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Plombage in the 1980s*

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History

Before the days of antituberculous chemotherapy various surgical methods were used to collapse tuberculous pulmonary cavities.[1] These included artificial pneumothorax (often requiring adhesion section), phrenic nerve crush, and the major operations of extrapleural or extraperiosteal pneumonolysis and thoracoplasty. The latter had several disadvantages[2 3] (table 1) and pneumothorax techniques were plagued by rapid disappearance of the air, and by infection or haemorrhage[4] in the space.

Extrapleural pneumonolysis consisted of mobilising the cavitated apex of a lung in the extrapleural plane.[5] Advantages were that a tuberculous cavity was less likely to be breached and it was a single stage operation that did not interfere with the integrity of the chest wall. The collapse had to be maintained, however, and it was in the continuing search for substances other than air suitable to fill the space that plombage evolved. Over the years many tissues and materials were tried as a filler, or plombe, with varying degrees of success[6–12] (table 2). When the more unyielding plastics became available, extraperiosteal pneumonolysis was preferred[13] because a thicker, tougher base was presented to the plombe inside the ribcage (the "birdcage operation"). It was thought moreover that subsequent ossification might deter late migration of the foreign material.

Plombage was considered to have several advantages over thoracoplasty[14] (table 3) and was used, especially from 1948 to 1955, either alone or in combination with limited thoracoplasty.[15] The prime indication for plombage was the presence of an apical cavity less than 4 cm in diameter at or above the first interspace on the chest radiograph (fig 1). A review of major surgery in the treatment of pulmonary tuberculosis in the year 1953–4 was published in 1964.[16] Over 8000 patients in the United Kingdom had either resection or a major collapse procedure, of which 452 were plombage operations. Sixteen per cent developed postoperative complications (table 4). In an attempt to avoid these, temporary plombage was tried,[12 17] the foreign material being removed and thoracoplasty done as a second

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Table 1 *Disadvantages of thoracoplasty*

Required multiple stages
Performed under local anaesthesia with associated harmful psychological effects
Physical deformity
Postoperative early paradox and poor expectoration
Postoperative atelectasis and spread of tuberculous infection
Not applicable to poor risk patients
High incidence of late cardiorespiratory problems

Table 2 *History of plombage*

1891	Extrapleural pneumonolysis	Tuffier
1941	Extraperiosteal pneumonolysis	Bailey, Cleland
1907	Gauze Pack	Schlange
1910	Fat	Tuffier
1913	Air	Mayer
1913	Oil	Graf
1913	Paraffin wax	Baer
1913	Bone	Wilms
1924	Rubber bag	Gwerder
1928	Rubber sheeting	Lilienthal
1932	Muscle	Alexander
1937	Paraffin pack	Head
1945	Methylmethacrylate spheres	Wilson
1946–8	Fibreglass	O'Neil
	Polythene sheeting	Morriston Davies
	Polystan sponge	
	Shredded polystan packs	
1948	Drilled polythene spheres	Cleland

Table 3 *Advantages of plombage over thoracoplasty*

One operation
No physical deformity
No paradox
Preservation of lung function
Selective collapse
Immediate result
Short hospital stay
Applicable to bilateral disease
Applicable to poor risk patients
Age no bar
No late cardiorespiratory problems
Could be combined with limited thoracoplasty

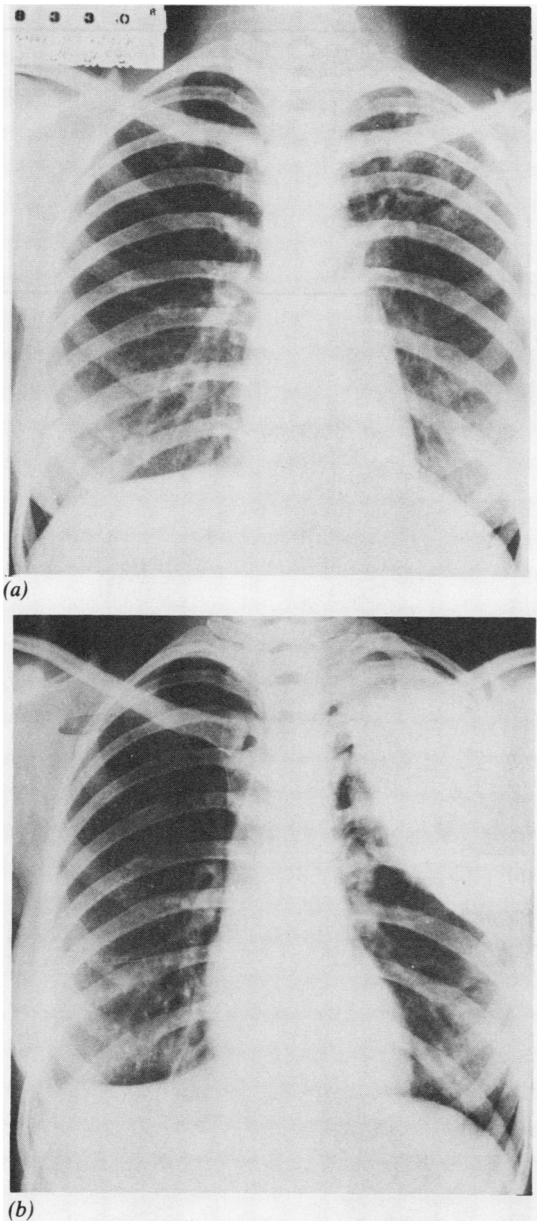


Fig 1 *(a) Chest radiograph showing a typical tuberculous cavity for treatment by plombage. (b) Postoperative chest radiograph of the same patient four years after left polystan sponge plombage.*

