

In the remaining 30 patients, all adhesions that were seen could not be cauterized, but one or more adhesions were cauterized in every case. As a result of the operation, the collapse of the lung was increased in all 30. Twelve patients were 'much improved' and nine 'improved', making a total of 21 or 70 per cent positive results. Tubercle bacilli were present in all the 30 patients in this group at the time of the operation, and they disappeared from the sputum in 14 or 46.7 per cent after the operation.

TABLE I
Results of treatment

Number of patients	Much improved	Improved	Stationary	Worse
All adhesions cauterized 10	5	2	2	1
One or more adhesions cauterized (but not all) 30	12	9	2	7
TOTAL 40	17	11	4	8

Positive results 28 out of 40.

TABLE II
Disappearance of tubercle bacilli

Number of patients	+ T B before cauterization	- T B after cauterization
All adhesions cauterized 10	10	6
One or more adhesions cauterized (but not all) 30	30	14
TOTAL 40	40	20

Judged from the point of view of general improvement and from the point of view of disappearance of tubercle bacilli from the sputum, these results are encouraging and give an idea of the scope of thoracoscopy and cauterization in improving the results of artificial pneumothorax treatment in pulmonary tuberculosis.

The results of the cauterization of adhesions in four individual cases are shown in figures 1 to 8 in plates VIII and IX.

THE APPLICABILITY OF PHRENIC EVULSION IN PULMONARY TUBERCULOSIS AT THE OUT-PATIENTS' DEPARTMENT OF A CITY HOSPITAL

By A. C. UKIL, M.B., M.S.P.E. (Paris), F.S.M.F., F.N.I.
P. CHATTERJEE, M.B., F.R.C.S. (Edin.)

and

K. N. DE, B.Sc., M.B.

(From the Chest Department, Medical College Hospitals, Calcutta)

Introduction

WITH an annual mortality of 3,000 from pulmonary tuberculosis in Calcutta and a provision of approximately only 200 beds for the tuberculous in the city and suburbs of Calcutta, we were faced with the problem of rendering aid to 1,500 to 2,000 cases of pulmonary tuberculosis in this department every year. The Medical College Hospitals have only 24 beds for the treatment of pulmonary tuberculosis which were very frequently occupied with urgent cases needing hospitalization.

Being anxious to bring surgical aid to the treatment of pulmonary tuberculosis, we managed to secure the temporary beds in the emergency section of the hospital where a stay of 48 hours was allowed to each patient after either primary artificial pneumothorax (A P), phrenic evulsion or gas replacement of pleural effusion. Although handicapped in many ways, we were able to deal with 164 cases of primary A P, 2,252 A P refills, 41 cases of phrenic evulsion and 40 cases of gas replacement of pleural effusion, besides numerous cases of minor surgical procedures, in the year 1935. The number of cases is increasing so steadily that we find it difficult to deal effectively with all cases in the absence of a larger hospital accommodation. For example, out of 446 cases found suitable for admission in the indoor tuberculosis wards of this hospital only 49 cases could be admitted. Out of 143 cases which were referred to the various sanatoria, only 10 could secure admission. Besides these, it may be pointed out that 52.7 per cent of the patients seeking our aid for the first time were in stage III of the Turban-Gerhardt classification, i.e., fairly advanced cases.

Under the circumstances, we were obliged to perform phrenic evulsion in the following types of cases:—

1. PRIMARY

(a) In unilateral cases

- (i) Where artificial pneumothorax had failed.
- (ii) In basal lesions.
- (iii) In cases with dragging pleuro-pericardial adhesions on the left side.
- (iv) In fibroid cases with considerable displacement of the mediastinum and accompanying dyspnoea.

- (v) In cases of hæmoptysis where A P has failed and where a thoracoplasty is contra-indicated.
- (vi) In cases of dry bronchiectasis with recurrent small hæmoptysis.
- (vii) In some cases of non-productive cough with diaphragmatic pleurisy.
- (viii) In early bronchiectasis and abscess of lung in the lower lobe before induration has set in.
- (ix) In tuberculous empyema as a preliminary procedure to thoracoplasty.
- (x) When concluding pneumothorax treatment in cases where re-expansion is tardy.

(b) *In bilateral cases*

Where artificial pneumothorax was not considered to be a judicious procedure owing to more or less extensive disease, but where the reduction of lung volume and movement on the more actively diseased side was deemed likely to reduce the absorption of tuberculo-toxin and to bring about a certain degree of relaxation of pulmonary traction sufficiently well to turn the scale towards improvement.

