

## BASAL PLOMBAGE

BY

J. K. CLAREBROUGH AND W. P. CLELAND

*From the Brompton Hospital, London*

(RECEIVED FOR PUBLICATION DECEMBER 6, 1955)

The treatment of tuberculous cavities in the lower lobe is difficult. Simple measures such as phrenic paralysis with or without pneumoperitoneum, artificial pneumothorax, postural retention, chemotherapy and bed rest, alone or in combination, have proved effective in only two-thirds of the patients, and, even in these, relapse has been frequent. Crofton (1949), reviewing a series of 54 cases in which a tuberculous cavity in the apex of the lower lobe was the dominant lesion, reported that 66% of cases were treated successfully with artificial pneumothorax, whilst Macdonald (1952) recorded almost identical figures for cases treated by the simpler measures outlined above. It is difficult to determine the causes of failure, but it would appear that the apex of the lower lobe is difficult to relax adequately. Not only is it a relatively short, squat segment whose inward migration is hindered by the rigid hilum, but adhesions between the segment and the costo-vertebral groove are common and frequently extensive and short. Furthermore, the rise of the diaphragm produced by phrenic paralysis, even when supplemented by pneumoperitoneum, is often disappointingly limited posteriorly (though often extensive in front) so that the effect on the apex of the lower lobe is not considerable.

Resection has been increasingly used either as a primary method of treatment, or more often where simpler measures have failed in patients whose disease is limited to the lower lobe. It is, however, generally regarded as inadvisable where lesions are more widespread owing to the risks of extension of the disease.

Thoracoplasty as an alternative method of treatment is particularly applicable to those patients with cavitation in both the upper and the lower lobe. Hiddlestone and Taylor (1954) record only four successes among eight patients treated by thoracoplasty, although in three of the failures the disease was extensive. In some cases, however, the upper lobe lesion no longer requires treatment and yet is hardly stable enough to permit resection of the lower lobe. In such cases an extensive thoracoplasty, designed to relax a lower lobe cavity,

would sacrifice a great deal of functioning lung tissue. Thoracoplasty for lower lobe disease alone can rarely be entertained for similar reasons.

More localized and less extensive thoracoplasties are mentioned by Freedlander (1938) and O'Shaughnessy and Mason (1939); the former records two instances where ribs overlying a basal cavity were resected with apparently successful results. O'Shaughnessy and Mason reported eight cases treated by "thoracolysis" with cavity closure and sputum conversion in all instances, although in one the procedure had to be repeated. Their operation consisted of the resection of a varying number of ribs above and below the cavity; they used Zenker's solution to delay rib regeneration and an external pad to increase the collapse. Their report encouraged us to use a modification of this technique to treat persistent basal cavitation where simpler measures had failed and where resection or thoracoplasty were considered to be impracticable. Our experience with nine cases has been extremely encouraging.

### OPERATION

The aim of the operation is to mobilize the cavity as widely as possible and to maintain the lung in the relaxed position by a plomb. The mobilized area extends for a distance of two ribs above and two ribs below the cavity, and for similar distances in front of and behind the cavity.

Before operation, in all cases the cavity was accurately localized by means of standard radiographs and lateral tomograms. Bronchoscopy was carried out in most cases, but this was not regarded as an investigation essential to the operation. Most of the patients had received much treatment with various antibiotics before operation.

The operation is carried out through a curved periscapular incision placed approximately over the site of the cavity. The inner layer of the periosteum is stripped from the selected ribs whilst the outer layer is left attached. The intercostal muscles and bundles are divided near the neck of the rib, but remain attached to the lung together with the inner

layer of the periosteum. The ribs need not be divided but can be separated to permit the mobilization of the lung from the costovertebral gutter and the sides of the vertebral bodies. The divided ends of the intercostal bundles and muscles are sutured to the anterior longitudinal ligament of the spine. In this way all bare parietal pleura is covered by a layer of muscle.

The mobilized lung is retained in position by filling the space loosely with plastic spheres. In the first three patients, hollow methyl methacrylate spheres were used whilst in the remainder solid polyethylene balls were employed.

The space is drained temporarily for 24 to 48 hours. No specific post-operative management has been necessary.

Early post-operative assessment is not easy, as the standard postero-anterior radiograph is of little value and good lateral films are difficult to obtain in the early stages. Lateral tomography, however, at a later stage gives an accurate picture of the state of affairs and is much more informative than postero-anterior tomograms. Lateral tomography and repeated sputum cultures have been carried out in all cases.

