SEVEN CASES OF THORACOPLASTY PERFORMED FOR THE RELIEF OF CHRONIC EMPYEMA.

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THE problem to be faced by the surgeon in attempting to secure by operative means the obliteration of the cavity of a chronic empyema may be attacked from two different directions, according to his decision to deal either with the lung or with the chest wall.

On the inner side of the cavity is the lung, collapsed to a greater or lesser extent; and on the outer side is the chest wall in the condition assumed in expiration, the degree of retraction depending on the size of the cavity.

The tension in a large unopened empyema seriously compresses the lung, but if the thickening of the visceral pleura, as a result of the inflammation, be not very excessive, ordinary, and more especially forced, expiratory movements after the fluid has been evacuated will successfully re-expand the lung and bring it once more in contact with the chest wall.

It is impossible to estimate the loss of elasticity in a shrunk lung, depending on interstitial fibrosis in its substance, that may have occurred as the result of a chronic empyema. It is to be expected that these interstitial changes will be greater after a purulent than after a serous pleural effusion, and Dr. West has recently recorded 2 cases of serous effusion of eighteen months' and twelve months' duration respectively, in which re-expansion occurred with great readiness upon the fluid being let out. This does not often happen in cases of empyemata of long duration, but the same observer has placed on record a case of an unopened empyema which had been present for six months, and in which re-expansion occurred rapidly when the pus was evacuated.

In the case of a chronic empyema of ordinary type, the chest wall on the outer side of the cavity is depressed to a certain extent, but not sufficiently so to reach the lung and cause obliteration of the cavity. The thoracic wall on this side moves very little in respiration as compared with that of the opposite side. There is no useful purpose to be served in its expanding: it cannot draw the lung with it. Automatically and without the knowledge of the patient, the respiratory mechanism has accommodated itself to the altered circum-

Case II. Photograph I.—This photograph represents the soft parts removed after the ribs had been excised. These parts consist of the intercostal muscles, periosteum of ribs, and parietal pleura. The pleural surface is shown. Notice the nodosities and bands on the surface of the pleura, and at the lower right-hand corner of the figure, the great thickness of the membrane where it is seen cut across.

It is probable that the dressings on the side of the chest round an empyema wound act as a rough kind of valve. Owing to the sudden tension in the pleural cavity as the result of coughing, the dressings are lifted a little from the surface of the body, and air and pus are forcibly ejected into them. The moment the tension drops, the moist dressings fall over the wound once more and prevent the re-entrance of the ejected air. The lung is, therefore, held in a slightly more expanded condition than was the case before the fit of coughing, its elasticity will come into play, and there will be little negative tension in the empyema cavity. To put it shortly, a valve mechanism will allow air and pus to be forced out, will prevent air rushing in through the wound to take their place, and will encourage the lung to expand by reason of the negative intrapleural tension thus created.

In an empyema that has become chronic the lung has been rendered incapable of expansion by reason of the thickening of the visceral pleura. This would appear to depend upon the time the pus has been allowed to remain in the pleura before being evacuated, upon the systematic attempts made in the early days after evacuation to encourage expansion of the lung by expiratory exercises, and perhaps upon the nature of the micro-organism present in the case.

stances, and only those respiratory muscles act which can do useful work.

The chest wall is prevented from collapsing by the rigidity of the ribs and by the thickening of the parietal pleura. In the case of children depression of the ribs occurs with great readiness; their pliability is a measure of the retraction of the chest. I shall deal later with the influence exerted by the thickened costal pleura in preventing the sinking in of the chest wall.

If in any given case it has been decided to attack the lung in order to secure the obliteration of the cavity, the operation is commenced by raising its outer wall, consisting of skin, muscles, ribs, and parietal pleura in the form of a large flap. The visceral pleura is then seen forming the floor of the cavity exposed. This is systematically stripped from the lung. The procedure is known as "decortication of the lung," or more commonly Delorme's operation. George Ryerson Fowler also advocated this method about the same time as Delorme. If the lung has not lost its elasticity as the result of interstitial changes it will re-expand, under the influence of expiratory efforts, upon the liberation of its structure from the thickened and inelastic pulmonary pleura.