In some cases, phrenic evulsion was done on the side contralateral to that undergoing artificial pneumothorax.

2. SECONDARY

Where the operation was done as a supplementary procedure to artificial pneumothorax, especially in cases showing adhesions interfering with effective collapse and in some cases with peri-hilar cavities where pneumothorax alone was not sufficient to bring about an effective shrinkage of cavities owing to the contiguity of the lesion to the resistant root of the lung. It has also been done in some cases before concluding artificial pneumothorax, especially in cases where a thick pleura interfered with re-expansion of the lung. In some of the latter, compressive oleothorax was done as a final procedure where the patient could not stay in town or where the lung tried to expand, while still showing a certain amount of activity in the affected area of the lung.

In a few cases with upper lobe lesions, scalenotomy was also performed in addition to phrenic evulsion.

A few points about the operation

We do not propose to describe the whole technique of the operation, but a few points about it may not be out of place here. The operation itself is simple and can be performed easily under local anæsthesia, except in young children in whom we have used evipan-sodium injections (intravenous) with success.

The researches of Felix and Goetze (1922) in Sauerbruch's clinic showed that simple division of the nerve was inadequate, as in 20 to 30 per cent of cases an important accessory branch joined the nerve below the usual level of section. There are several accessory branches but

the most common runs with the nerve to the subclavius and 3 cm. lateral to the phrenic, and has to be divided if the diaphragm is to be truly paralysed. This nerve arises from the fifth cervical nerve in the neck, enters the thorax in front of the subclavian vein and joins the main cord immediately below the sterno-clavicular articulation. At least 4 to 5 inches of the phrenic nerve should, therefore, be evulsed to make one feel reasonably certain that connections with the accessory phrenic nerve have been broken.

During the dissection of the nerve no pain is experienced by the patient. Clamping before division and traction on the nerve causes pain. The intensity of the pain is variable and, we believe, depends on two factors, (1) the amount of adhesions to be torn through and (2) the temperament of the patient. It is, however, by no means unbearable. During traction, there is always an acceleration of the heart beat.

The dissection became more difficult in our series when the pad of fat overlying the scalenus anticus muscle was excessive or where big veins or adherent enlarged lymphatic glands and lymphatics had to be dissected out.

The situation of the nerve is by no means constant. Usually it is situated on the scalenus anticus muscle and runs across its middle, downwards and inwards. This position may vary and the nerve may run along the inner edge of the muscle, at times covered by the sheath of the carotid artery or along its outer edge. In our series, the nerve was seen to run along the inner margin in 40 and along the outer border in 22 instances. The difficulties in finding the nerve, however, are more when it arises from the brachial plexus or arises from a common trunk with the nerve to the subclavius, *i.e.*, when they arise from behind the scalenus anticus. In this series, the nerve was found to arise in 5 cases from the brachial plexus and in 2 cases from the common trunk with the nerve to the subclavius.

It is not always easy to take out the whole nerve. The size of the nerve varies considerably and, at times, is so thin that it cannot stand the amount of traction necessary to pull out the whole length. Chronic inflammation around the nerve may interfere with its elasticity and make it friable. If the nerve is bound down by dense adhesions not only does the patient complain of pain but it has a chance of breaking above the level of adhesion. During traction, slight oozing of blood occurs around the nerve at the inlet of the thorax. If the oozing is more than usual and blood is seen to well up it has become necessary at times to cut the nerve at the lowest point exposed.

Complications, such as division of the vagus, sympathetic and branches of the brachial plexuses and tearing of the subclavian vein or even of portions of the infected lung, are fortunately rare. In our series, there were

fortunately no untoward operative complications. In one case, there was a moderate amount of hæmoptysis which lasted for four days, while in a few there was a slight elevation of temperature which usually lasted for four or five days after the operation. In some cases of bilateral disease, the temperature lasted for a longer time, owing perhaps to an activation of foci in the other lung. In a few cases, dyspnoea disappearing in a few days after the operation was noticed. Mild gastric and intestinal disturbances, such as borborygmi and flatulence, nausea and vomiting, appeared in some cases but they disappeared in three to five days. These were commoner in left-sided cases. Some of the right-sided cases complained of pain in the lower part of the chest and right hypochondrium for a few days after operation.