stage after two to six weeks. Early elective removal of a plombe often proved extremely difficult and the method did not become popular.

The type of plombage used depended on the experience and preference of the surgeon but,

Table 4 *Early complications of plombage*

Shortness of breath
Cavity breach and spread of TB infection
Mediastinal shift and/or compression
SVC obstruction
Cardiac failure resultant upon reduction in pulmonary vascular bed
Haemorrhage
Infection
Migration
Wound breakdown

because of late complications (table 5) the plombe had to be removed in many cases within five years. This was invariably done by the surgeon who had put it in and many who have now retired believe that they subsequently removed most that they had inserted (WP Cleland and CA Jackson, personal communications).

Survey

Having seen four patients with complications of plombage in the last few years and being unable to find guidance on management in recent publications, I undertook a national survey in an attempt to assess the size of the potential clientele. With the help of the British Thoracic Society members were circulated. It transpired that there is no recording and retrieval system available for identifying plombage operations. It has been only through the invaluable assistance and excellent memories of many senior thoracic medical and surgical colleagues that 119 patients with plombage have been located. There must be more who have not been found. One fact that emerged is that the presence of plombage does not prevent a person emigrating to Australia (P Stradling, personal communication). With the help of the Australian medical authorities at least one such individual has been located, fit and well, in the State of Victoria.

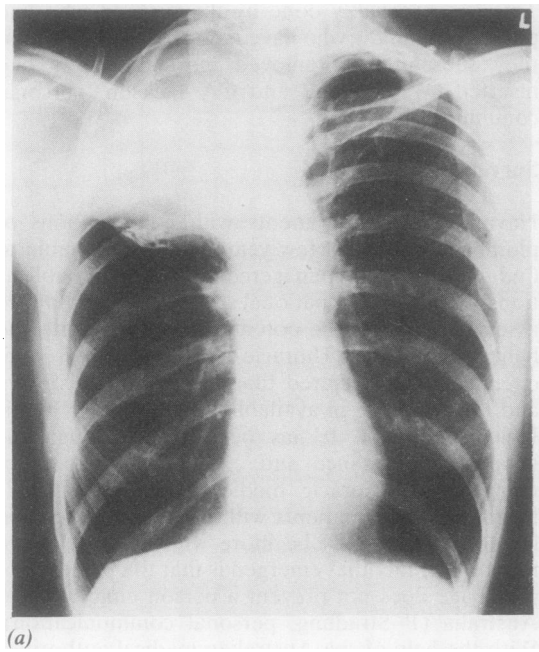
Information about removal of plombage in recent years was not sought specifically but a summary of experiences reported by surgical colleagues is included.

Table 5 *Late complications of plombage*

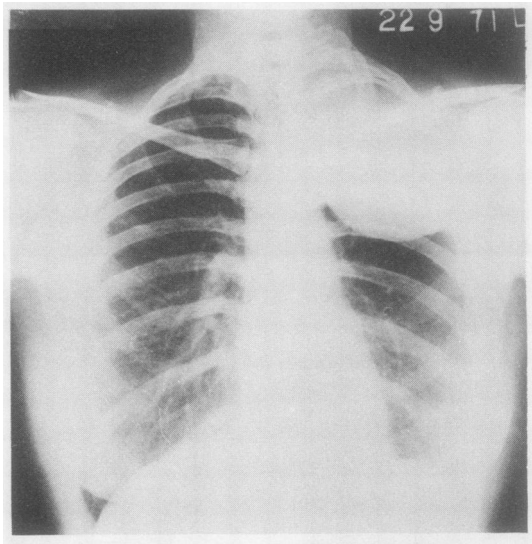
Shortness of breath
Tuberculous infection
Acute infection
Migration:
Bronchopleural fistula
Extrusion
Cutaneous fistula
Superior vena caval obstruction
Haemorrhage
Brachial plexus irritation
Pain
Expectoration of wax or oil
Sarcomatous change in tissues around plombe

Table 6 *Survey: types of plombage*

Material	*Left*	*Right*	*Bilateral*	*Total patients*	*Total plombes*
Polystan	22	21	6	49	55
Lucite spheres	18	20	2	40	42
Drilled spheres	13	6	2	21	23
Oleothorax	5	2	—	7	7
"Mixed" bilateral					
Polystan and drilled spheres	—	—	1	1	2
Lucite spheres and oleothorax	—	—	1	1	2
Total	58	49	12	119	131



