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A CONTRIBUTION

TO THE

TREATMENT OF EMPYEMA.

BY

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TREATMENT OF EMPYEMA.<sup>1</sup>

BY A. T. CABOT, M. D.

BEFORE proceeding to the consideration of the cases upon which this paper is based I wish to review briefly the mechanical principles involved in the expansion of a lung which has been compressed by fluid in the chest, and to show how this expansion may be favored by an appropriate dressing after the establishment of a free opening into the pleural cavity.

Suppose a case of empyema in which an opening has been made and the pus allowed to escape. Upon the removal of the pressure the lung at once expands somewhat by virtue of its own resiliency, and by the partial reestablishment of its circulation. Further, each contraction of the chest with closed glottis (cough or sneeze) presses the air from the well side over into the affected lung, partially expands this, and so forces the air or fluid in the pleural cavity out through the opening in the side. When the cough subsides, and the chest again expands, air rushes back to take the place of that just expelled. There are two avenues by which this returning air enters the chest; namely, the bronchus of the lung, and the opening into the pleural cavity.

If this latter opening be as free and unobstructed as the bronchus, the air has as ready access to the pleural cavity as to the bronchial tubes, and the pressure on the outside and inside of the lung being thus equalized it resumes its condition of semi-collapse.

<sup>1</sup> Read before the Section for Clinical Medicine, Suffolk District Medical Society.



If, however, the opening in the side is narrowed by the closing in of granulations or by the obstruction of a dressing, the air returning after a forced expulsion is somewhat opposed in its entry into the pleural cavity, while the bronchus admits it freely, so that the atmospheric pressure inside the lung is somewhat greater than upon its outer surface, and the dilatation effected by the cough is more or less maintained. It is thus that nature, with its fistulous openings, provides for the expansion of the lung, and we here, too, find the explanation of the gradual dilatation effected by the usual dressings of oakum or other absorbent material.

This gradual dilatation of the lung is liable to be interfered with by a provision of nature which here may act detrimentally to the healing process. I refer to the adhesion of the inflamed pleural surfaces when brought in contact. Of course, if the surface of a lung only partially dilated becomes firmly adherent to the parietal pleura, the further dilatation is greatly interfered with, and may become impossible. It is, therefore, very important to induce the lung to dilate to its fullest extent as soon as possible, so that the pleural adhesion, when it takes place, may bind things in their proper places. That this rapid dilatation may be powerfully assisted by a proper dressing I shall endeavor to show.

The problem is to provide for the easy escape of air and fluids from the chest, and to obstruct the reëntry of air into it.

A Lister dressing properly applied fulfills the required conditions more thoroughly than any other which I have seen in use. The method of application which I have found best is as follows:—

The tubes, of which I generally use two, side by side, are arranged so that they barely project within the chest wall, and the outer ends, after being securely fastened with safety pins and adhesive plaster, are cut off as close to the skin as possible. A handful of loose gauze wrung out in an antiseptic solution is placed around and over them, and over this a piece of mackin-

tosh large enough to project in every direction beyond the gauze beneath it. Over this again are placed many (twelve to fifteen) layers of dry gauze, and lastly a sheet of cotton batting to provide for equal pressure. This whole dressing is held in place by a gauze or flannel bandage, some of the turns of which should go over the shoulder to prevent its slipping down.

The loose gauze next the tube catches and holds the discharge, which in a favorable case is reduced to almost nothing after the third or fourth dressing, and soon becomes serous.

This rapid diminution of the discharge under antiseptic treatment, and the fact that it speedily becomes serous in character, was pointed out some years since by Professor Lister; but he did not mention, and I have never seen elsewhere described, the great advantage of this form of dressing in favoring the expansion of the lung and obliteration of the cavity. This latter action of the dressing, which will, I think, be sufficiently manifest in the cases I shall report, is due to the method in which the mackintosh is applied.

This rubber layer, impervious to air, overlaps the gauze beneath it so that its edges are held closely applied to the skin by the elastic pressure outside. How closely it clings to the skin can only be appreciated by one who has frequently removed these dressings.

When, now, air is forcibly driven out of the chest by a cough, it lifts the edge of the mackintosh somewhat and escapes; but as the elastic outside dressings immediately press the mackintosh again to the side, the air which could lift it from within cannot get beneath it from without. It acts, in short, as a valve, allowing air to escape from under it, but not to get back again.