Rise of the diaphragm and length of nerve removed

The rise of the diaphragm was not immediate. It takes months after the operation to reach its utmost limit. In the cases observed by us, the extent of average ascent was 3.75 cm. at the end of three weeks and 6.25 cm. at the end of two months. In two cases of removal of the whole nerve the hemidiaphragm was seen to reach up to the level of the third rib, yielding excellent results.

Many observers are of opinion that it is the positive intra-abdominal pressure which causes the elevation of the paralysed diaphragm and that, if the whole nerve is removed, the hemidiaphragm, by gradual atrophy of the muscle fibres, can be expected to rise high up. But this does not take place in cases where there are dense and extensive lateral adhesions. The degree of rise of the diaphragm is influenced by the nature of the lung changes and is greatest, other factors being equal, where the disease is of the chronic productive type with extensive fibrous-tissue changes.

The minimum rise in our series was noted to be 2.5 cm. and the maximum 9 cm. The average rise of diaphragm on the right side was found to be 3.5 cm., while that on the left side was 4 cm. It has been noticed that the rise of the diaphragm is higher and quicker on the left than on the right side. The following table gives some of the details:—

Rise of the diaphragm in relation to the length of nerve removed

Length of nerve removed	Number of cases	Average rise of diaphragm	
		Right	Left
Less than 12.5 cm. . .	110	3.5 cm.	4 cm.
More than 12.5 cm. but not the whole nerve.	60	4.5 cm.	5 cm.
The whole nerve . . .	30	8.0 cm.	9 cm.

A brief analysis of the cases

We are dealing with 200 cases of phrenic evulsion, of which 198 were of pulmonary tuberculosis and two of lung abscess. The two cases of lung abscess had involvement of the lower lobe and both were benefited by the operation.

Primary phrenic evulsion, i.e., where it was done as the sole surgical procedure, was done in 112 cases, and secondary phrenic evulsion, i.e., where it was done as an adjunct to artificial pneumothorax or as a preliminary to thoracoplasty, was done in 86 cases. In one case of bilateral involvement, artificial pneumothorax was done on the left side and phrenic evulsion was done on the right with beneficial results. Of the total number of cases, four were operated on in 1932, 36 in 1933, 50 in 1934, 62 in 1935 and 48 in 1936, which means that all the cases have not yet passed the time test in assessing the results.

Age and sex distribution

Of the total number of cases 155 were males and 45 females. One of the female cases was pregnant at the time of operation which was followed by good after-results. The details of age and sex distribution are shown in the following table:—

Age	Male	Female
9-10 years	1	Nil
10-15 "	2	Nil
15-20 "	32	10
20-30 "	84	22
30-40 "	32	12
40-50 "	4	1
TOTAL ..	155	45

Classification according to stage of disease

According to Turban-Gerhardt classification, 18 cases were in stage II and 180 cases in stage III at the time of operation. None of the cases were in state I.

Localization of lesion

The following table shows the extent of lung involvement on both sides according to regions:—

Extent of involvement	SITE OF DISEASE		TOTAL
	Right lung	Left lung	
Chiefly limited to the upper zone.	58	22	80
Limited to the middle zone.	7	3	10
Limited to the lower zone.	10	4	14
Bilateral disease with more extensive lesion on the side indicated.	57	37	94
TOTAL ..	132	66	198

It will be noticed that, in the present series of cases, lesions on the right side were twice as frequent as those on the left side. Of the total number of cases, 112 showed the presence of single or multiple cavities (usually thin-walled) distributed as follows:—

In the lower zone	..	10 cases.
„ „ middle „	..	38 „
„ „ upper „	..	64 „

EFFECTS OF THE OPERATION ON THE DISEASE PROCESS

1. *On cough and expectoration.*—If cough is due to diaphragmatic irritation and expectoration is prevented by a tonic contraction of the diaphragm, the cough is relieved and expectoration facilitated by phrenic evulsion. Expectoration is gradually diminished along with a clinical improvement of the case. The sputum was markedly diminished, after the operation, in 76 and moderately diminished in 32 of our cases; the remainder showing no effect. This information, in outdoor cases, had naturally to be gathered from the statements of the patients and hence we do not consider it as of unimpeachable accuracy.

2. *On tubercle bacilli (TB) in sputum.*—Out of 198 cases, 178 had TB-positive sputum at the time of operation. The 20 negative-sputum cases never became positive during the period of observation. Of the 178 positive-sputum cases, 98 (or 55 per cent) became negative as a result of phrenic evulsion, while 80 still remained positive.