(a)



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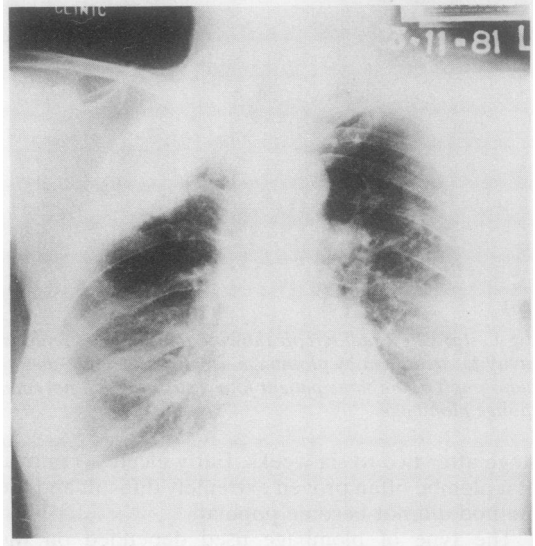


(c)

Fig 2 *Variable radiographic appearances of polystan plombage, 20 years (a), 18 years (b) and 19 years (c) after insertion. Disorganisation in the overlying ribs is evident.*

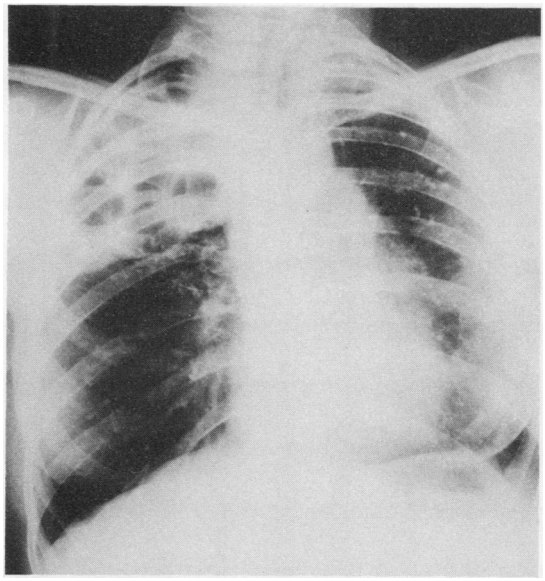


Fig 3 *Chest radiograph demonstrating the translucent appearance of methyl methacrylate (lucite) spheres six years after insertion.*

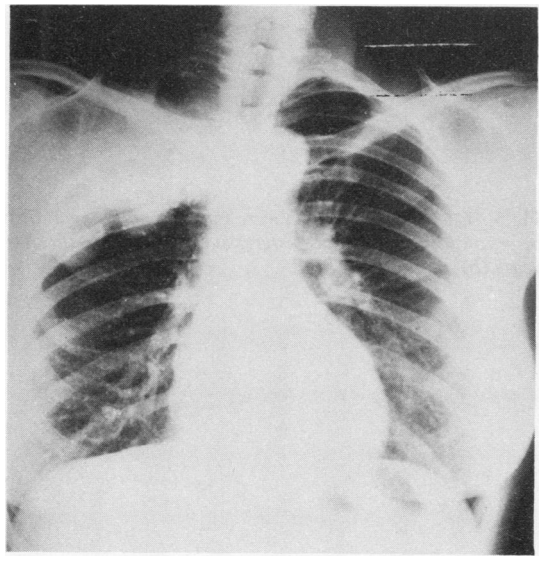


Fig 4 *Opacification of lucite spheres can occur. These were inserted 26 years previously at the time of a limited right thoracoplasty.*

TYPES OF PLOMBAGE

The exact nature of the plombage material used could not be determined in several instances, even after perusal of the operation note. All, however, could be allocated to one of four general groups (table 6):

Group 1: polystan

Polystan sponge, polystan packs, and packets of shredded plastic are included together as it was impossible to distinguish between them. Fifty five such plombes were found in 49 people, 22 left sided, 21 right sided, and six bilateral.

Radiological appearances The lower edge of the opacity produced by this type is usually fairly smooth and convex, but variable (fig 2). Disorganisation or thinning of the overlying ribs is frequently evident.

Group 2: lucite spheres

These hollow, rigid, lightweight, transparent methyl methacrylate balls are about 2.5 cm in diameter. They were assembled immediately before use by sealing two hemispheres together with chloroform under sterile conditions. Forty two instances of lucite plombage were identified in 40 people, 18 being on the left, 20 on the right, and two bilateral.

Radiological appearances In many instances, these spheres are readily recognised by their circular hollow appearance (fig 3); in others they are opaque (fig 4) or have collapsed (fig 5) or show a mixture of these changes (fig 6). In most cases pressure erosion of some of the overlying ribs can be identified. In one case, fluid levels were present (fig 7).

