of collapse therapy such as phrenic nerve operations, pneumothorax and thoracoplasty were employed with enthusiasm. The opinion at present is that all of these procedures are not only of no value whatsoever, but are definitely contraindicated. The value of collapse treatment is undisputed in dealing with tuberculous cavities. Although in both conditions there is literally a “hole in the lung,” the analogy goes no further. The cavity in tuberculosis is inhabited by an aerobic organism which will be inhibited with the shutting off of an oxygen supply by collapsing the lung. The various forms of collapse therapy, and particularly operations upon the phrenic nerve, have a tendency to lower the vital capacity and to inhibit the cough reflex. These results are particularly dangerous to any patient producing a large quantity of sputum, because of the difficulty he may have in emptying his bronchi, which might result in either a spread of the infection or the development of a bronchial obstruction. Pneumothorax has been tried and found to be of no use and exceedingly dangerous. In 1935, Clyde Allen and James Blackman reported on twenty-six cases in which this procedure was tried. In five of these cases no collapse could be obtained because of adherent pleurae. In seventeen cases, a partial collapse was obtained which affected, for the most part, only the healthy portions of the lungs. Five cases of complicating empyemata occurred in this group. In only four cases was a satisfactory collapse obtained. One of these recovered, one was lost track of, and two died. Ten cases of this group went on to have surgical interference with only two deaths.

At the present time, there is still a great deal of discussion concerning the treatment of lung abscesses. One group advocates so-called conservative measures, while the other is in favor of surgical treatment. It might be recalled here that, in connection with tuberculosis, at one time the group who were opposed to collapse treatment called themselves conservatives; but when the truth was out, it was the other group who was conserving the patients.

Before going any further let us all recognize one fact. We all know that some lung abscesses heal spontaneously without any special form of treatment. About fifteen to twenty per cent of all lung abscesses will do this. We also know that there is no manner of telling which case will fall into this group or into the much larger group in which progression of the disease occurs. And unless someone comes along with a form of treatment listing higher than twenty per cent cures, it will be hard for him to prove that some of his cases did not get well in spite of and not because of the treatment. We have to think of this when we talk about the use of bronchoscopy, chemotherapy, and the myriad of other proposed remedies. Another frequently forgotten point in connection with conservative therapy is the time it takes for a case to get well and resume his former occupation. Besides the physical disability connected with several months’ prolonged treatment there is also a huge economic loss.

The medical procedures in the treatment of lung abscesses include postural drainage, bronchoscopic aspiration and irrigation, intravenous injections of arsphenamine and guaiacol, rectal instillations of ether in oil, and oral administrations of iodides, sulfanilamide, sulfapyridine, sulfathiazole and other drugs.

The accepted surgical treatment is open drainage by removing the ribs and unroofing the abscess cavity with the cautery. This is done by means of either a one-stage or two-stage procedure. The latter consists of removal of the ribs and packing to promote adhesions and later opening into the abscess cavity; the former consists of opening into the abscess all in one operation. The two-stage procedure is by far the safest and does not permit the possibility of a complicating empyema. It has been the custom of the author to operate all cases by the two-stage method. In the first stage, after removal of the ribs and intercostal bundles, iodoform packing is placed in contact with the parietal pleura and the wound is closed with interrupted sutures going through all layers. A rubber tissue drain is inserted to relieve the
pressure of the exudate that forms. By the third day the parietal and visceral pleurae will be found to be well adherent and the abscess then can be opened and unroofed by means of the actual cautery. Thus it can be seen that the time interval between the two stages is insignificant. Formerly the packing was left in place for from five to seven days before performing the second stage operation. It was later discovered that from thirty-six to forty-eight hours was sufficient for strong adhesions to form. The second stage is simple and requires for anesthesia only the local injection of novocaine to reopen the wound and remove the packing. There is no shock and no pain when the cautery is used. With this technique there is absolutely no danger of creating a complicating empyema, the occurrence of which would be disastrous. In fourteen of a series of eighteen cases, the author has been able to demonstrate the visceral pleura freely moving beneath the parietal layer indicating a possible danger if the one-stage technique should be used. This has been true even with abscesses having a duration of as long as twelve and fifteen months. The accuracy of previously interpreting adhesions between the pleurae by means of an X-ray film is hereby questioned. In none of this series of cases was there a resulting empyema. There were no cases of a persistent broncho-cutaneous fistula. This fact leads to what is believed an important point in the technique of performing the first stage. Long sections (about five inches) of three ribs are usually removed along with the intercostal bundles, thus producing early mobilization of a large surface of lung overlying the abscess. By so doing this, it is possible for the elastic lung tissue to contract completely around the cavity and close it without leaving a fistula. No sutures are used in the second stage of the operation. The wound is left wide open. The cut margins of the skin, subcutaneous tissue and muscle layers are protected with vaseline gauze and the abscess cavity is loosely packed with plain gauze. The dressing and packing are changed daily. When there is very considerable drainage the dressing is changed more often. It is of the utmost importance to carefully pack the wound daily in the later weeks otherwise the skin will close over before the abscess has shrunk sufficiently to heal. Many individuals can be up and about within a week following drainage and can resume their occupations long before the wound is completely closed. In the above series, even with daily packing, it was not possible to keep the majority of the wounds open longer than an average of eight or nine weeks. Some closed in six weeks.