3. *On cavities.*—Cavities may be thin-walled, thick-walled or moth-eaten. It is well known now that thin-walled cavities are a predominant feature of subacute or chronic pulmonary tuberculosis in this country owing to comparative scarcity of urban and industrial areas and a consequent low degree of tuberculization of the population as compared with highly industrialized and urbanized countries in the West. A majority of our cases had thin-walled cavities.

Cavities could be demarcated in 112 cases and their localization was as follows:—

Localization	Number of cases	No. showing shrinkage and fibrosis	Percentage
Upper zone	64	54	84.3
Middle „	38	36	94.7
Lower „	10	10	100.0

A complete obliteration of cavities was noticed in 42 cases (= 37 per cent). Cavities were appreciably shrunk in 58 cases (= 52 per cent), and no results were discernible in 12 cases (= 11 per cent).

As will appear from the above table, of 64 upper lobe cavity cases, 54 showed diminution in size and fibrosis, showing that upper-lobe

lesions need not constitute a contra-indication to phrenic evulsion. O'Brien's (1930) (*Journ. Amer. Med. Assoc.*, xcv, p. 650) figures in this connection will be found interesting. Among 311 cases of cavity in the upper lung field in his series 46.6 per cent were closed, in 40 cases of cavity in the middle lung field 62 per cent were closed and in 27 cases with cavity in the lower lung field 80 per cent were closed.

4. *Other effects.*—It has already been mentioned that symptoms such as cough and expectoration are greatly relieved. Symptoms such as pain or dragging due to diaphragmatic adhesions are also greatly relieved. Owing to the diminution or obliteration of cavities and of the lymph and venous stasis, there is diminished absorption of tubercle toxins and a consequent reduction of pyrexia and improvement in general health. The sedimentation rate of blood is also correspondingly lessened.

It should be well understood that phrenic evulsion is but an accessory to general sanatorium regime, coupled or not with other measures such as gold therapy, artificial pneumothorax, etc. We have employed it in those cases where from the nature of lung changes or from the social status and general condition of the patient we desired to overcome those mechanical changes which appeared to us to act as a hindrance or barrier to healing. Those patients who listened strictly to our instructions regarding regulation of rest and exercise naturally did better than the foolish ones who took the law into their own hands and thought that they could disregard our instructions after the operation has been done.

Results in relation to the rise of the dome of the diaphragm

The degree of improvement depends, to some extent, on the length of the nerve removed—the greater the length of nerve removed, the better the improvement, as will appear from the following table in our series:—

Length of nerve removed	Number of cases	Clinically improved	Percentage
Less than 12.5 cm.	110	50	45.4
More than 12.5 cm. but not the whole nerve.	60	45	75.0
The whole nerve	30	25	83.3

Morrison Davies (1933) (*Pulmonary Tuberculosis*, p. 323) is of the opinion that the diminution in the volume of the lung which follows as a result of hemidiaphragmatic paralysis is manifested in some cases as strikingly on the apical as on the basal lesions. There is some divergence of opinion on this point but our findings lend support to his views. Unless the root of the lung is firmly fixed by

adhesions, the movements of the diaphragm affect the apex almost as much as the base. The collapse of the lung, consequent on the paralysis of the hemidiaphragm, is probably equally distributed throughout the whole lung, although the effects are more noticeable in those parts which show more proliferative lesions or where there are basal adhesions.

The results given below in relation to localization of lesions in our series will lend support to the views of Morrison Davies and others:—

We cite below three typical cases for illustration:—

Case I.—A. H., Mohammedan, male, aged 30 years, tailor, came under our observation on 29th June, 1932.

History.—Wife died of pulmonary tuberculosis. He has been suffering from cough for five months and fever and wasting for one month before he sought treatment here.

Physical examination.—Comparative loss of resonance and medium crepitant râles over both subclavicular areas, but more extensive over the left. Skiagraph taken on 18th July, 1932, showed semi-productive infiltration and cavitation of both upper lobes in the

Results in relation to localization of lesions

Extent of involvement	Arrested	Much improved	Improved	Stationary	Worse	Died	Total	Percentage of positive results
Limited to upper zone	1	1	20	27	14	17	80	27.5
Limited to middle zone	0	2	0	0	2	6	10	20.0
Limited to lower zone	1	8	4	1	2	0	16	81.2
Bilateral disease, with more extensive disease on the side operated upon.	0	11	72	0	2	9	94	88.2
TOTAL ..	2	22	96	28	20	32	200	..