The extent to which these changes have progressed cannot

be foretold before the pulmonary pleura has been removed. This is a drawback to the operation. There is a danger in the freshly-liberated lung substance coming into association with the septic contents of the cavity. This has resulted in death from septic pneumonia.

I have not performed Delorme's operation, and, although it may be ideally a better and sounder procedure to attempt to free the lung and allow it to resume once more its functions than to cause the collapse of the chest wall upon it for the purpose of closing the cavity, yet I have not been dissatisfied with the results of thoracoplasty up to the present, and my patients have been able to get on in life and to follow arduous occupations with one lung and a bit, apparently as well as individuals whose respiratory capacity had not been diminished.

The cure of a chronic empyema by the method of causing its outer wall to fall in upon a partially collapsed lung is illustrated by the cases recorded in this paper.

The procedure carried out has been that advocated by Schede, an extension of the operation brought prominently before the medical world by Estlander in 1879. The extensive cavities dealt with, and the great thickening of the parietal pleura found in all the cases, make it probable that Estlander's operation, which consists in shelling out the ribs bounding the external wall of a cavity from their periosteal sheaths, would have proved ineffectual. The rapid reformation of ribs from the periosteum, which is left behind in this procedure, soon produces rigidity of the chest wall once more, and the operation has to be repeated.

The resistance offered by the thickened parietal pleura, even after removal of the ribs, to an adequate sinking in of the chest wall is very real, and to obtain a reasonable prospect of success, it should be freely cut away, as pointed out by Schede.

In the cases recorded below a U-shaped flap was raised commensurate with the cavity to be closed, and reaching down to or below the discharging sinus. This flap included parts of the latissimus dorsi and serratus magnus, and in certain cases the pectoralis major. The ribs, with the intercostal muscles between them, were thereby exposed. The sinus was enlarged sufficiently to allow accurate determination of the size of the cavity, and the ribs forming its outer wall were then one by one shelled out of their periosteal coverings, divided at first posteriorly, then anteriorly, and removed. The remaining soft parts, consisting of intercostal muscles, periosteum of ribs, and parietal pleura were removed in a single piece by the insertion of one blade of a strong pair of scissors into the sinus and rapidly cutting through these structures following the lines of sections of the ribs. Haemorrhage was not excessive. The visceral pleura was by this means freely exposed. It was rubbed with a swab, or in some instances lightly curetted, to rid its surface of a considerable amount of unhealthy granulation tissue which was always found thereon. The flap of skin and superficial muscles was then allowed to fall down upon it, and the edges of the long wound stitched. A drainage tube was inserted at the lowest part of the wound.

Although Kocher recommends the excision of the first rib, should the cavity extend above its level, I have neither removed it nor the parietal pleura upon its inner surface. The cases recorded in this paper, in which the cavity extended into the neck, healed without the removal of the first rib and appear to show, therefore, that this is unnecessary.

The removal of the lower part of the scapula has not been required in any of my cases even in the most extensive ones, although the procedure has been suggested for those cases in which this bone is included in the outer wall of a residual empyemic cavity.

The following cases are recorded in the order in which I have operated upon them:

CASE I.

J. R., male, aged 32, was admitted into hospital on September 25th, 1896, under the care of my colleague Dr. Burton-Fanning. Six months previously he had had a left-sided empyema opened in the posterior axillary line and a tube inserted between the seventh and eighth ribs and it had been discharging ever since.

There was a strong tuberculous history in this case, one sister and two brothers having died of phthisis, but no definite signs of tubercle could be found in the patient.

Upon admission the patient was in good condition, but the drainage proving inadequate, I removed on October 9th 2 in. of the seventh and eighth ribs which bounded the sinus. The parietal pleura was $\frac{1}{2}$ in. thick.