Dr. A. M. Phelps, of Chateaugay, N. Y., in an article in the *New York Medical Record* for April, 1880, upon *The Treatment of Empyema by Valvular Drainage*, recommends the use of a drainage tube with a valve attached which should allow the escape of fluids

from the chest and prevent the entry of air. This contrivance I have never used, as I had already found that the antiseptic dressing accomplished this same object, with the additional advantage of guarding against septic absorption. I have, however, seen a valvular tube used by Dr. M. H. Richardson, who combined it with an antiseptic dressing, but did not find that it added to the efficiency of the dressing.

The cases given in the table on pages 12, 13 will illustrate the advantages of the antiseptic dressing, applied as I have described, both in preventing septic absorption and in promoting the expansion of the lung. They include all the cases of empyema which I have treated in this way, and one case (No. 3) which I saw with Dr. J. B. Swift, who operated antiseptically, and dressed the patient in the way I have described. All of these patients were operated upon under ether except where it is otherwise stated. The final removal of the tube in each case is emphasized as giving the date when the pleural cavity was finally closed. In none of them was there any reaccumulation or further discharge, and the opening always closed rapidly. ★

Of these fourteen cases, three died and eleven recovered.

Two of the fatal cases succumbed to phthisis, and in the remaining case the effusion had existed so long (four years) that the lung was without doubt converted into a mere fibrous cake at the top and back of the chest, and was totally unable to expand. The final cause of sudden death is unknown.

In all of the successful cases the empyema was of tolerably recent origin, so that in none of them was the lung disabled. The expansion of the lung was ordinarily very rapid. In Case 7, for instance, the heart had returned to the normal position, and the lung had filled the chest at the end of twenty-four hours, and this, too, in spite of the fact that the disease had existed for three months. This rapid dilatation can, I think, be fairly ascribed to the suction

power of the dressing which I have above discussed. The average time that the tube remained in the chest was twenty-four days, and this low average cannot be accounted for by the influence of the children (who notoriously do well) upon the statistics, for the average for the four adults is the same (twenty-four days).

These figures, when compared with the statistics of the results of other methods of treatment, will go far to illustrate the advantages of the dressing I have described, and I feel sure that to obtain these results the mechanical action of the dressing must be intelligently regarded.

Dr. William C. Dabney, in the *American Journal of Medical Sciences* for October, 1882, in an article entitled "The Treatment of Empyema," gives a summary of his conclusions as to the value of various methods of treatment, and says in a final clause that "Listerism would probably be advisable in city or hospital practice, but is of doubtful efficacy in the country, and under no circumstances should be allowed to interfere with through drainage."

This conclusion might be true if the only advantage of the Lister dressing were in the avoidance of septic infection. But if we consider the mechanics of the closure of these cavities, and seek to assist the expansion of the lung, we shall find the close antiseptic dressing a powerful aid in bringing about favorable results.

#### REMOVAL OF THE TUBE.

One of the two tubes introduced at the time of operation is best removed when the clots have all escaped and the discharge is reduced to about one fluid drachm in the twenty-four hours. The last tube is to be finally left out when the discharge dwindles to a few drops a day, when in short it is no more than would come from the sinus in which the tube lies.

I think the introduction of long tubes (catheters and the like) for injection of the cavity, as recommended by Fraentzel, is to be avoided, as you thereby separate

the pleural surfaces already adhering and obliterating the cavity.

#### THE FETID CHARACTER OF THE PUS.

In the three cases in which the pus was fetid the recovery was not in the least interfered with by this circumstance. Two of these patients had a chill soon after the operation, but no ill effects followed it, the temperature rapidly fell to normal and stayed there. The odor disappeared in all of them after the third or fourth dressing, and recovery was uninterrupted.

#### ANTISEPTICS EMPLOYED.

At first I used carbolic acid exclusively as an antiseptic, but soon substituted chlorinated soda for it as an injection into the chest, using a solution such as described below. This proved so satisfactory that I later substituted it entirely for carbolic acid in the spray and various solutions, still continuing, however, to use carbolized gauze as a matter of convenience, it being easily obtained, and never giving rise to carbolism.