In the consideration of medical procedures, postural drainage is of definite help in removal of secretions and should be used in all cases. Bronchoscopy may help with establishing drainage but has no direct effect upon the abscess itself. The essential value of bronchoscopy is for diagnosis and not therapeutic purposes, except for the removal of foreign bodies or plugs. Pneumothorax is definitely contraindicated because of the danger of tearing pleural adhesions and producing an empyema. When a pneumothorax is instituted, a potential pleural space is converted into an actual one. Thus, if the disease should extend to the periphery of the lung, it could readily spill into the pleural cavity, there being no protection afforded by previously inflamed and adherent pleurae. Whatever successes achieved with any of the other methods alone, most likely have been due to spontaneous improvement rather than to the effects of the specific therapy.

Symptomatic improvement in the patient is a totally unreliable index of the ultimate prognosis. Remissions of temperature and recurrence of exacerbations are typical of the disease. The patient, in the majority of instances, will show a marked clinical improvement as soon as bronchial drainage is established. His temperature may return to normal and even his expectoration may decrease. However, unless the X-ray film shows a definite clearing of the process, he will have recurrences at later dates.

Milton B. Rosenblatt, in a recent excellent survey of seventy-two cases of lung abscesses treated medically at New York City Hospital, has presented the following statistics. Cured, four cases (five per cent); improved, three cases (four per cent); unimproved, thirty-one cases (forty-four per cent); dead, thirty-four cases (forty-seven per cent). In other words, nine per cent were cured or improved and ninety-one per cent were unimproved or dead. In forming his statistics, he used these criteria:
1) Cured: No symptoms and no x-ray evidence of abscess.

2) Improved: No symptoms and x-ray evidence of retrogressive lesion.

3) Unimproved: Symptoms present or absent, but x-ray shows abscess to be stationary or progressive.

His statistics are not the only ones to show a poor prognosis for the conservative treatment of lung abscesses. F. T. Lord reported a seventy-five per cent mortality rate in ninety-seven cases. Allen and Blackman reported twenty-five per cent dead in fifty-five cases; Cutler and Gross, thirty-eight cases with twenty-eight per cent dead.

One must remember, though, that unless definite criteria for classifying the cases has been established, many erroneous discharge diagnoses will be made. Many of the cases discharged as improved from the hospitals, if followed up carefully, might be discovered as having died later on, elsewhere. A majority of the unimproved cases will swell the mortality statistics if they are followed up over a period of time.

In regard to the statistics following surgery, a summing up of the reports of Cutler and Gross, Flick, Clerf, Funk and Farrell shows that out of one hundred and forty-eight surgically treated patients, sixty-two per cent recovered and thirty-eight per cent died. Here again the cases must be definitely classified in order to find the true picture. The figure thirty-eight per cent is not a true mortality rate for the "surgical treatment of lung abscesses." The techniques of thoracoplasty and thoracotomy were employed in these cases as well as drainage by pneumonostomy. Whenever any of the aforementioned techniques or lobectomy has been used, it means that the lung abscess has been complicated by an empyema, bronchiectasis or extension of the disease. This, in many instances, is due to improper handling of the case before it reaches the surgeon or to too long a period of waiting with conservative treatment. The mortality of simple abscess cases that are treated by cautery pneumonostomy, there were seventeen complete recoveries and only one death. This occurred in a man sixty years old who had uncontrollable diabetes and a multilocular abscess that almost completely excavated his right upper lobe. He was almost in a state of asphyxiation from the huge quantity of sputum he was producing and was operated upon as an emergency. His condition alternated between threatening diabetic coma and insulin shock and he died three days after the operation. A post-mortem examination revealed eight small fresh abscesses, each about two centimeters in diameter, in both the right and left lower lobes, that were not present on an x-ray taken four days before death.