On January 8th, 1897, ten months from the first opening of the empyema, as the cavity showed no signs of closing, I raised a flap from

the side of the chest and removed parts of five ribs (ninth, eighth, seventh, sixth, fifth). The longest piece removed measured 4 in., the shortest 1 in. The remaining soft parts of the outer wall of the cavity were then cut away, the parietal pleura being $\frac{1}{2}$ in. to $\frac{3}{4}$ in. in thickness. The cavity was pear-shaped, tailing off in front towards the pericardium, and measured 7 in. in length. The flap was sutured in position and a drainage tube inserted below.

Case I. Clinical Chart.—The chart shows by means of the shaded area the extent of the cavity, also the sinus between the seventh and eighth ribs. The unshaded portions of these two ribs represent the parts removed soon after admission. The shaded portions of the ninth to the fifth ribs inclusive represent the parts which entered into the formation of the outer wall of the cavity, and which were removed at the thoracoplasty.

Seven weeks after this operation the patient was attacked with pleurisy of the right side, and 32 oz. of serous fluid were withdrawn by aspiration.

In November, 1898, nearly two years after the thoracoplasty, although the patient was in excellent health, a sinus still persisted. It was explored, and found to lead to a cavity measuring 4 in. by 1½ in. An inch of one rib which still overhung this cavity, and a fibrous membrane one sixth of an inch thick, which formed its outer wall, and which had

Photograph of Case I.—The photograph is a recent one, and shows the size of the flap raised, the incision extending between the two crosses.

taken the place of the parietal pleura removed previously, were excised. The wound was soundly healed in a few months, and the patient is now in robust health, following the occupation of a labourer, and having had no further trouble. There is no lateral curvature.

CASE II.

T. C., male, 21, was admitted into hospital on February 24th, 1898, under the care of my colleague, Dr. Burton-Fanning. In August, 1897, the patient had suffered from pleurisy, and clear fluid had been withdrawn from the right side of his chest. He returned to work for a few months, but became worse about Christmas, and a month before admission the chest had been aspirated again and pus withdrawn. Upon admission the patient was in considerable distress of breathing. A portion of the right eighth rib was resected, and four pints of thin pus were evacuated.

The cavity showed no signs of closing, so on June 30th, four months from the time of the opening of the empyema, the patient being in good general health, a large flap was raised from the right side of the chest, and the ribs from the third to the ninth inclusive, where they bounded the cavity, were removed. The remaining soft

Case II. Photograph II, back view.—Note that the spinal column is very nearly straight, and that the incision does not extend much above the level of the angle of the scapula.

Case II. Clinical chart, showing cavity.—The shaded area shows the extent of the cavity, the darker portion of the eighth rib represents the piece excised at the first operation.

parts in the outer wall, including the parietal pleura, which was 1 in. in thickness, were next excised, the visceral pleura lightly scraped, and the flap replaced.

Severe shock followed the operation, and the patient was in a critical condition for the first twenty-four hours, but by means of hypodermic injections of strychnine and two separate infusions of saline solution (saline 3 pints, brandy 3 drachms) into the median basilic vein, he rallied, and thereafter made a satisfactory recovery.

One year later he was readmitted into hospital on account of a sinus which still persisted. This was thoroughly scraped, and five months later he was soundly healed and in robust health. The photograph is a recent one. He is engaged in hard manual labour.

Case II. Clinical chart, showing ribs removed.—The shaded portions of ribs represent the lengths removed at the thoracoplasty. The light portion of the eighth rib represents the piece previously excised. Note that the extent of ribs removed corresponds accurately to the limits of the cavity.

CASE III.

H. C., male, aged 18, was admitted into hospital on January 31st, 1899, under the care of my colleague, Dr. Barton. The patient had suffered from pneumonia in May, 1898, and ten weeks after the onset of the illness a portion of the sixth right rib in the mid-axillary line had been excised, two quarts of pus evacuated, and a tube inserted. He had worn a tube ever since.