We should like to state that all the operations have not been done in the same year. We introduced the operation in our out-patient's clinic in the year 1932. As will appear from the following table, as many as 110 cases were operated on during the last two years. Many of these cases have swelled the figures under the category of 'improved cases', especially in the bilateral ones. With further 'time control' some of them will shift their categories to the better or worse side. The assessment of results according to the period of observation will be seen better in the following table:—

sub-clavicular area, but more active on the left side (plate X). There were no extra-pulmonary complications. Sputum was TB-positive (in large numbers).

Treatment.—Artificial pneumothorax was tried on the left side but failed. Left phrenic evulsion was, therefore, done on 12th August, 1932, 20 cm. of the nerve being removed. Sputum has remained TB-negative since 5th December, 1932. He has gained 32 lb. in weight since then and has remained symptom-free. Is doing full work (tailoring) for the last two years. Has had two courses of gold therapy (intramuscular solganal B. oleosum).

Case II.—M. M. R., Hindu, male, aged 26 years.

Previous history.—Pleurisy left, six years ago.

Hæmoptysis in streaks, a year ago.

Year in which operation was done	1932	1933	1934	1935	1936	TOTAL
Period of observation with results ..	5 years	4 years	3 years	2 years	1 year	..
Arrested	1	1	0	0	0	2
Much improved	1	8	6	5	2	22
Improved	1	4	28	35	28	96
Stationary	0	3	8	5	10	28
Worse	0	8	5	5	4	20
Died	1	12	3	12	4	32
TOTAL ..	4	36	50	62	48	200

It will be seen that 'positive' results (i.e., improvement) have been obtained in 60 per cent of cases. If we leave aside the cases for 1935 and 1936, it will be seen that 50 out of 90 cases (or 55 per cent) showed improvement and are still living. If we take the cases operated on during the first three years, we shall find that at least 20 per cent of the persons operated on have regained their working capacity.

Complaints.—Cough, with half an ounce of expectoration in 24 hours—for four months, a low fever for two months and a moderate amount of wasting.

Physical examination.—Comparative loss of resonance over the left upper lobe of lung. Cavernous breathing and medium crepitant râles over the same area. Deficient air entry in right upper lobe. Sputum showed a large number of TB in smear. Skiagraph showed extensive semi-productive infiltration with a cavity in the middle zone (plate X).

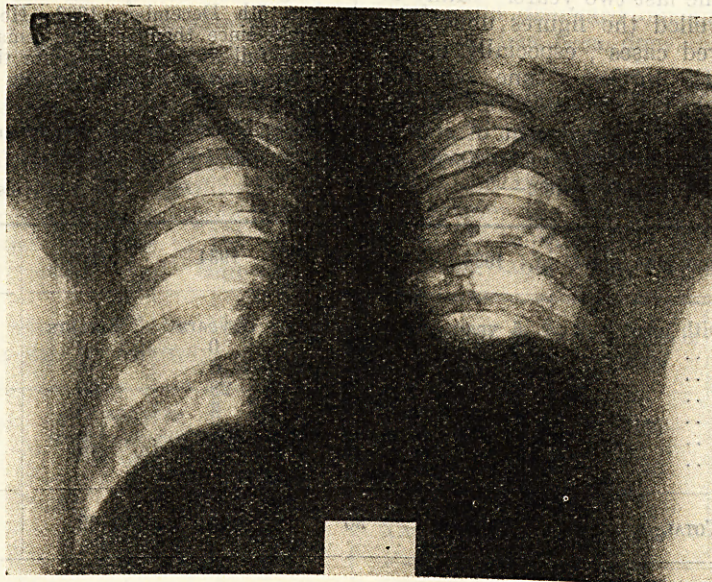
Treatment adopted.—Artificial pneumothorax having failed on the left side, phrenic evulsion was done on 26th June, 1936, and the entire nerve (31 cm.) was removed. Since then the patient has gained 36½ lb. in weight within six months, the sputum has remained TB-negative since 16th July, 1936, and the case has remained symptom-free. A course of solganal B. oleosum has also been given. There is no extra-pulmonary complication.

Case III.—Dr. D. M., Hindu, male, aged 40 years, medical practitioner, Calcutta.

History.—Diabetes and high blood-sugar detected in 1928. Came to the senior author on 7th January, 1936, for progressive loss of weight for two years, slight cough, repeated moderate hæmoptysis and the fever off and on since 1934.