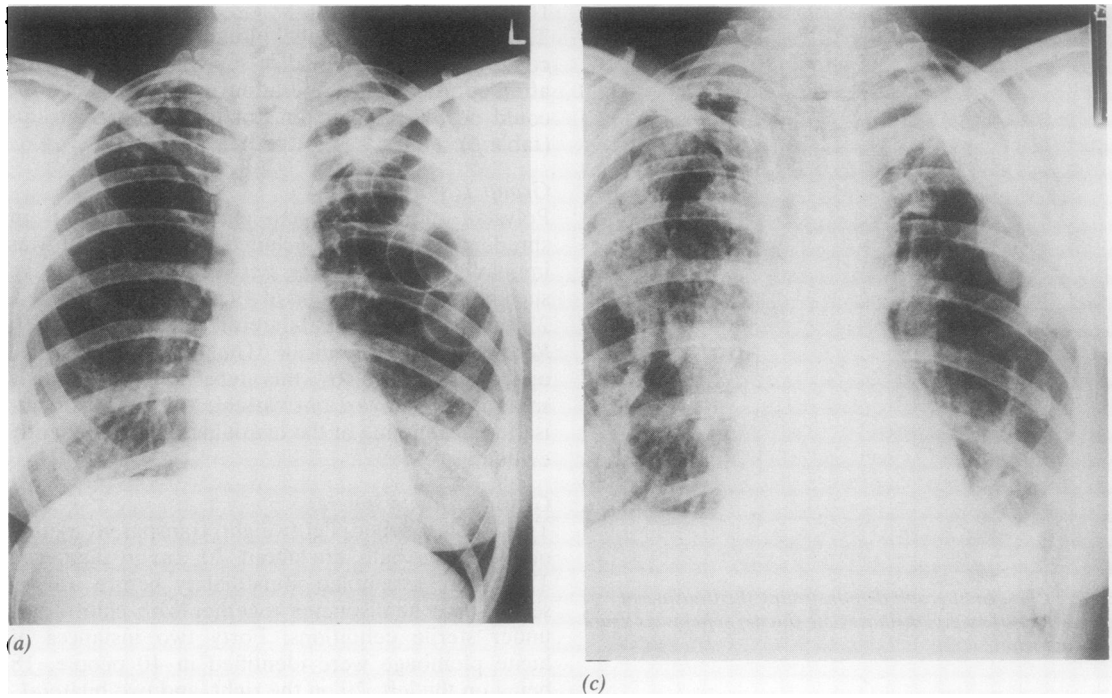
Group 3: drilled spheres

The centres of heavy, solid one inch diameter polythene balls were drilled out converting them into lighter "beads" or "doughnuts" for insertion. Their great advantage was that they were readily sterilised by boiling. Twenty one people had this type of plombage—on the left side in 13, on the right in six and bilateral in two.

Radiological appearances Time has shown that these spheres become distorted and lose their circular outline (fig 8). The lower border of the opacity is often irregular and it may prove difficult to distinguish this type radiologically from opacified lucite balls or from the polystan type of plombe (fig 9). Rarefaction in the overlying ribs is frequently seen (fig 8b).

Group 4: oleothorax

Examples of the use of paraffin wax or arachis or olive oil to fill the air space are included together in this smallest group. Of the seven cases of oleothorax five were left sided and two right sided.



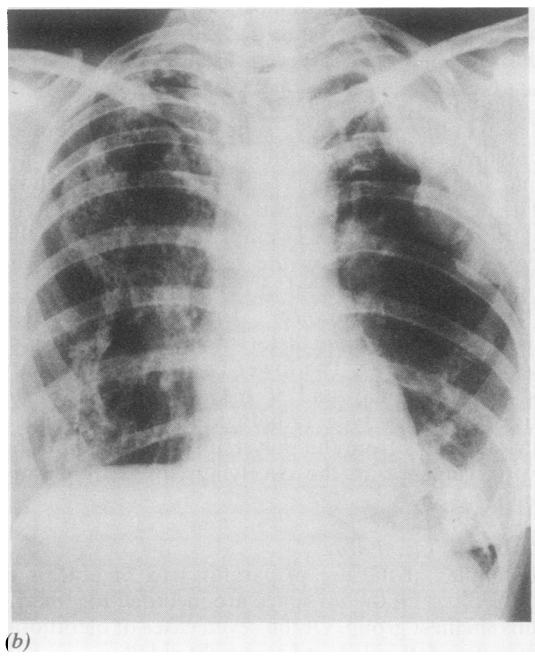


Fig 5 *Lucite spheres which were translucent one year after insertion (a), opaque and progressively collapsing after 20 years (b) and 30 years (c).*

Radiological appearances These resemble the present appearances of artificial pneumothorax but the radiological opacity is more localised (fig 10). The fluid filled space is invariably clearly defined by calcification in the wall of the cavity.

Bilateral plombage was found in 12 patients. Most have the same material on both sides but in two the plombes were mixed: one has polystan on the right and drilled spheres on the left (fig 11) and the other has lucite spheres on the right and an oleothorax on the left.