Upon admission the patient was in good general health, but showed evidence of a large cavity in the right half of the chest. A probe passed upwards from the sinus could be made to project under the skin in the posterior triangle of the neck.

Upon February 9th, six months from the date of the opening of the empyema, a large U-shaped flap was raised from the right side of the chest, commencing near the nipple in front, and passing up behind midway between the vertebral column and the vertebral border of the scapula to a level with the spinous process of the latter. The ribs from the third to the ninth inclusive were then removed in the usual way from the costo-chondral junctions in front to the angles behind. As the patient began to get somewhat faint, further operation was postponed for that day and the flap replaced. A fortnight later the flap was again raised and the second rib removed from its cartilage to its angle. The soft parts, including the parietal pleura, which was $\frac{3}{4}$ in. thick, remaining in that part of the outer wall of the cavity from which the ribs had been removed, were then cut away, and the cavity displayed as shown in the chart. It extended up into the neck above the clavicle, back to the bodies of the vertebrae and down to the twelfth rib. The visceral pleura and the parietal pleura existing beneath the ribs which had not been removed were thoroughly curetted, and closure of the lower part of the incision assisted by sliding two curved skin flaps.

Case III. Clinical Chart.—The chart shows the extent of the cavity. The thick vertical lines on certain of the ribs towards their anterior and posterior extremities indicate the lines of section of these ribs, the intervening portions being taken away. Note that the only ribs not touched were the first, tenth, eleventh, and twelfth.

The patient made a very satisfactory recovery, and was completely healed in eleven months. He is now in excellent health, and engaged in heavy manual labour—farming in South Africa. He finds his right arm and shoulder almost as powerful as his left. The photographs were taken after the patient had been healed for some months.

Case III. Photograph I, back view.—This view shows the line of the incision behind. It is unnecessary to carry it so far up the vertebral border of the scapula; it is quite sufficient if it reach a little way above the level of the lower angle. In this case the incision passed through the rhomboids and the levator anguli scapulae, and much time was consumed in suturing them again towards the end of the operation. It is quite unnecessary to divide these muscles. The arm with the scapula may be allowed to fall back so that the posterior ends of the ribs are easily attacked in the interval between the scapula and the thoracic wall. Note that there is no lateral curvature.

Case III. Photograph II, front view.—The depression in the chest wall in this patient is more marked than in any of the other cases.

CASE IV.

W. L., male, aged 23, was admitted into hospital on February 2nd, 1899, under the care of my colleague, Dr. Burton-Fanning.

Two years previously the patient had had an attack of pneumonia, and three weeks after the onset of the illness 5 pints of pus had been removed by aspiration from the left side of the chest. One week later a portion of the ninth rib, in the line of the angle of the scapula, had been resected and a tube inserted. The cavity had continued to discharge ever since.

Upon admission the patient was in very fair general condition, but there was a little temperature at night, and the discharge was offensive. The left side of the chest was greatly retracted.

Upon March 2nd an incision was made from close to the upper end of the vertebral border of the scapula downwards to below the sinus and upwards and forwards to the anterior axillary line. The flap being raised, portions of six ribs (fourth to ninth inclusive), varying in length from 3 to 6 in., were shelled out of their periosteal sheaths, and the remaining soft parts with the parietal pleura, which was $\frac{1}{2}$ to $\frac{3}{4}$ in. thick, were cut away.

The cavity exposed measured 5 in. across, and was triangular in shape with the base upwards. The visceral pleura was well scraped before replacing the flap.

Case IV. Clinical Chart.—The shaded area indicates the size of the cavity. The shaded section of the ninth rib shows the length excised when the empyema was drained. The portions of ribs excised at the thoracoplasty are indicated by the lengths between the pairs of vertical lines on the fourth to the ninth ribs inclusive. It will be noted that the pieces of ribs removed projected beyond the limits of the cavity, both anteriorly and posteriorly. When dealing with a small cavity it appears to be advisable to remove lengths of ribs greater than the width of the cavity. By this means the flap can be replaced upon the visceral pleura with greater readiness, adhesions take place more quickly, and the healing process is shortened.