Physical examination.—The patient was running a slight temperature at the time and the maximum daily pulse rate was 100 per min. Expectoration—four teaspoonfuls daily, containing a fair number of tubercle bacilli. Chest examination showed some loss of resonance, increase of vocal fremitus and presence of occasional râles. Skiagraph of the chest showed a 'circular focus' in the medial portion of the right upper lobe and semi-productive infiltration of the whole of the left lung with a good-size cavity in the left sub-apical area.

Treatment undertaken.—Glycosuria was controlled with insulin therapy. Artificial pneumothorax was tried on the left side but failed. Left phrenic evulsion was done on 27th January, 1936, six inches of the nerve being removed. The temperature came down to normal a fortnight after the operation and he has been fever-free since. He has had two courses of solganal B. oleosum. He was examined last on 20th February, 1937. He has gained 2 stones 2 lb. since operation and has a pulse rate of 70 to 76 per minute. The left hemidiaphragm has risen to 3rd rib above, the infiltrations are fibrosing well, the old cavity has nearly been obliterated and the sputum has remained negative since June 1936 (see figure below).



Case III.—Phrenic evulsion in a diabetic, resorbing infiltrations and obliterating the vomica in the left upper lobe.

Discussion

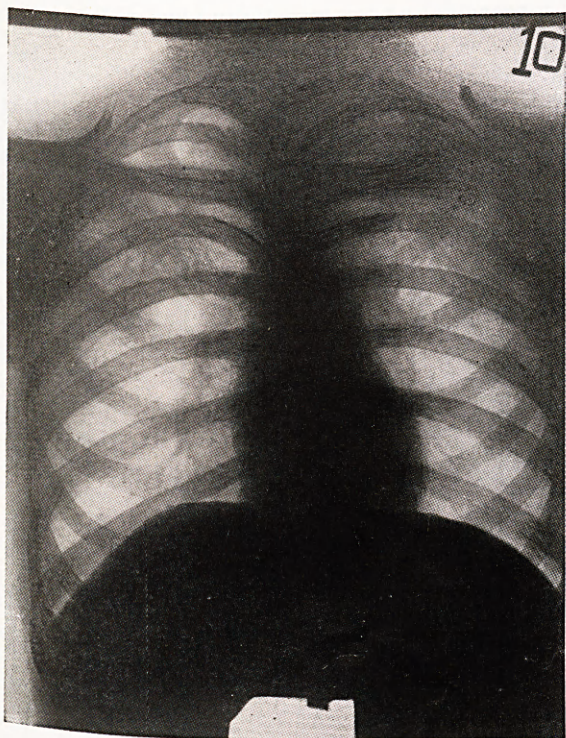
We have already stated that over 50 per cent of the patients who seek the aid of this section of the hospital are found to be in a fairly advanced stage of the disease. A fair number of patients comes from rural and semi-rural

areas, in whom localization of lesions in the lung is rather fragmentary owing to generally marked hypersensitiveness to tuberculo-toxin, as has already been stated.

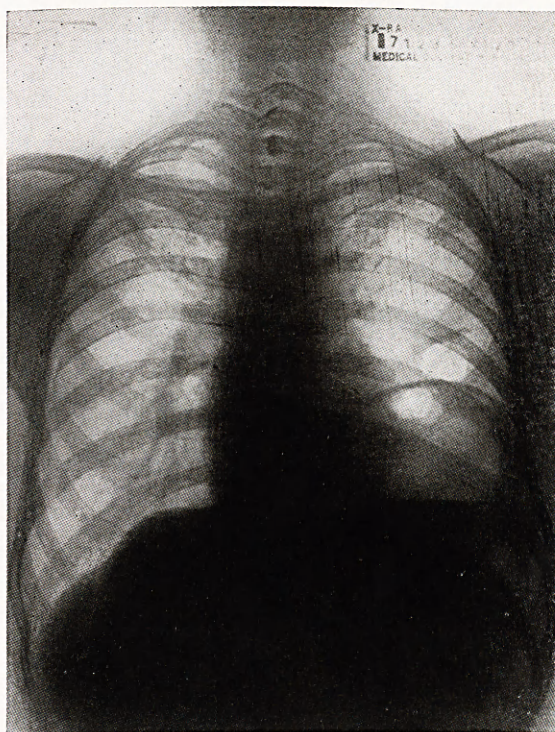
Barely 10 per cent of the cases are found to be suitable for artificial pneumothorax therapy. Among them also, various degrees of ineffective compression of lung are obtained owing either to the presence of adhesions or to the proliferative nature of the changes. Among the latter, where cauterization of adhesions is not possible and where thoracoplasty is not indicated or possible, we have to choose our cases for phrenicectomy. Besides these, we have to think of this procedure where artificial pneumothorax has failed or where, from the extensive distribution of lesions, no other surgical procedure is applicable. Where pneumothorax is practicable and effective, the question of phrenic evulsion does not arise, nor does it arise when there are multiple and thick-walled cavities or when the lesions are acute and exudative. Whether phrenic evulsion is the sole surgical procedure or is used as an adjunct to pneumothorax, the cases have got to be properly chosen. The fact that it is a simple operation which is not likely to give rise to shock or serious reaction, that it has to be done only once, that it brings about the same sclerotic changes in involved lung tissues as in pneumothorax, that it can be performed on patients who are in a grave condition, and that it is free from the risks of reaction and