AGE AND SEX

The present ages of the 119 people (table 7) in the

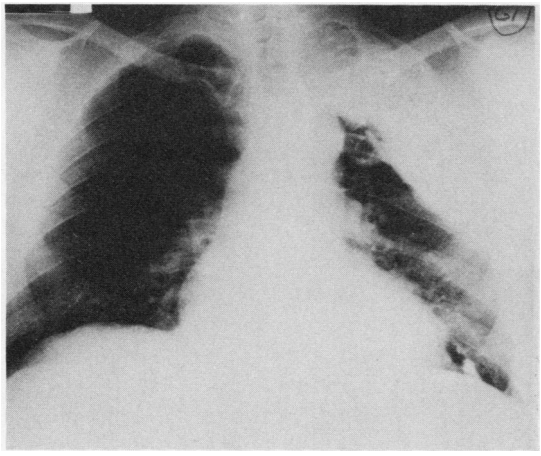


Fig 6 *Translucency, opacification, and collapse of lucite spheres seen in one patient 32 years after insertion.*

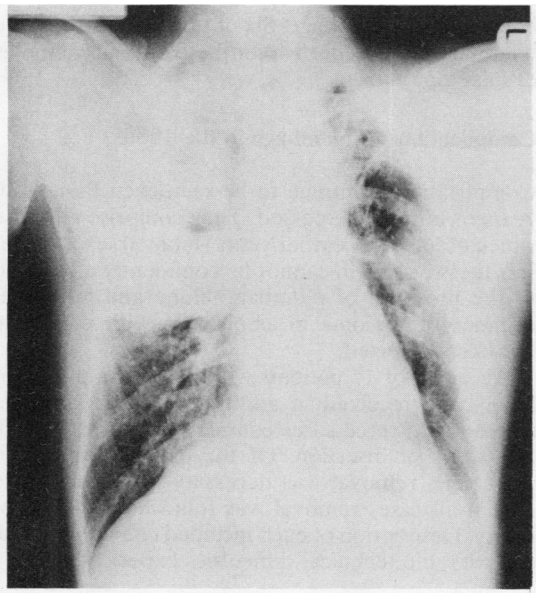
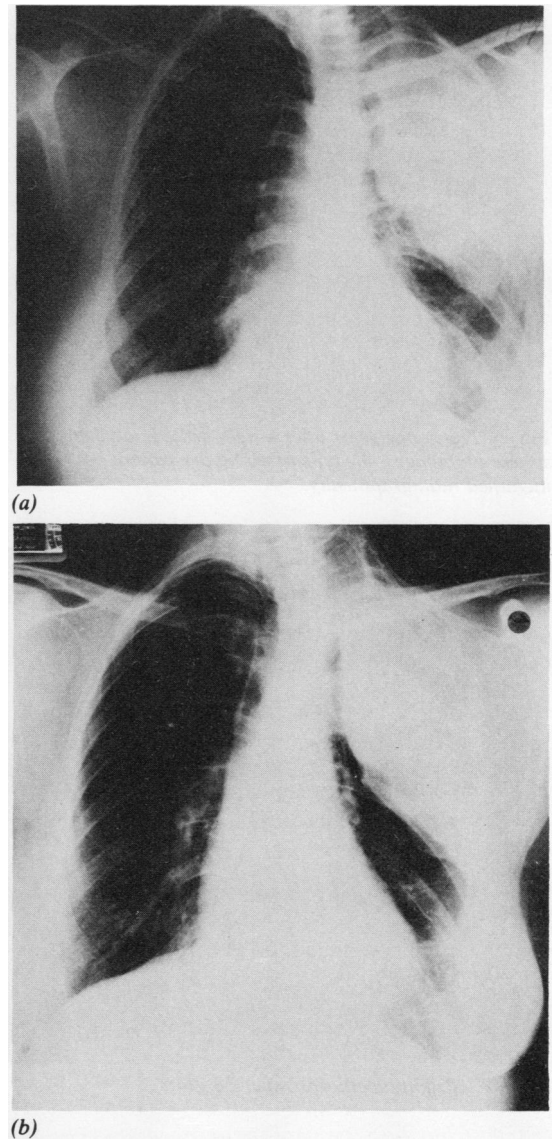


Fig 7 *Lucite spheres demonstrating fluid levels 32 years after insertion. This patient, aged 48 years, has "asthma."*



(a)

(b)

Fig 8 *Appearances of drilled polythene sphere plombage one year (a) and 32 years (b) after insertion. Disorganisation of the overlying ribs and sphere distortion has occurred.*