The patient left the hospital one month later, and was soundly healed and in excellent health five and a half months from the date of the operation. There was no lateral curvature.

I have not been able to obtain a photograph of the chest, as he has left the neighbourhood.

CASE V.

E. S., female, aged 18, was admitted into hospital on April 13th, 1901, under the care of my colleague, Dr. Barton.

Four and a half years before admission the patient had suffered from pleurisy on the left side, from which she had made a good recovery.

Eighteen months before admission she had been taken ill again, and three and a half pints of "thick offensive fluid" had been withdrawn by aspiration from the left side of the chest.

Three months before admission the fluid had reaccumulated, and had burst spontaneously in the left fifth interspace, where it had been discharging ever since. During the latter period she had been confined to bed, and there had been a considerable amount of offensive purulent expectoration.

Upon admission the girl was much emaciated and pulled down in general health, but she took her food well. The temperature was normal. There were two sinuses in the left fifth interspace discharging offensive pus—one, two and a half inches vertically below the nipple, and another, one and a half inches further out in the same space. The left side was much retracted, and there was free offensive muco-purulent expectoration. This was examined twice for tubercle bacilli with negative results. There was a mitral systolic murmur. There was no albumen in the urine.

On April 25th I explored the cavity through an incision connecting the two fistulous openings, and found it to be a very large one. A flap was raised from the lower part of the chest, and portions of six ribs (fourth to ninth inclusive) were removed subperiosteally from the angles behind to the limit of the cavity forwards. The flap was then replaced, further manipulation being postponed, as the patient's condition rendered it unwise to subject her to further shock on that day.

The patient went on well till the fifth day from the operation, when she had a fit in the early morning lasting ten minutes. It began in the fingers of the right hand, spread to the right arm and side, and then she lost consciousness. Three more fits similar to the first followed in the course of the day. The next day she had six fits. In some the twitchings began in the left side of the face, spread rapidly to the left

side of the body and then became generalized. The fits continued each day, and the patient became more and more drowsy, and the pulse more rapid and weak. The temperature varied from normal to 102° . She died on May 5th, ten days from the date of the thoracoplasty.

At the necropsy the pericardium was found to be universally adherent, and the mitral valve thickened and incompetent. The right lung was healthy. The left lung was greatly shrunken and the size of the empyema cavity was as shown in the figure. The parietal pleura was $\frac{1}{2}$ in. thick. There was no evidence of tubercle in either lung. There were six abscesses in the cerebral cortex, varying in size from $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. in diameter, and all save one were in the frontal or parietal regions. There were two abscesses in the right and four in the left half of the brain. They possessed no defined walls and were obviously of recent formation. They were without doubt due to septic emboli as a result of the operation. There was no extensive meningitis. The ventricles were healthy. The cerebellum was healthy. There were no infarcts in the abdominal organs.

Case v. Clinical Chart.—The shaded area shows the extent of the cavity. The two circles in the fifth space indicate the sinuses where the empyema had spontaneously discharged. The shaded portions of the fourth to the ninth ribs indicate the lengths removed at the operation. It would have been necessary to resect the second, the third, and more of the fourth rib if the patient had survived.

CASE VI.

W. B., male, aged 31, was admitted into hospital on February 25th, 1901, under the care of my colleague, Dr. Long. The patient had suffered from typhoid fever in June, 1900, and since that date he had been short of breath on exertion. He remained away from work until October, when he resumed it until Christmas. He had then been obliged to give up work again owing to shortness of breath and some cough. Since Christmas he had been getting more and more dyspnoeic with continuous "aching pain round the heart." He had been confined to bed for three weeks prior to admission. He had been subject to bronchitis for four or five years, but there was no history of phthisis in the family.