#### CLINICAL FEATURES

The nine patients who form the basis of this report have all been operated upon in the last seven years, with a maximum follow-up of seven years and a minimum of two years. In all patients, the tuberculous infection has been widespread, and simpler measures tried over a number of years failed to produce a satisfactory result. The majority were obviously poor surgical risks with little respiratory reserve, and several had been refused other forms of surgical treatment on these grounds. In all cases a formal resection was considered to be impracticable, whilst a thoracoplasty appeared likely to lead to severe respiratory crippling.

Detailed clinical features are given below, whilst the radiological findings are represented diagrammatically in each case. The upper diagram is a composite figure representing the various radiological changes which have appeared during the course of observation. The lower figure shows the state of the lung fields at the time of the operation.

**CASE 1.**—In 1933, at the age of 10, E. W. developed a tuberculous ankle joint. Three years later she developed bilateral pulmonary tuberculosis and was treated with a right artificial pneumothorax (A.P.) for five years and a left A.P. for six years. In 1944, at the age of 21, she had a right nephro-ureterectomy for a tuberculous kidney. Following a short period of work in 1947, she was readmitted to hospital with a large cavity in the apical segment of the right lower lobe and calcified

nodular lesions scattered throughout both lungs (Fig. 1). Despite bed rest and chemotherapy, the cavity persisted. A basal plombage was performed in January, 1949, when she was aged 26. Apart from a positive sputum in 1952 she has remained fit and well and is married and working. Lateral tomography does not reveal a cavity, and further positive cultures have not been obtained.

**CASE 2.**—In October, 1946, after this patient had had pleurisy and a haemoptysis radiography showed extensive tuberculous infiltration in the upper zone of the right lung. The right phrenic nerve was crushed and a pneumoperitoneum induced. During a refill in 1948 a right A.P. was accidentally induced. This was subsequently maintained and the pneumoperitoneum abandoned. In June, 1948, there was considerable extension of the disease to the right lower zone with the development of a cavity in the apical segment of the lower lobe. The pneumoperitoneum was reintroduced, but in April, 1949, the disease spread in the left mid zone. Chemotherapy improved the lesions in the left lung, but the right apical cavity remained (Fig. 2). In September, 1949, when he was aged 26, a right basal plombage was carried out. In 1950 he had an isolated positive sputum and the pneumoperitoneum was reintroduced. Subsequent sputum cultures have all been negative and lateral tomographs show no cavitation. He has been working as a dental mechanic for the past three years.

**CASE 3.**—In 1948 radiography revealed minimal infiltration at the left apex. Four months later, when she was admitted to hospital, the disease had spread extensively at the right apex. A right phrenic crush was performed and a pneumoperitoneum induced. In spite of additional chemotherapy, the right upper lobe



FIG. 1

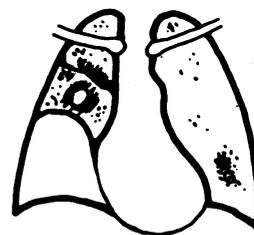


FIG. 2

became atelectatic and cavitated, and the disease extended at the left apex. A left artificial pneumothorax was induced. In January, 1950, a cavity appeared in the apex of the right lower lobe and, despite bed rest, chemotherapy, and a pneumoperitoneum, persisted (Fig. 3). In July, 1950, when she was aged 19, a right basal plombage was performed. Convalescence was satisfactory, and the pneumoperitoneum was abandoned one month after operation. Seven months after operation she was discharged home with negative sputum and a satisfactory left pneumothorax. One year after operation she died suddenly at home, having been in good health the previous day. Necropsy revealed no adequate cause for death. The plomb space was satisfactory and the cavity in the apical segment was

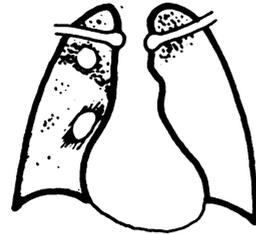


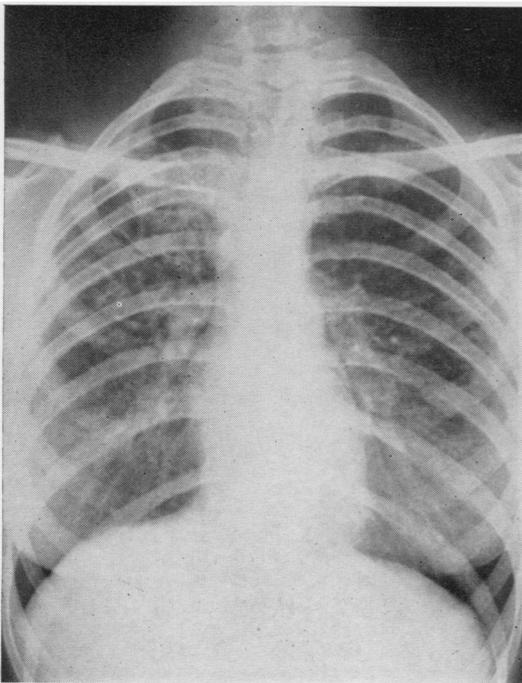
FIG. 3

closed, but there was some disease in the underlying lung.