pleural effusion common in pneumothorax, no doubt makes a great appeal for its application in suitable cases. The paralysis of the hemidiaphragm gives an additional amount of rest

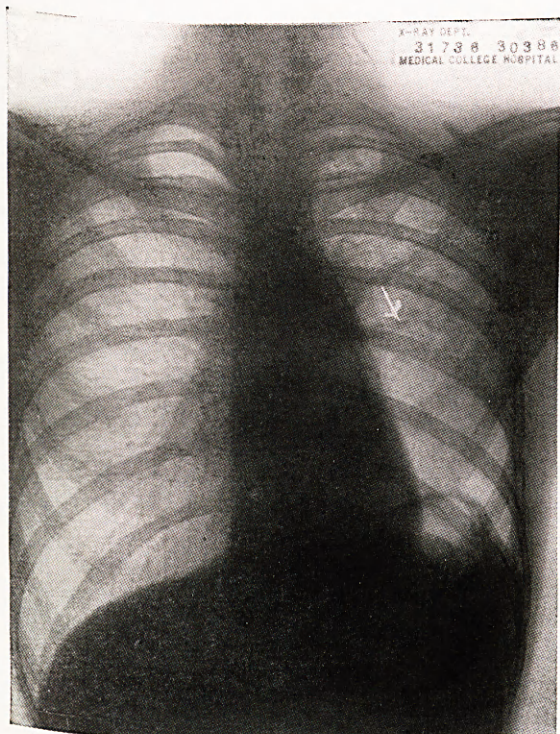
(Continued at foot of opposite page)



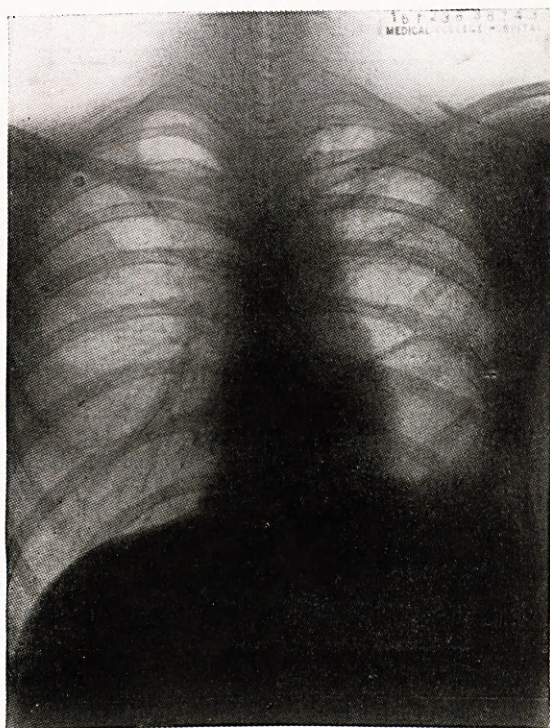
Case I. Fig. 1.—Lesions when patient first came under observation (18th July, 1932).



Case I. Fig. 2.—Same patient 3½ years after left phrenic evulsion. It will be seen that after the correction of the toxic imbalance by the left-sided operation, the lesions on both sides began to improve.



Case II. Fig. 1.—Lesions one month after left phrenic evulsion.



Case II. Fig. 2.—Same case six months after operation. The infiltration in the left upper and middle zones has considerably cleared up and the cavity in the middle zone practically closed.