A few days before admission the left side of the chest had been aspirated and 3 pints of pus removed. Upon admission, the patient was in fair condition and the dyspnoea was only slight. The temperature was normal, pulse 92, regular, respirations 28. The apex beat was in the right fourth space immediately below the nipple. There were the signs of a large left pyopneumothorax.

March 12th, 74 oz. of greenish inodorous pus were removed from the left side of the chest by aspiration through the eighth space.

April 11th, 41 oz. of pus possessing the same characters were removed to-day. By changing the position of the patient air or pus could be withdrawn at will from the pleural cavity.

April 26th, 23 oz. of pus were removed to-day. During all this period the temperature had not risen above the normal, the pus had remained sterile even to repeated examinations, and the apex beat had kept well to the right of the sternum.

June 12th, 34 oz. of greenish pus were withdrawn through a cannula in the left eighth space, and 4 pints of sterilized saline solution were then introduced through a cannula in the seventh space and subsequently withdrawn through the cannula below so as to wash out the pleural cavity.

July 1st, 84 oz. of thick yellow pus were removed to-day from the left side. The temperature had been somewhat raised since the last aspiration.

August 10th. Since the last note the patient had spent some weeks at a convalescent home, where he had gained two pounds in weight. Upon readmission he was coughing up considerable quantities of offensive expectoration. This was examined for tubercle bacilli with a negative result. The temperature occasionally reached 100° at night. The apex beat was still in the right nipple line. As the repeated aspirations did not prevent reaccumulation, a portion of the left ninth rib in the posterior axillary line was excised to-day. Eighty-four ounces of pus were evacuated and a tube inserted. Once more no growth could be obtained from the pus. That withdrawn on July 1st had also been cultivated without success.

November 26th. The cavity had not been draining well of late, and the temperature had reached 101° to 102° at night. The discharge had been considerable. For the previous week the patient had complained of

precordial pain, but there had been no physical signs to account for it. The apex beat had been situated under the xiphi-sternum since the rib resection on August 10th. As it was evident that there could be no chance of the cavity closing without a plastic operation, portions of the eighth to the eleventh ribs, with the parietal pleura, which was $\frac{1}{2}$ in. thick, were removed to-day in the usual way, as a preliminary measure. A sinus was seen on the surface of the collapsed lung through which air was passing. The patient stood the operation well.

December 3rd. Three days after the thoracoplasty severe precordial pain commenced and the pulse became very rapid. The temperature rose to 103.8° , and from that time he gradually sank and died to-day, seven days from the last operation.

Necropsy.—Miliary tubercles were found scattered through every part of the right lung. The pleura was healthy. The left lung was very small, and shrunken against the pericardium and the spine. Vertically the viscus extended only from the level of the second to that of the seventh left costal cartilage. Caseous patches of tubercle were present

Case VI. Clinical Chart.—The shaded area shows the extent of the cavity. The shaded portions of the eighth to the eleventh ribs indicate the lengths removed at the thoracoplasty. The unshaded portion of the ninth rib indicates the piece removed when the empyema was first drained.

throughout the lung, and there were also numerous miliary deposits. There was a sinus on the surface of the lower lobe, which passed for 2 in. into the substance of the viscus. The parietal pleura at the back of the chest was reflected forwards to become the visceral on the surface of the lung from the junction of the anterior and lateral aspects of the bodies of the vertebrae, leaving the sides of the vertebral bodies and the heads of the ribs clearly visible. The pericardium contained about 10 oz. of pus. There was very little lymph in the sac, but on the under surface of the diaphragm and the upper surfaces of the liver and spleen were a few flakes, showing that the process was extending through into the peritoneum.

Even without the tuberculous infection, which was no doubt the cause of the pneumothorax, it is difficult to see how the chest wall could ever have collapsed sufficiently to have met the retracted lung. The patient probably had commencing pericarditis when the thoracoplasty was performed.

CASE VII.