To show how small an amount of carbolic acid will cause poisonous symptoms in these cases I would cite Case 12. In operating upon this boy, four years of age, chlorinated soda was used for the spray and for moistening the inside dressings, but as chlorinated soda corrodes the instruments I laid them and the rubber tube in a carbolic solution, one part to thirty of water. This I also used to wash the boy's side before operating, and to cleanse my own hands. The minute quantity of carbolic acid which was conveyed to the wound by the instruments, tubes, and hand of the operator sufficed to cause frequent vomiting on the day after the operation, and to give the urine a dark, smoky color.



## THE USE OF INJECTIONS INTO THE CHEST.

Professor Lister advises against the use of injections, and regards them as unnecessary. For the simple removal of the pus injections are certainly not needed, but in those cases in which there were purulent clots in the chest I found injections of the greatest service in removing them, and their complete expulsion is very important, as they keep up enough irritation to cause a continued secretion of pus, which quickly ceases when they are gotten rid of. When the pus is fetid, injections not only hasten the disappearance of the fetor, but speedily relieve the fever following the operation.

In using chlorinated soda for injections it will be noticed that if a strong solution be used it forms coagula with the serum. By the use, however, of a solution containing one part of liquor sodæ chlorinatæ to twelve or fifteen parts of water this may be partially avoided, and the coagula are then so soft and gelatinous that they readily escape through the tubes, and cause no trouble.

QUESTION OF OPERATION IN PHTHISICAL PATIENTS, OR  
WHEN THE LUNG HAS BEEN LONG COMPRESSED.

It seems as if little good were to be expected from making a free opening into the chest when the existence of phthisis is clearly proven, as such a case is unavoidably fatal, and the opening, if it is of any avail, only unnecessarily prolongs the sufferer's last days with the added distress of a disagreeable discharge from the side. Aspiration to relieve urgent dyspnœa is the only proper operative procedure in such cases.

Data are as yet insufficient to decide how long a lung may be compressed and yet recover and dilate to fill the chest when the pressure is removed. In our series two cases in which the compression had existed for three months rapidly recovered when the fluid was removed. On the other hand, I have seen the lung

reduced to a fibrous cake without a vestige of proper lung tissue by two years of compression. Cases of course will differ greatly in this regard, and it would be well in a doubtful case to aspirate several times, and carefully watch the lung, and if noticeable dilatation follows the aspirations finally to establish a free opening. If no dilatation occurs frequent aspiration may be sufficient to relieve dyspnoea, and eventually to bring about closure of the cavity by collapse of the chest wall and approximation of the neighboring organs. If, however, the pus constantly reaccumulates, and gradual exhaustion threatens a fatal issue, a free incision and the resection of portions of several ribs are clearly indicated to allow the further collapse of the chest and closure of the cavity.

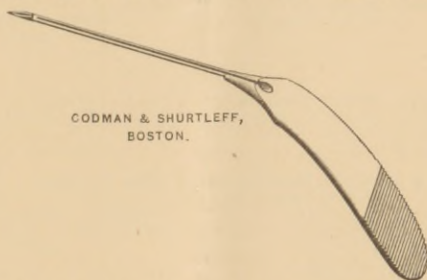
#### METHOD OF OPERATING.

In regard to the point selected for the opening, I almost invariably opened the chest in the eighth, occasionally in the seventh, intercostal space, just in front of the latissimus dorsi muscle. This place offers several advantages: the chest wall is here thinly covered by muscles; the opening is dependent in any ordinary position of the body except when lying on the other side, and yet is not so far behind as to be directly pressed upon when the patient is on the back; it is not so low as to be interfered with by the diaphragm even when this is considerably pressed upwards, as it may be after the fluid is out; it is far enough from the shoulder to allow a good dressing to be applied without interfering with the arm.

Lastly a word as to the technique of the operation.

In opening the chest near the base there is always danger of injuring the diaphragm, or even, as has occurred, the abdominal organs, and the preliminary introduction of an aspirator needle is a common precaution to gain assurance of the presence of pus at the point selected. In some of my first cases I used a grooved needle for this exploration, and when

pus was found, the groove of the needle guided the knife directly into the cavity, and in withdrawing it an incision of proper length could be made. The only drawback to this method was that with an ordinary grooved needle the elastic skin closed into and filled the groove, and thus prevented the pus from readily showing itself. To avoid this I had the needle, figured at the end of this article, made for me by Codman and Shurtleff, instrument makers. It is like an aspirator needle, with a slit upon one side wide enough for the point of the knife to slip along. This form makes it impossible for the skin to press into and occlude the groove, and the pus always escapes readily along it. The handle is set at an angle to allow the ready use of the knife beside it. After the opening is made with the knife a director is slipped in, and the sharp needle removed. If after the incision one



instrument is withdrawn before another is introduced a slight shifting of the muscles may close the opening, which is then difficult to find again. The operation done thus with an exploring needle is finished ordinarily in a few seconds, and the pain is reduced to a minimum, an important consideration when ether cannot be administered.