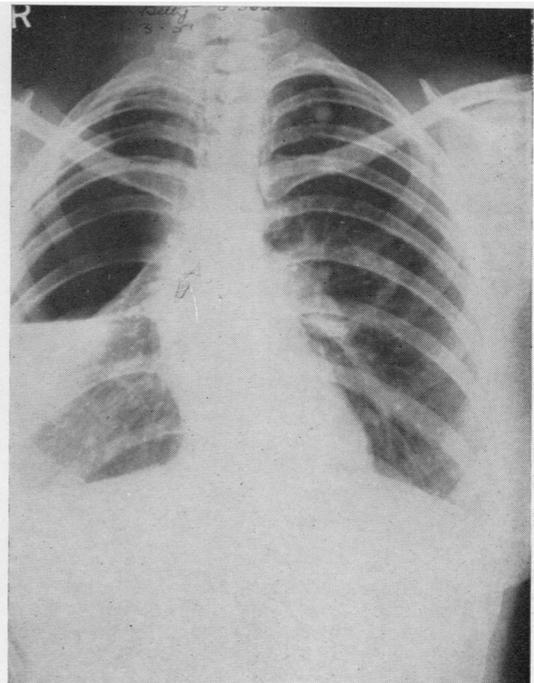
CASE 4.—In 1944 radiography revealed bilateral infiltration with cavitation in the right upper lobe (Fig. 4a). A right A.P. was induced, and the patient remained well for four years. In 1948 the disease spread to the middle zone of the left lung, and a cavity appeared in the apical segment of the left lower lobe. A left A.P. was induced, but the cavity persisted. The pneumothorax was abandoned in January, 1951. Refills of the right A.P. were discontinued at this time, seven years after induction, but the lung failed to re-expand (Fig. 4b). Radiography at this time showed a large cavity in the apical segment of the left lower lobe with an unexpandable right lung (Fig. 5). In March, 1951, when she was aged 24, a left basal plombage



FIG. 5



(a)



(b)

FIG. 4.—Case 4: B. F. (a) Radiograph (1944) showing extensive infiltration and cavitation in the upper and middle zones of the right lung and infiltration in the mid zone of the left lung. (b) Radiograph (1951) showing a large cavity in the apex of the left lower lobe and a hydro-pneumothorax on the right side.