W. T., male, aged 19, was admitted into hospital on February 13th, 1902, under the care of my colleague Dr. Burton-Fanning. The patient had been taken ill six weeks previously with severe pain in the right side of the chest and a cough. Distress in breathing became very

Case VII. Clinical chart showing cavity. The shaded area shows the extent of the cavity, the darker portion of the ninth rib represents the piece excised when the empyema was drained.

marked, and on admission he was evidently extremely ill, anaemic, and wasted; the breathing was painful and laboured, 44 to the minute. The right side of the chest gave the signs of fluid from apex to base, and the heart's apex beat was displaced into the sixth space, two inches

Case VII. Clinical chart, showing ribs removed.—The shaded portions of ribs represent the lengths removed at the thoracoplasty. The light portion of the ninth rib represents the piece previously excised. Note that the sections of the ribs correspond accurately to the anterior limit of the cavity, but that the ribs were not removed as far as its extreme posterior limit.

outside the left nipple line. Twelve ounces of thick yellow pus were at once withdrawn by aspiration from the right pleura to give temporary relief.

The next day a portion of the right ninth rib in the posterior axillary line was resected, and six and a half pints of thick pus were evacuated. The patient made a satisfactory recovery from the acute stage of his illness, but the sinus persisted and showed no signs of closing.

On July 25th, five and a-half months from the first operation, the general health being good, I raised a flap from the right side of the chest, and removed subperiosteally five ribs, the fifth to the ninth inclusive, from their angles behind to just outside their cartilages in front. The soft parts, including the parietal pleura, which were beneath

Case VII. Photograph I, side view.—The photograph shows the size of the flap.

these ribs, were then cut away in the usual manner. The parietal pleura was about half an inch in thickness. The flap was then replaced. A fortnight later the flap was reflected again, and portions of the fourth, third, and second ribs were removed in the same manner as before, together with the parietal pleura beneath them. The visceral pleura was curetted. The patient made a satisfactory recovery, and was soundly healed one year later. He is now in robust health.

REMARKS.

Two deaths out of 7 cases gives the high mortality of 28.6 per cent. The death from cerebral abscess (Case v) is an ex-

ample of a complication of a chronic empyema which it is well known may supervene even if no operation be performed. In this case the thoracoplasty evidently dislodged septic material which furnished the infective emboli to the brain. Possibly it would have been a more prudent course to have made at first a counter-opening through the ninth or tenth rib, and thus to have induced a more satisfactory general condition before proceeding to an extensive operation. Even then it is quite possible that the excision of a portion of a single rib might have been sufficient to cause a cerebral embolism, and but for this unfortunate supervention I have no reason to doubt that the patient would have been in a fit condition in a week or two later to have undergone the removal of the remaining ribs situated in the outer wall of the cavity.

The case of pyopneumothorax (Case vi) was, I am afraid, hopeless from the first, and one which should not have been subjected even to a modified thoracoplasty.

With the exception of the procedure known as decortication of the lung, there is no operation other than Schede's which holds out a reasonable prospect of success in the case of a large cavity, in spite of the various modifications which have been suggested from time to time, with a view to a diminution in extent of the parts to be excised.

It does not appear to be necessary to remove the ribs further back than the angles, although the cavity may extend as far as the vertebral bodies. The spinal muscles are therefore not disturbed. It is certainly not necessary to remove a portion of the scapula, nor should the first rib be interfered with. Lateral curvature, as the result of an extensive thoracoplasty, need not be anticipated.

As a rule it is not advisable to perform the major operation until a period of six months has elapsed from the time that the empyema was drained. Retraction of the chest has then reached a point beyond which it is not likely to go.

Case VII. Photograph II, back view.—Note that the spinal column is very nearly straight. There is posterior displacement of the scapula and rotation of its lower angle from interference with the serratus magnus.

The cases must be chosen with care and judgement, and success will then be attained in a very large majority. They should be individuals otherwise in good health, not suffering at the time from hectic induced by an inefficiently drained cavity, or from lardaceous disease. There should not be any active tubercle present.

The operation in extensive cases should always be performed in stages.