OLEOTHORAX IN THE TREATMENT OF PLEURO-PULMONARY TUBERCULOSIS

By A. C. UKIL, M.B., M.S.P.E. (Paris), F.S.M.F., F.N.I.
and

K. N. DE, B.Sc., M.B.

(From the Department of Chest Diseases, Medical College Hospitals, Calcutta)

By the term 'oleothorax' is meant the introduction of massive quantities of oil (plain or antiseptic) into the pleural cavity for therapeutic purposes. This branch of phthisiology is indebted to Bernou (1922) for introducing and developing the method. A large amount of work has now been done on the subject in France, Switzerland, Germany, England and other countries. The method, however, requires a careful judgment in the selection of cases, a far greater technical skill in application and a closer observation of cases than pneumothorax therapy. Hence, like all new methods of therapy, it has been subjected to some divergence of opinion among different workers.

A case of uninterrupted and successful pneumothorax treatment requires a period of three years or more to bring about healing of the lesion. Unfortunately certain difficulties and complications are encountered during

(Continued from previous page)

to the affected lung by diminishing the respiratory excursion, by increased compression and by relaxation of lung when cavities are held open by adhesions to chest wall.

In apical lesions, we have now begun to perform scalenotomy, in combination with phrenicectomy, in suitable cases but are not yet in a position to assess its results. As the scalene muscles are accessory muscles of respiration, the operation is expected to relax the apical region of the lung and to reduce the size of cavities.

Phrenicectomy has a definite place in the treatment of pulmonary tuberculosis, particularly in the type of case we had to deal with. We do not subscribe to the view that phrenic evulsion should be done as an adjuvant in every case of pneumothorax where there is cavitation. It is better to judge each case on its own merits. Remembering that 91 per cent of our cases were in stage III and the remainder (9 per cent) in stage II of the disease before the operation and that, in the absence of sanatorium or hospital beds, we could offer them no other treatment, we have reason to be gratified to find that 55 per cent of the patients became TB-negative in the sputum and that 60 per cent of the total showed 'positive' results. Even extra-pulmonary lesions, like laryngeal tuberculosis, have been seen to improve after the control of the TB in the sputum brought about by phrenic evulsion.

the course of treatment. The introduction of aseptic or antiseptic oils into the pleural cavity has been devised to mitigate or solve some of them. It is in no sense a substitute for pneumothorax treatment.

For example, in some cases of pneumothorax, especially where selective collapse has been obtained, the healthy part of the lung may tend to expand too quickly and form 'riding' adhesions with parietal pleural membrane and gradually obliterate the pneumothorax space. In these cases, the introduction of aseptic oil into the pleural cavity checks the re-expansion and consequent adhesions by virtue of its slow absorption and weight and thus allows effective pneumothorax to be carried on. This is called *inhibition pneumothorax* (= *oleothorax anti-symphysaire* of French authors).

In some cases where a pleural effusion has occurred, the tendency to adhere becomes more marked and the pleura becomes thicker and more rigid. Air inflations are not always enough to maintain an effective collapse in such cases. In these cases, the introduction of oil into the pleural cavity lessens the permeability of the pleural membrane and secures a better compression of the affected area of the lung and, owing to its slow absorption, obviates the necessity of frequent refills. In certain cases with rigid-wall cavities, air insufflations are inadequate to effect a closure of the cavities. In some of these cases, the replacement of air by oil serves the purpose. This type of oleothorax is called *compression oleothorax*. In a smaller number of cases, the mediastinum shows insufficient rigidity and does not allow the introduction of enough air for pneumothorax without producing a mediastinal hernia. In these cases, the introduction of oil stimulates slight reactions and thickens the mediastinal pleura. In some cases a patient may be unable to continue the air insufflations at the required intervals. Here oleothorax may be substituted for pneumothorax very carefully. Oleothorax has sometimes been employed to close *small* transitory, intermittent or valve-type perforations, where the viscosity and pressure of the oil, aided by a thickening of the pleura at the mouth of the fistula, effect a closure of the opening. The addition of a small percentage of antiseptic serves to inhibit or relieve a complicating pyothorax later on. It is contra-indicated for pleuro-pulmonary fistulæ with a *large* opening. In all the above types of cases, oleothorax exercises both a mechanical and rigidifying action.

By far the largest use of oleothorax is in the treatment of chronic tuberculous pleurisies, sero-fibrinous or purulent, which may occur primarily or in the course of pneumothorax treatment. It has been noted that 30 per cent of pulmonary tuberculosis cases give a previous history of pleurisy and that 80 per cent of chronic pleural effusion are of tuberculous