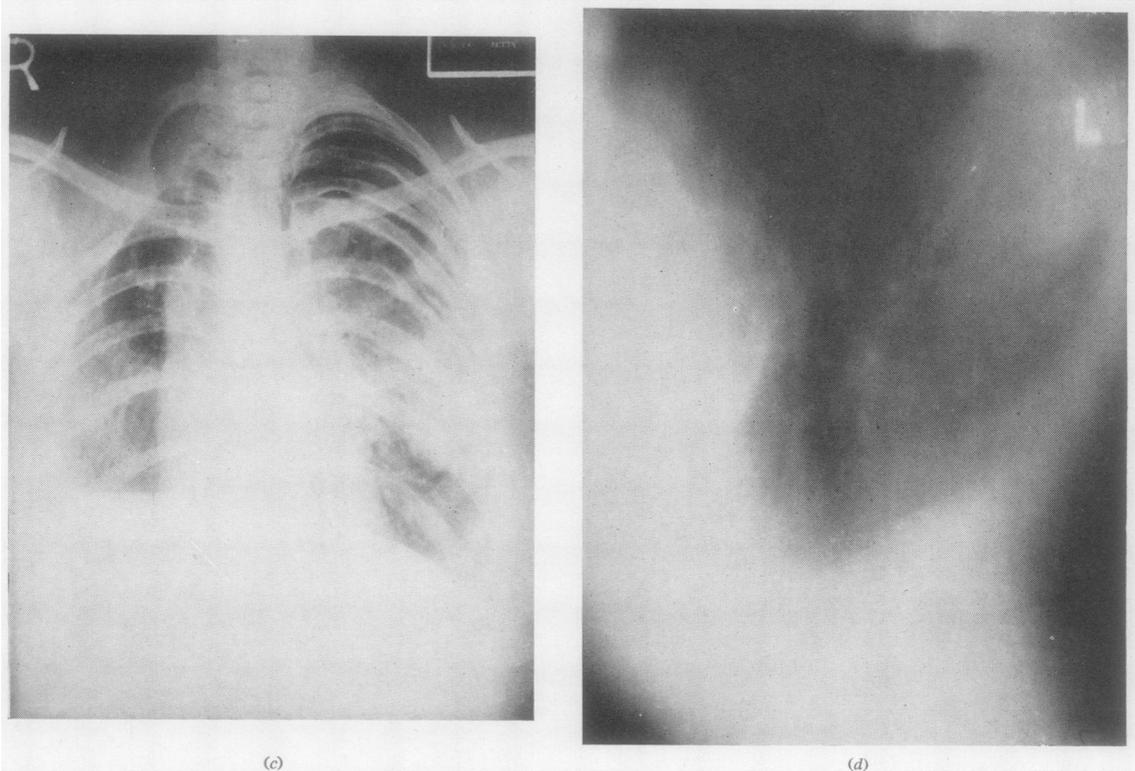


FIG. 4.—Case 4: B. F. (c) Radiograph (1955) after a left basal plombage (1951) and a right upper lobectomy, decortication, and thoracoplasty (1953). (d) Lateral tomograph (1955) showing no evidence of a persistent cavity.

was carried out, with a satisfactory convalescence. By November, 1952, she had no sputum and was well. In July, 1953, she was readmitted to hospital with a right-sided pyogenic empyema. The infection was controlled by aspirations and intrapleural antibiotics, and in November, 1953, a right upper lobectomy, decortication, and four-rib thoracoplasty was carried out. The patient is now well, with negative sputum (Fig. 4c). Lateral tomographs show no evidence of persistent cavitation (Fig. 4d).

CASE 5.—In 1946, at the age of 20, this patient had a chest radiograph which showed infiltration throughout the right lung with multiple cavities in the upper and the lower zones. A right A.P. was induced but soon abandoned and replaced by a pneumoperitoneum combined with phrenic paralysis. By 1949 the apical cavity had closed, but the cavity in the apical segment of the right lower lobe persisted. Two years later tomograms showed that the cavity in the apical lower segment was still present together with considerable scarring and bronchiectasis in the apical and posterior segments of the right upper lobe (Fig. 6). In October, 1951, when she was aged 25, a right basal plombage was performed. The sputum has been persistently negative since operation, and lateral tomographs show no evidence of cavitation. She remains well and does

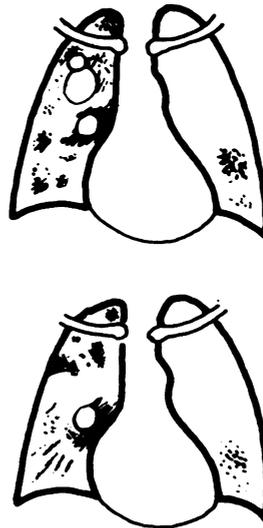


FIG. 6

all her own housework.

CASE 6.—In December, 1951, this patient developed a severe attack of influenza followed by the development of a persistent cough. Radiography revealed extensive infiltration with cavitation in the right upper lobe. He was treated with streptomycin and P.A.S., but cavitation persisted. In January, 1953, radiography showed a cavity in the apical segment of the right lower lobe in addition to the apical disease (Fig. 7). Treatment with postural retention and further chemotherapy resulted in the closure of the cavity at the apex, but the lower lobe cavity persisted. In June, 1953, when he was aged 47, a basal plombage

was performed. After operation he developed ascites and oedema of the legs, which were relieved promptly by aspirating the plomb space. His subsequent course has been uneventful. He has been working full-time for 18 months, has no sputum or evidence of residual cavitation.