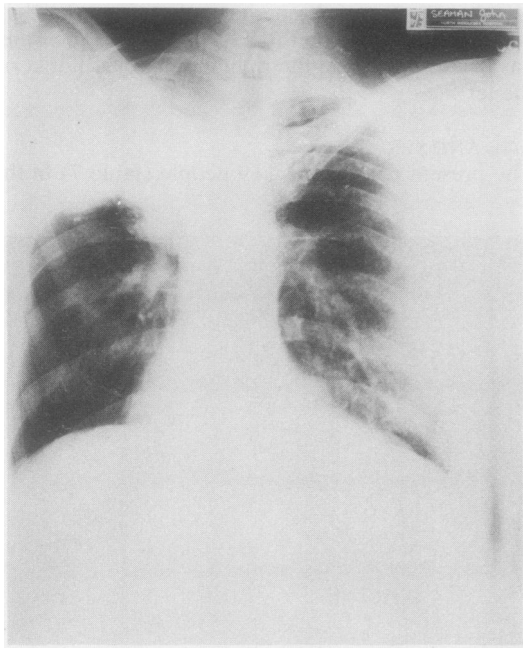


Fig 9 *Thirty one years after a right drilled polythene sphere plombage—the type of plombage cannot be identified radiographically.*

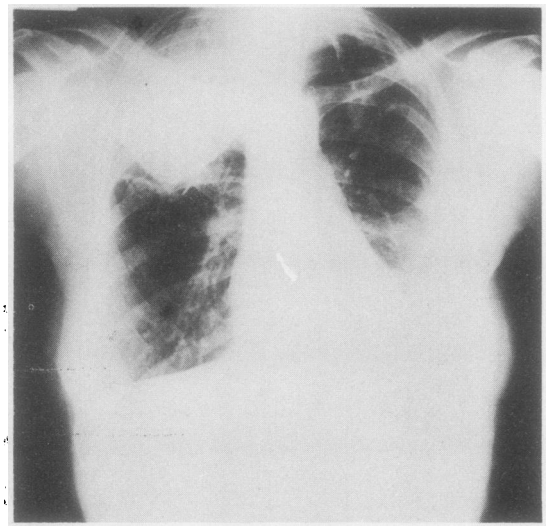


Fig 10 *A right oleothorax, after 38 years.*

survey range from 46 to 79 years. Half are still under 60 years of age and 33 of these are women. Twenty eight patients are not yet 55 years old.

A total of 69 women were located, of whom six have bilateral plombage. Six of the 50 men also have bilateral plombes, but two of these are the examples of mixed plombage.

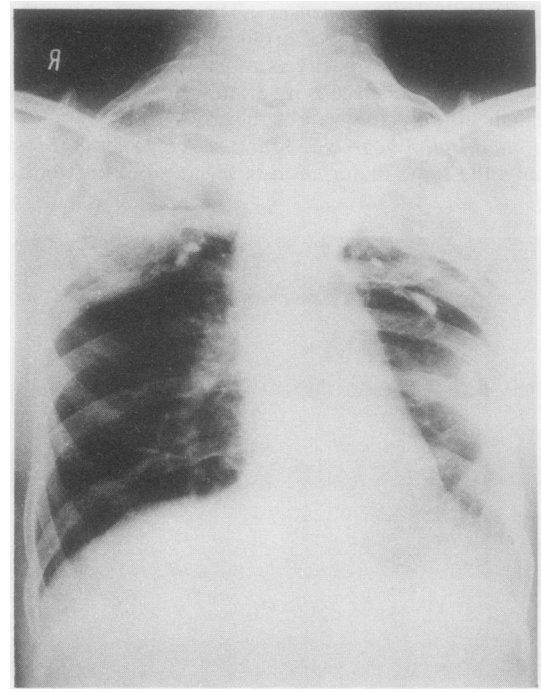


Fig 11 *"Mixed" plombage. Appearances 30 years after right polystan plombage and 28 years after a left drilled sphere plombage. Rib disorganisation is evident on both sides.*

Complications of plombage in the 1980s

Complications continue to be seen even though 30 years or more have passed. They comprise all those which occurred in earlier years (table 5), except that shortness of breath cannot be confidently attributed to the presence of plombage alone and no recent instance of sarcoma in association with plombage has been reported.

Accounts of 17 patients with plombage problems have been received in addition to my four cases (table 8). In three cases complications arose within five years of insertion. Of the patients with solid plombage, removal was necessary in all but three, and in all cases removal was followed by thoracoplasty. Description of each included comment on the considerable technical difficulties experienced.

CASE REPORTS

The four cases referred to here are summarised.

Table 7 *Survey: age and sex*

	Under 50 y		*50–54 y*		*55–59 y*		*60–64 y*		*≥65 y*		*Total*
	M	*F*	*M*	*F*	*M*	*F*	*M*	*F*	*M*	*F*	
Polystan	—	4	5	4	6	7	3	9	2	9	49
Lucite spheres	1	1	3	4	2	8	4	6	4	7	40
Drilled spheres	1	—	3	1	6	2	2	2	3	1	21
Oleothorax	—	—	—	—	—	2	1	1	2	1	7
"Mixed bilateral"	—	—	1	—	—	—	—	—	1	—	2
	2	5	12	9	14	19	10	18	12	18	119
Total	7		21		33		28		30		

Case 1

A woman of 58 years with bilateral shredded polystan pack plombage developed an axillary abscess, which proved to be an empyema necessitans from an acutely infected left plombe 17 years after insertion (fig 12). After drainage a chronic discharging sinus persisted until the offending shredded plastic pack had been removed and the space obliterated by thoracoplasty. Removing all the shreds of plastic was difficult and tedious. This, combined with the necessity to excise the first rib, made the operation a very testing one.

