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Publication Date: August, 1945

Name of Journal: The Leech being the University of the Witwatersrand Medical Journal

Volume: 16

Issue: 1

Pages: 28 - 32

Accessed from http://wiredspace.wits.ac.za
The Place of Surgery in the Treatment of Pulmonary Tuberculosis.

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In dealing with the place of surgery in the treatment of pulmonary tuberculosis, the guiding principles will be discussed, in order to emphasize the true status of surgery, but no attempt will be made to describe the thoracic operations in any set form.

1. WHY IS SURGERY NECESSARY IN THE TREATMENT OF PULMONARY TUBERCULOSIS?

Briefly, surgical treatment has become necessary because the vast majority of cases cannot be adequately treated by conservative means. This fact needs considerable elucidation, and I should like to consider the relevant facts.

By conservative treatment, I refer to passive methods of building up the patient's resistance by means of good food, adequate rest, and absence of worry.

Let us first consider:—

The Nature of the Disease.

The earliest lung lesion generally consists of a site of infiltration which is usually unilateral and limited to a very small area. This is the type of case which responds well to conservative treatment; but a certain proportion of cases will progress despite this treatment, and unfortunately very few cases present themselves for treatment at this controllable stage of the disease.

With progression of the disease, the infiltration becomes more widespread, and excavation of part of the involved area may occur. In other cases, infiltrated areas may coalesce, leading to consolidation of a large area of lung tissue. In the less acute forms, fibrous tissue is formed.

I wish to emphasize that whether there is rapid or slow progression of the infection, cavity formation is a result of the disease, and a sign of its activity.

I will not here enter into the controversial pathology of "cavitation"—the more widely accepted views are sufficient for our general discussion.

Unfortunately, a small percentage of cases with pulmonary cavitation heal on conservative treatment—I say "unfortunately" advisedly, as this minority of successes has far too often influenced the physicians to treat the majority of cases on similar lines. Careful follow-up examinations of patients with cavities of one inch diameter, show very little chance of a five-year survival on conservative treatment alone.

Specific Drug Therapy.

As you know, there have been many drugs advertised as cures for tuberculosis—such as gold and, more recently, Promin and Diason. So far there is no evidence that any drug, as part of conservative treatment, is specific for this disease. Before concluding this section of my talk, I should like to point out two types of cases of particular interest in this discussion.

It has been known for years that patients who have had a spontaneous pneumothorax whilst suffering from pulmonary tuberculosis show remarkable improvement and even arrest of the disease. It has also been observed that many patients suffering from the disease and developing a pleural effusion will show signs of improvement.

In both these cases there has been a "splinting" of the lung, and it will be seen that by surgical measures, Nature's methods of healing may be successfully imitated.

In the first section I pointed out that the disease may undergo cure or arrest when conservative lines are followed, and indicated where this conservative treatment falls short in many cases. In this section I wish to show the aims of surgery, when applied to those cases in which conservative treatment has failed.

2. THE AIM OF SURGICAL TREATMENT.

The aim of surgical treatment is identical with that of conservative treatment—namely, to bring about healing of the lesion. In the early type of case, with infiltration only, simple bodily rest gives the lesion a chance to heal; but in the more advanced type, the rest must be much more positive, and the lung itself must be placed in a position which gives it maximum rest, to ensure healing.

"Selective Rest."

The question of rest may have to be carried a step further, and it may be necessary to provide "selective rest" to a part of the lung. By this is meant that the diseased portion of the lung is so treated that it is rested, and this introduces a variety of surgical procedures.

Closure of Cavities.

The presence of a cavity indicates that the disease is progressive; thus the great aim of all surgery is to bring about closure of such cavities. Here again it may be necessary to resort to major procedures.

In many longstanding cases which have had no surgical treatment, marked structural changes develop as the disease undergoes cure. Many surgical procedures are attempts to imitate these structural changes and thereby bring about identical conditions.

Whilst many of the operations bring about some control of the diseased areas of lung, they may be associated with gross deformities of the chest. Surgical treatment, whilst bringing about the cure, must also attempt to avoid the complications. Life must be prolonged, and it must be endurable.

Control of Case to Person Infection.

Obviously, if surgical treatment successfully controls the disease, and the patients are rendered unlikely to spread the infection to others, we are within sight of a very practical and important public health application.
SUITABLE CASES FOR SURGICAL TREATMENT.

It may be laid down as a general principle that the earlier the disease comes under treatment, the less radical is the treatment likely to prove. The converse does not hold good, as some cases may be so extensive that surgical treatment becomes impractical.

The unilateral case usually responds very well to treatment, but this does not mean that bilateral cases are excluded.