CASE 7.—In 1937 radiographic examination of this patient showed bilateral apical cavitation with infiltration in the middle zone of the left lung. Bilateral A.P.s were induced, together with a phrenic crush on the right. As neither resulted in the closure of the cavities they were discontinued (Fig. 8a). In 1942 a cavity appeared in the apical segment of the right lower lobe. The patient was treated in a sanatorium for 10 years with intermittent chemotherapy and postural retention (Fig. 8b). This resulted in closure of both the upper

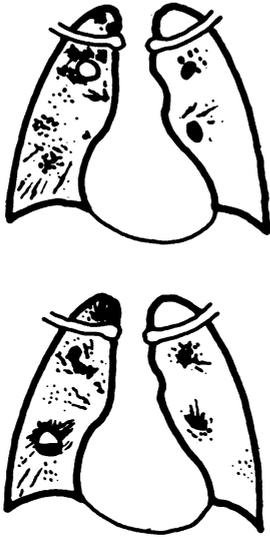
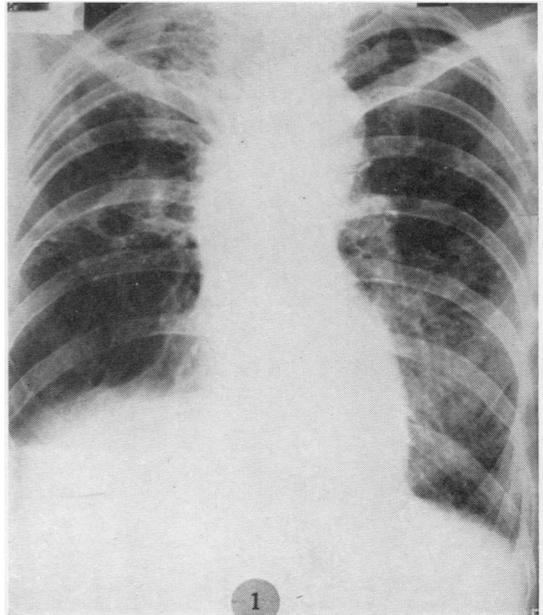
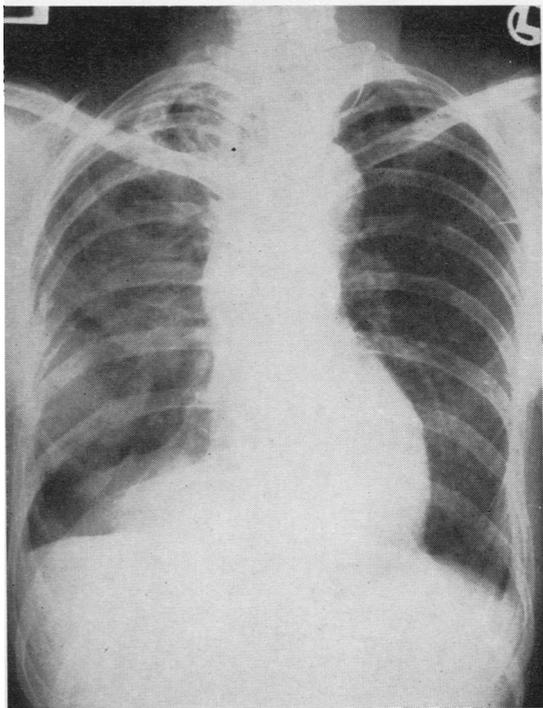


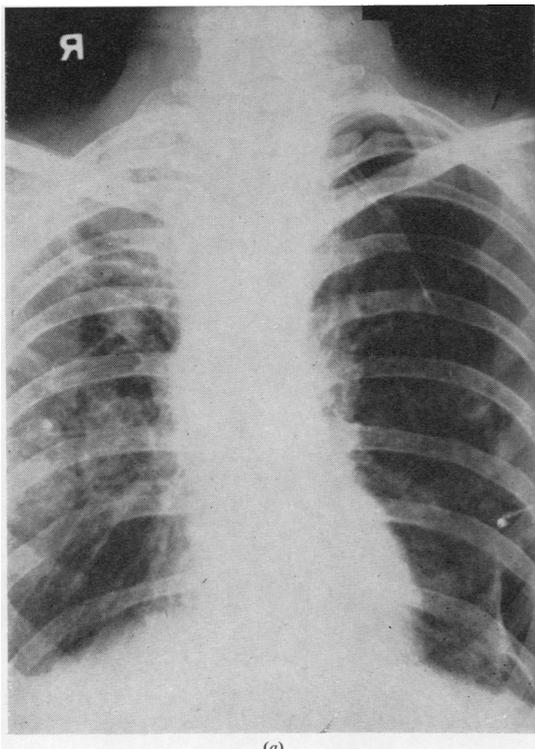
FIG. 7



(b)



(c)



(a)

FIG. 8.—Case 7: D. B. (a) Radiograph (1940) showing extensive disease throughout the right lung with apical cavitation and a left artificial pneumothorax. (b) Radiograph (1953) showing a large cavity in the apex of the right lower lobe and honeycombing at the right apex. (c) Radiograph (1955) after right basal plombage.