Case 2

A 60 year old woman presented with a right tuberculous subclavicular empyema necessitans 30 years after a right lucite plombage (fig 13). During the essential three month preoperative period on antituberculous chemotherapy the abscess was controlled by aspiration. At operation it was found that the sphere seen radiographically to be migrating towards the axilla had almost eroded through the chest wall. Others had also caused rib erosion. All had remained remarkably spherical. Fifteen lucite balls were removed from a bed of "green cheese" and this material filled two of them (fig 14). The subsequent thoracoplasty was difficult because of copious caseous material and unstable ribs. The first rib was left in place as it was felt unwise to open further tissue planes. Antituberculous chemotherapy was continued for a further year and the patient is now very well.

Case 3

A fit man of 71 years developed a painless, tense left pectoral swelling. A diagnosis of sarcoma was made until the underlying 30 year old lucite plombe and limited thoracoplasty were found (fig 15). Scrutiny

Table 8 *Removal of plombes*

	Sex	*Age*	*Side*	*Interval (y)*	*Age (y) at complication*	*Complication*	*Treatment*
Polystan	F	63	L	1	34	Acute infection	Removal and thoracoplasty
(n = 7)	F	62	L (+R)	2	34	Acute infection	Removal and thoracoplasty
	F	69	L	3	37	Acute infection and extrusion	Removal and thoracoplasty
	F	76	L (+R)	12	55	Extrusion	Removal and thoracoplasty
	*F	72	L (+R)	17	58	Acute infection	Removal and thoracoplasty
	F	62	R	21	50	Acute infection	Removal and thoracoplasty
	F	58	L	34	57	Acute infection and haemorrhage	Removal and thoracoplasty
Lucite spheres	F	59	R	26	57	Acute infection	Removal and thoracoplasty
(n = 9)	F	71	R	26	68	Erosion and haemorrhage	Removal and thoracoplasty
	F	62	L	29	58	Acute infection and extrusion	Removal and thoracoplasty
	F	67	R	29	65	Pain and erosion	Removal and thoracoplasty
	*F	60	R	30	60	Tuberculous infection	Removal and thoracoplasty
	*M	75	L	30	71	Erosion and haemorrhage	Aspiration
	F	54	L	32	54	Tuberculous infection	Antituberculous chemotherapy
	F	79	L	33	79	Acute infection	Removal and thoracoplasty
	M	69	R	34	64	Acute infection	Antibiotics
Drilled spheres (n = 1)	F	68	L	15	52	Tuberculous infection	Removal and thoracoplasty
Oleothorax (n = 4)	M	65	R	26	57	Acute infection and superior vena caval obstruction	Drainage
	F	68	L	34	65	Bronchopleural fistula	Wax coughed up—none
	*M	62	L	37	62	Acute infection and Bronchopleural fistula	Aspiration and sterilisation of space
	F	63	R	39	59	Acute infection	Aspiration

*Illustrative cases.

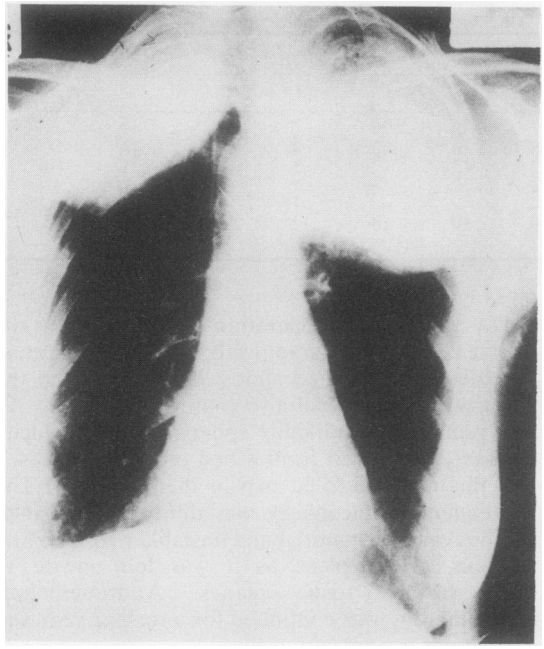


Fig 12 *Case 1: Bilateral shredded polystan pack plombage. The left plombe is infected.*