The discussion now comes to the point of what to do for a case with a lung abscess. Instead of the medical treatment being set entirely apart from the surgical treatment, it is believed that the medical man and the surgeon should work in close cooperation with each other. All cases should be treated with early postural drainage. Bronchoscopy should be used as a diagnostic procedure and in those cases in which a foreign body is suspected. This is an important routine procedure, and will often avoid the distressing experience of opening into a lung abscess that is secondary to a bronchial carcinoma. The sputum should be cultured and in those cases in which there is a specific drug for the predominating organism present, it should be given along with the rest of the treatment. Then early operation and aeration of the abscess is the rational solution to the problem.

It is probably needless to say but it will do no harm to mention the fact that all possible efforts should be expended in eliminating the tubercle bacillus as a cause of the cavity before any surgical drainage is attempted.

The question now arises as to when these patients should be operated upon. According to many authors, an observation period of six weeks was arbitrarily chosen because it usually comprised the acute phase of the disease. During that time there is an acute inflammatory pneumonitis with the lung breaking down and being expectorated, forming the cavity. Some cases break down earlier than this, however, and may within a short time become complicated with an empyema which very often means death to the patient. At
one time a case came to our attention of a girl twenty years old who developed a lung abscess one week following a tonsillectomy. She was treated conservatively and four weeks later the abscess spontaneously ruptured into the pleural space causing a virulent putrid empyema. A thoracotomy was performed but within a week she developed a pneumonitis in the contralateral lung and died. All these events occurred within six weeks following the tonsillectomy. As there is no definite yardstick to tell us which of these cases will get rapidly worse and which will get well spontaneously, it seems logical to make the statement that as soon as a definite abscess cavity can be demonstrated and localized on an x-ray film (by means of postero-anterior and direct lateral films), it should be opened and drained. One of the arguments advanced by those opposed to early surgery in the acute stage has been the possibility of a spread of the gangrene caused by early incision through acute pneumatic lung tissue. In reply to this, it can be stated that the author has encountered no instances of such an occurrence in any of his series of eighteen cases, eight of which were operated upon within four weeks from the onset of symptoms. Two of these cases had their operations thirteen and fifteen days after the beginning of the disease. It is quite possible that some of the reported instances in which a spread of the gangrene has occurred following operation were due not so much to the actual incision of the gangrenous tissue at operation but to hypoventilation of localized portions of the lungs and retained bronchial plugs of infected exudate. If this is so, extremely careful postoperative management with principal attention to hyperventilation, cough, postural drainage, limitation of narcotics, and possibly bronchoscopic removal of secretion would be the logical prophylaxis. Don't blame the actual surgery for spreads.

Summary

1) The majority of lung abscesses occur by means of aspiration through the bronchogenic route.
2) The anaerobic character of the infection in the majority of abscesses is emphasized.
3) Various forms of collapse treatment have been tried and found wanting and are definitely contraindicated.
4) Fifteen to twenty per cent of lung abscess cases do heal spontaneously but it is a serious offense to hold a case on so-called conservative treatment indefinitely because eighty to eighty-five per cent will get worse and after a time develop a bronchiectasis or an empyema which would require radical surgery or else permit no help at all.
5) Various medical procedures used in the treatment of lung abscesses have no definite therapeutic value except as an adjunct. Whatever improvement occurs with their use alone is probably the result of spontaneous healing.
6) A plea for definite standard criteria for the evaluation of statistics is made.
7) A brief mention is made of a personal series of eighteen cases with a mortality of one case.
8) In answer to the question, "How soon should we operate?", the statement is made: "As soon as a definite abscess cavity can be demonstrated and localized accurately, it should be opened and drained." No one questions the advisability of open drainage of a brain abscess, ischiorectal abscess, appendiceal abscess, or one on the finger or toe. Therefore, it is difficult to understand why one should make an exception to the long recognized treatment of localized pus, merely because it occurs in the lung.

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References