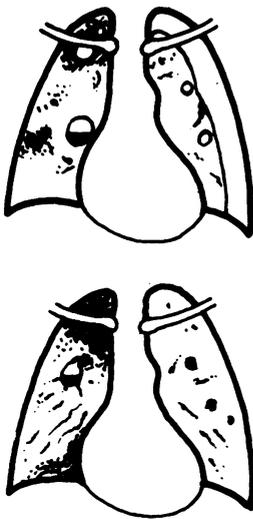


FIG. 9

June, 1955, he developed uraemia and died. There was no necropsy.

CASE 8.—This patient first became ill in December, 1950, when she developed a cough with sputum and

lobe cavities, but the cavity in the apical segment of the right lower lobe persisted (Fig. 9). Bronchograms showed extensive bronchiectatic changes in the right upper lobe. Bronchoscopy showed acute tuberculous bronchitis with granulations in the main bronchus on the right side. In June, 1953, when he was aged 40, a basal plombage was performed (Fig. 8c). After operation the patient had an acute exacerbation of a chronic nephritis from which he nearly died, but responded to a Borst diet. His subsequent course was satisfactory with the sputum negative and the cavity closed, until, in

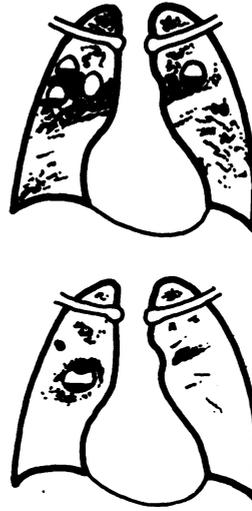
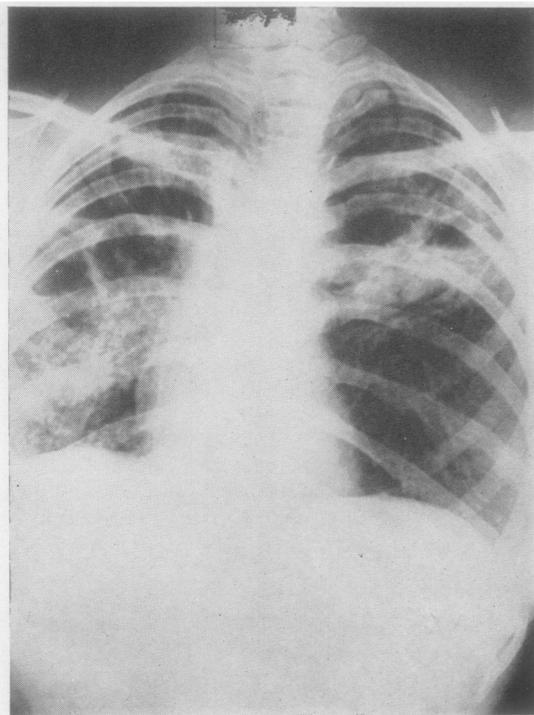


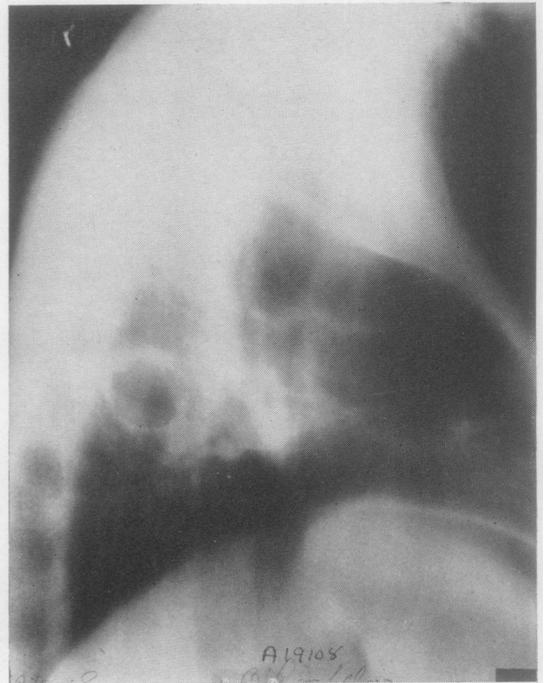
FIG. 11

1953 (Fig. 10c), the apical cavities on both sides had closed, but the cavity in the apical segment of the right lower lobe and a small cavity in the middle lobe persisted (Fig. 11). Basal plombage was performed

later noticed a husky voice. She was admitted to hospital in July with tuberculous laryngitis. Radiography showed extensive infiltration in both lungs with cavitation in the upper and middle zones (Fig. 10a). She was treated with intensive chemotherapy, pneumoperitoneum, and right phrenic crush. Lateral tomography showed cavitation in the apical segment of the upper lobe, in the middle lobe and in the apical segment of the right lower lobe (Fig. 10b). With continuous treatment and despite an exacerbation in June, 1953, with frequent haemoptyses, she gradually improved. By October,



(a)



A19105

(b)

FIG. 10.—Case 8: B. O'L. (a) Radiograph (1950) showing extensive bilateral disease and cavitation. (b) Lateral tomograph (1953) showing cavity in the apex of the right lower lobe.