No.	Sex.	Age.	Medical Attendants.	Previous Duration of Disease.	Side Affected.	Previous Treatment.
1	F.	11		1 month.	Right.	Aspirated once.
2	M.	29	Dr. R. Amory. Dr. F. I. Knight.	Uncertain.	Right.	Aspirated once. Fetid pus.
3	M.	1½	Dr. J. B. Swift.	2 months.	Left. Apex beat below right nipple.	- -
4	M.	33	Dr. J. L. Sullivan. Dr. F. I. Knight.	3 months.	Left.	Aspirated three times; twice serum, once pus.
5	M.	14	Dr. J. L. Sullivan.	2 months	Right.	Aspirated five times.
6	M.	22	Dr. J. W. Elliott.	Uncertain.	Left.	- -
7	F.	11	Dr. Chandler. Dr. F. I. Knight.	3 months.	Left. Apex beat under right nipple.	Aspirated twice.
8	M.	33	Dr. B. S. Shaw.	4 years.	Left. Heart beat only above right nipple.	Aspirated five times; four times serum, once pus.
9	M.	24	Dr. G. C. Shattuck. Dr. F. C. Shattuck.	3 weeks.	Right.	Aspirated once. Fetid pus.
10	F.	29	Dr. H. W. Broughton. Dr. H. I. Bowditch. Dr. F. H. Williams.	1 month.	Right.	Aspirated once. Fetid pus.
11	M.	4	Dr. G. W. Snow. Dr. F. I. Knight.	1½ months.	Right.	Aspirated three times.
12	M.	3½	Dr. Hildreth. Dr. Dow.	5 weeks.	Left.	Aspirated once for diagnosis.
13	F.	26	Dr. Newell. Dr. H. I. Bowditch.	6 weeks.	Right.	Aspirated twice.
14	M.	5½	Dr. J. A. Dow.	2 months.	Right.	

Date of Operation.	Progress.	Result.	Remarks.
March, 1879.	Lung fully dilated three days after operation.	Tube removed on seventeenth day.	The lung was fully restored, and child recovered perfect health.
January, 1880.	Chill after operation. Normal temperature after second day. Attended business after ninth day.	Tube removed on twenty-eighth day.	Quickly recovered full health.
February, 1880.	Lung dilated rapidly.	Tube removed on thirteenth day.	Operation without ether. Perfect recovery.
May, 1880.	Improved for a time, then developed phthisis.	Died in the autumn.	The lung never dilated satisfactorily.
June, 1881.	Lung dilated rapidly.	Tube removed on twenty-third day.	Operation without ether. Only one tube introduced.
June, 1881.	Lung did not dilate well.	Died at end of eight months.	Operation without ether, at time regarded as palliative, as phthisis evidently existed.
July, 1881.	Heart in normal place, and respiration to the base of the chest twenty-four hours after operation.	Tube removed on thirty-eighth day.	Complete recovery.
August, 1881.	Lung never showed a sign of dilating.	Died suddenly on fifty-first day.	In this case two gallons of pus by measurement obtained at the operation. Autopsy refused.
December, 1881.	Chill after operation. Normal temperature after fourth day. Lung dilated rapidly.	Tube removed on twelfth day.	This patient had pneumonia in the newly expanded lung soon after the pleural cavity closed, but with no reaccumulation of pus. Made a good recovery. Seen 1 year later, lung in perfect condition.
March, 1882.	Lung dilated well.	Tube removed on thirtieth day.	Opening quickly closed. No further trouble in the pleura.
April, 1882.		Tube removed on forty-ninth day.	Opening quickly closed.
June, 1882.	Rapid dilatation of the lung.	Tube removed on thirteenth day.	Perfect recovery.
April, 1883.	Lung dilated rapidly.	Tube removed on twenty-sixth day.	Opening quickly closed.
June, 1883.	Lung dilated rapidly.	Tube removed on tenth day.	Opening quickly closed. Lung fully restored.