All forms of surgery may be combined—one type of operation on one side of the chest, another type on the other side. Sometimes two different procedures are used on the one side.

What then are the criteria which allow or preclude surgical treatment?

(a) The Vital Capacity.

All surgical operations reduce the vital capacity temporarily. In spite of the fact that patients can be trained to increase their vital capacities after surgical treatment has been completed, it must be remembered that a preliminary low vital capacity will be made lower by most procedures.

Any adult with a vital capacity of less than 1,000 cc. is very unlikely to survive if any form of surgical treatment is carried out, and even if the vital capacity is 1,500 cc. or less, major procedures are definitely excluded.

(b) Age.

Similarly, patients over the age of 45 react badly to surgery, as in many there is very little chest expansion, since the chest becomes a more rigid structure with the passing of the years.

On the other hand, the very young endure types of major surgery very well; but it must be remembered that operations on the bony skeleton should not be performed while growth is taking place as this will only accentuate any deformity which is likely to develop.

It is hardly necessary to emphasise the fact that major surgery should not be performed if the patient is suffering from an extra-pulmonary defect such as diabetes, until this is brought under control.

Recently it has been brought to our notice that many tuberculous patients have urogenital tuberculosis in an asymptomatic form. A major chest operation in such a case may be successful, but the patient may die from renal failure.

3. THE OPERATIVE PROCEDURES EMPLOYED.

All the procedures carried out are devised to relax and to compress the lung. This is what we understand by the term “collapse therapy.”

Artificial Pneumothorax.

Artificial pneumothorax was the first type of active treatment used in tuberculosis, and its introduction was the first great step forward in the treatment of the disease. Its particular use is in the unilateral case in which there is cavitation.

Very soon after the pneumothorax was established, there is a marked improvement in the general condition and X-ray may reveal closure of the cavity. (Fig. 1).

Artificial pneumothorax, though a simple enough procedure on the face of it, is fraught with dangers and complications. It must be understood that a pneumothorax, once established, must be maintained by weekly or fortnightly refills for a period of three to five years. This means that the patient to whom this constant supervision is not accessible, must be denied this form of treatment.

During the course of artificial pneumothorax treatment, at least 50 per cent. of cases, at irregular intervals, develop pleural effusions which may lead to hospitalization.

The presence of adhesions may render an artificial pneumothorax inadequate, and in such cases the operation of adhesion section must be attempted. In some cases before adhesion section is employed, the adhesions tear away from the chest wall; this may lead to a spontaneous pneumothorax, with a mixed infection of the pleural space.

Many specialists in the field of chest surgery are veering round to the view that a more selective permanent type of compression is preferable to the artificial pneumothorax, which compresses the whole lung, irrespective of the site of the disease. Some surgeons aver that a case of unilateral apical cavitation which would ordinarily be considered the ideal case for artificial pneumothorax, should, because of the complications which I have pointed out, have an immediate upper-stage thoracoplasty performed.
Phrenic Paralysis.

Phrenic paralysis may be either temporary or permanent, depending on whether the nerve is crushed or severed. The operation of phrenic avulsion is occasionally used, but has several disadvantages. Crushing the nerve leads to a paralysis of the diaphragm for about six months.

As the effect of these procedures is mainly on the basal portion of the lung, it is a form of selective compression. (Figs. 2a, 2b.)

The elevation of the diaphragm can be increased by the induction of a pneumoperitoneum.

Phrenic paralysis may be combined with the procedure of artificial pneumothorax, as it will further reduce the expansion of the compressed lung. Personally, I feel that if a good pneumothorax is established, a temporary paralysis should be immediately instituted.

Thoracoscopy and Adhesion Section.

Adhesions, when they occur, generally extend from the diseased portion of the lung to the chest wall, and consequently the very area which should be compressed by a pneumothorax remains unaffected.

Adhesions may be single strands or cords, broad sheets, or even extensive areas of lung directly fused to the chest wall.

Owing to the elasticity of the adhesions, closure of a cavity by pneumothorax may occasionally be achieved without adhesion section; but if an adhesion is divisible, it should obviously be divided, to avoid a possible spontaneous pneumothorax.

In a case with multiple adhesions, some of which are divisible and some indivisible, all the divisible adhesions should be cut, in the hope that with the compression of the lung so achieved, the indivisible adhesions may, in time, stretch and become divisible.

When obviously indivisible adhesions are related to a cavity, more radical methods will have to be employed.

Bronchial Occlusion.

Occasionally a good pneumothorax, or a pneumothorax made complete by adhesion section, fails to bring about closure of the underlying lung cavity, which may even increase in size.

In such a case, the non-closure of the cavity is dependent on the fact that air is entering it from the bronchus. The introduction of a well-fitting bronchus plug results in the prevention of air entry through the bronchus, the gradual reabsorption of the air trapped behind the plug, and leads to massive collapse of that portion of the lung. (Fig. 3.)