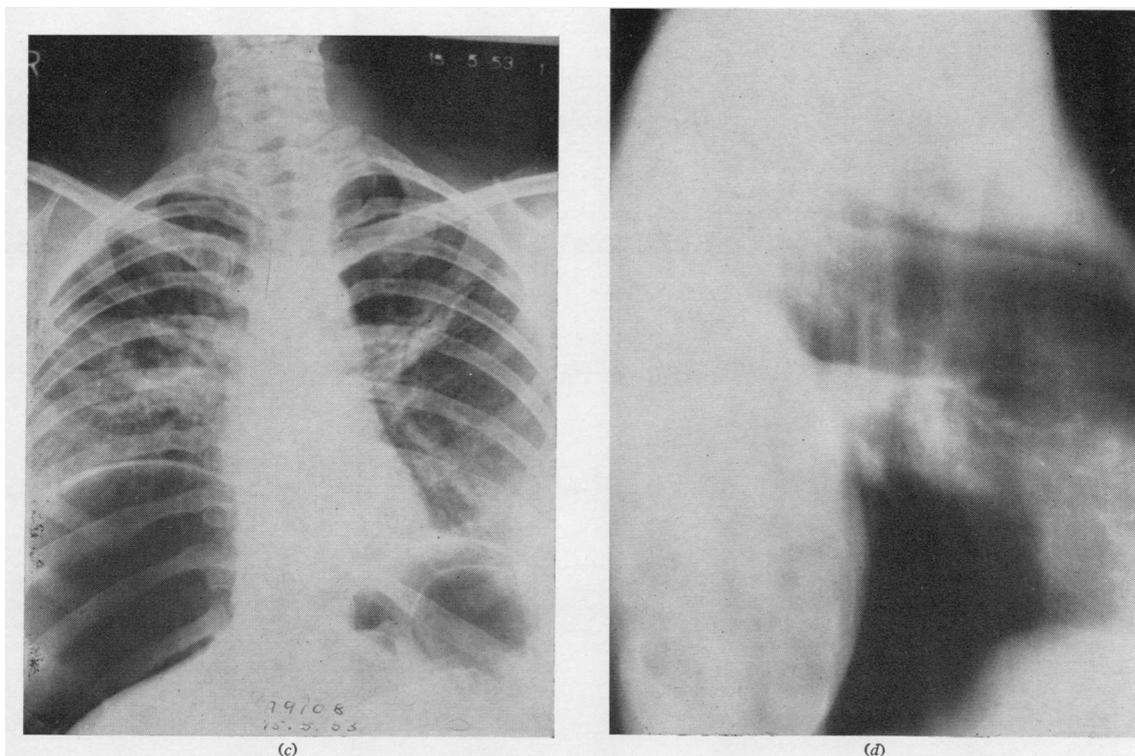


FIG. 10.—Case 8: B. O'L. (c) Radiograph (1953) after right phrenic paralysis and pneumoperitoneum. A large cavity system persists in the right mid-zone. (d) Lateral tomograph (1955) after right basal plombage. The cavity is no longer visible.

in October, 1953, when she was aged 21, and resulted in closure of the remaining cavities. Two years after operation she is remarkably fit and working full-time. She has no sputum and lateral tomographs show no evidence of cavitation (Fig. 10d).

CASE 9.—A mass miniature radiograph in 1943 showed bilateral apical infiltration. The patient was treated with bed rest and made a satisfactory recovery. In 1948, while doing part-time work, he had a haemoptysis, and radiography showed a cavity at the left apex. A pneumoperitoneum with phrenic crush resulted in cavity closure, and the pneumoperitoneum was abandoned after 18 months. A further exacerbation in 1951 was treated with chemotherapy, but soon after this the patient developed an anal fistula, and early in 1953 was admitted to hospital with



FIG. 12

bilateral apical cavitation. After a further six months' chemotherapy, tomograms demonstrated bilateral apical bullae in addition to a cavity in the apical segment of the left lower lobe (Fig. 12). In November, 1953, a left basal plombage was carried out. Although he still has some cough and sputum two years after operation, the latter has been negative on smear and culture, and lateral tomographs show no evidence of cavitation. He is a chronic bronchitic and is the only patient in the series who has noticed any increase in dyspnoea after operation. Although fit to do light work, he has not yet attempted to return to suitable employment.

RESULTS

The results of the operation with regard to cavity closure, sputum conversion and working ability are given in Table I. Seven patients survive and are available for follow-up. The third patient (I. M.) died suddenly at home one year after operation. Necropsy failed to reveal an adequate cause of death, which was attributed to cardiac failure. The plomb space was satisfactory. There was tuberculous disease in the underlying lung, but no evidence of a cavity. Another (D. B., Case 7) died from uraemia two years after an apparently successful operation.

TABLE I  
RESULTS

Case No.	Follow-up (Years)	Recent Sputum Culture	Tomography	Activity	Comments
1	7	Negative	No cavity	Married, working full-time	Sputum positive 2 years post-operatively. Chemotherapy
2	6	"	"	Working full-time	Sputum positive 1 year post-operatively. Pneumoperitoneum and chemotherapy
3	1	"	Not performed	Died one year after operation	No cavity seen at necropsy
4	4½	"	No cavity	Full household duties	Lobectomy and decortication on the opposite side 1 year post-operatively
5	4	"	"	"	—
6	2½	"	"	"Full-time clerical" work	—
7	2	"	"	Died 2 years post-operatively	No necropsy
8	2	"	"	Working full-time	—
9	2	"	"	Fit for light work. Not yet working	Moderate dyspnoea after operation

The follow-up period for the remainder varies between two and seven years. In all patients the sputum is now consistently negative on smear and culture, although in two conversion was delayed for four and five months respectively, and in another two an isolated positive sputum was found two years after operation, but these have not recurred.

In all surviving cases, lateral tomography has shown no evidence of persistent cavitation. This, in our opinion, is the only satisfactory method of determining whether the cavity is closed.

The ability of these patients to return to work is encouraging. Six out of the seven are now working, whilst the seventh is fit for work but has not yet found suitable employment.

Apart from the two patients (Cases 1 and 2) who developed a positive sputum two years after operation and who were treated with further courses of antibiotics, only one other (Case 4) has required further treatment. In this patient a long-standing pneumothorax on the opposite side became infected, and two and a half years after the plomb an upper lobectomy and decortication was successfully performed.

#### DISCUSSION

The patients described represent a small group with lower lobe cavitation, failing to respond to simpler forms of treatment, who were considered unsuitable for resection or thoracoplasty. The total series is not large and only nine of the patients we observed in a five-year period fell into this category. During this time 38 resections were carried out for lower lobe disease by one of us (W. P. C.).

The extent of the disease in other parts of the lung and the poor respiratory reserve were the

factors rendering all these patients unsuitable for resection or thoracoplasty. The operation has had remarkably little effect on respiratory reserve, and only one patient was more breathless post-operatively.

References in the literature to the use of plombage for lower lobe cavitation are few. Morrison Davies, Temple, and Stathatos (1951) in a series of 101 plomb operations recorded five instances where the operation was used for basal cavities. In no instance was sputum conversion secured.

#### SUMMARY

Nine patients with persistent tuberculous cavitation in the lower lobe who were considered unsuitable for either resection or thoracoplasty have been treated by basal plombage.

The operation is briefly described.

Two patients died, one and two years respectively, after operation from conditions not directly related to their tuberculous disease.

Of the remainder, followed up for periods of between two and seven years, all are well without evidence of persistent cavitation and with negative sputum cultures. All except one have returned to full-time work.

We believe that this operation has a place in the treatment of lower lobe cavitation when other methods of treatment have either failed or are inapplicable.

#### REFERENCES

- Crofton, J. (1949). *Thorax*, 4, 96.  
 Davies, H. Morrison, Temple, L. J., and Stathatos, C. (1951). *Ibid.*, 6, 209.  
 Freedlander, S. O. (1938). *J. thorac. Surg.*, 7, 455.  
 Hiddlestone, H. J. K., and Taylor, A. J. (1954). *Thorax*, 9, 344.  
 Macdonald, A. W. B. (1952). *Tubercle (Lond.)*, 33, 194.  
 O'Shaughnessy, L., and Mason, G. (1939). *Brit. med. J.*, 1, 97.