From my own experience I have observed that in cases of spontaneous pneumothorax, the insertion of a bronchus plug is extremely effective in preventing an increasing pressure in the pleural cavity.

Extra-Pleural Pneumothorax.

This is an operation which, owing to proved limitations, is not as frequently employed as formerly.

The type of case for which this operation is now most frequently used, is that in which a pneumothorax has been induced, but the apex of
the lung remains adherent to the chest wall by
indivisible adhesions. This adherent area is strup-
ted extrapleurally, and the space so produced is
made to join with the intrapleural pneumothorax,
producing one large pneumothorax cavity. There-
after it is refilled, as with an ordinary artificial
pneumothorax. (Fig. 4.)

Thoracoplasty.

Thoracoplasty provides the patient with a per-
manent form of compression treatment. The tho-
racoplasty which is advocated is that described by
Semb, a Scandinavian surgeon. The operation is
devised to give the lung concentric relaxation, and
to alter the structure of the chest wall in such
a way that the relaxed lung is then maintained
in a permanent form of collapse. (Fig. 5.)
The earlier types of thoracoplasty produced
lateral compression of the chest wall. The opera-
tion consisted of the removal of parts of the ribs,
and the result very frequently, was to compress
upper lobe cavities so that they assumed a narrow
elongated shape instead of the previously round-
ed shape. Many cavities were of course closed
by this method.

Semb realised the shortcoming of this opera-
tion. In order to provide apical relaxation of the
lung it was necessary to supplement this “para-
vertebral” operation with an “apicolysis” (collaps-
ing of the apex).

The extent of the thoracoplasty is measured
by the extent of the disease, and so this type of
compression treatment is essentially selective.

If necessary, the operation can be a total one,
as in a tuberculous empyema.

The operation is, of course, a major surgical
undertaking, and very careful assessment of the
patient is necessary before the procedure is de-
cided upon.

As a result of the extensive rib resection re-
quired, great care has to be exercised to prevent
post-operative chest deformities. It is not enough
to treat the patient’s disease—he must also have
his posture preserved, and therefore careful post-
operative postural exercises are an important part
of the treatment.

The operation often has to be done in stages,
depending on the patient’s resistance and the
extent of the disease; it must be remembered that
very major surgery is being performed on people
who are usually fairly ill.

The virtues of thoracoplasty are that the re-
 laxation is selective, immediate and permanent.

Cavity Drainage.

The difficulty of closure of cavities even after
the use of major surgical procedures has caused
anxiety to many surgeons.

Monaldi has described a method of cavity drain-
age which reduces the size of a cavity. It is
usually necessary to supplement this cavity drain-
age with a thoracoplasty, as the cavity re-opens
when the drainage is discontinued.

It is important that the closed type of cavity—
also known as the “tension cavity”—be treated
with this form of drainage, as otherwise there
will be no change in its size. This method has
been of help in many cases, and its full application
is still in the process of evaluation.

The surgery of pulmonary tuberculosis is not a
mere mechanical exercise, nor is the surgeon
merely a technician. The surgeon acts in consul-
tation with the physician, and carries out his work
with knowledge and experience of both tuberculosis and thoracic surgery.

It is estimated by specialists of repute throughout the world, that at least 60 per cent. of tuberculous patients admitted to hospital require some form of collapse therapy.

Analysis of results achieved by the surgical treatment of pulmonary tuberculosis shows quite definitely that this much-needed branch of chest surgery has achieved a sound and undisputed footing.

**Combined Procedures.**

It is enough to mention here that many of the surgical procedures can be combined when there is bilateral disease. (Fig. 6.)

**Lobectomy and Pneumonectomy.**

Radical removal of the tuberculous tissue would seem to be the ideal method of treatment. Unfortunately this is not possible—and where these radical measures have been carried out deliberately, there has been a mortality rate of over 50 per cent.

**RESUME.**

There have been great changes in the treatment of pulmonary tuberculosis, which have been particularly marked during the last ten years. Because conservative treatment reached a stage beyond which there was no progress and because it was limited in its application, something more became necessary. This need was supplied by active surgical treatment, which has given a new lease of life to many tuberculosis sufferers.

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the pathology is an ugly sequence of destruction and devastation. I feel that we still lack vital detailed knowledge of these very early processes, such as caseation and softening, which so rapidly transform a minimal tuberculosis into the grim travesties of the human frame that we so frequently see in the autopsy room, and of those factors which control and determine whether regression is to result. Only further research can hope to elucidate these problems, and this conference may serve the purpose of stimulating interest and inquiring into this grave South African problem.