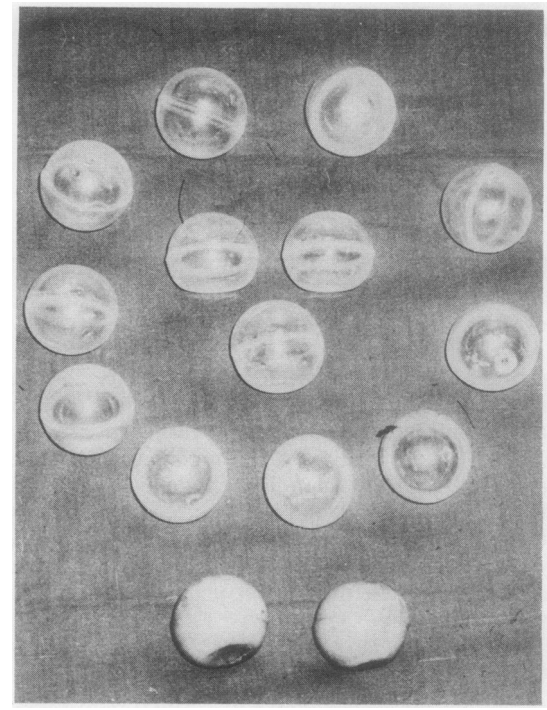


Fig 14 *The lucite spheres removed from case 2. Two are filled with caseous material and others show some distortion.*

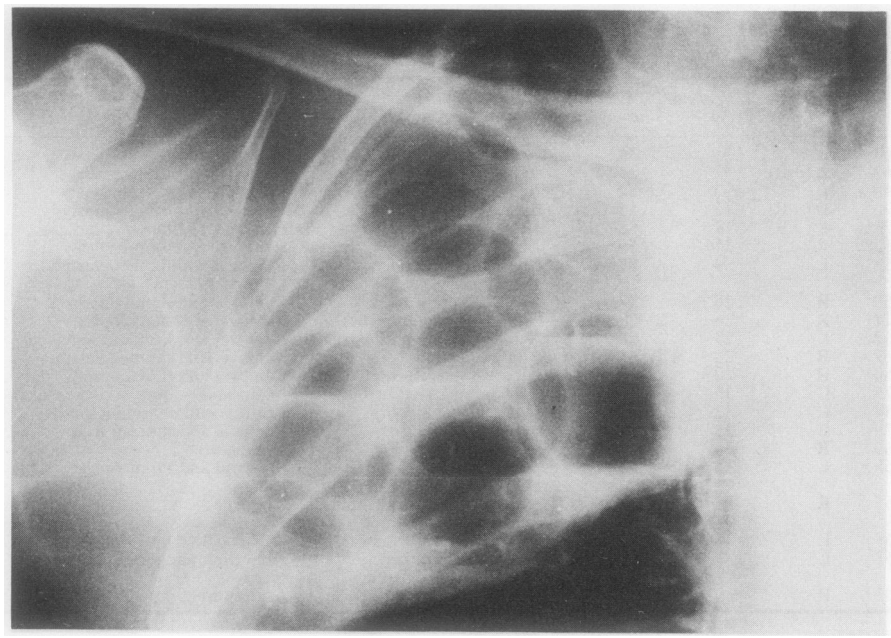


Fig 13 *Case 2: Apical radiograph of 15 lucite spheres associated with tuberculous infection 30 years after insertion. One sphere has eroded almost through the chest wall.*

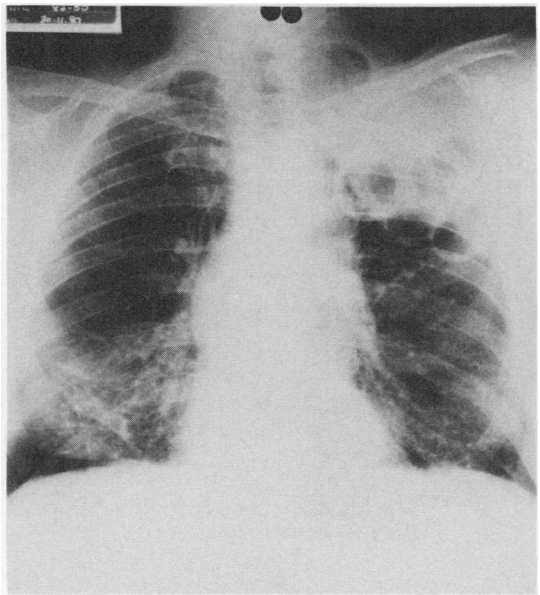


Fig 15 *Case 3: Chest radiograph 30 years after a left limited thoracoplasty and lucite sphere plombage. Examination of serial films over the years suggested that the sphere seen at the upper right had gradually altered its position.*

of the radiographs suggested that one of the hollow spheres had moved to such a position that an intercostal vessel could have been eroded. Aspiration of the swelling was attempted and 100 ml of heavily blood stained sterile fluid was removed with disappearance of the swelling. Fluid did not collect again and no further treatment was necessary.

Case 4

Another man aged 62 presented with a chest infection which led to a bronchopleural fistula and infection of his 37 year old oleothorax space (fig 16*a*). This was managed conservatively by repeated aspiration and sterilisation of the space by instillation of the appropriate antibiotic. The space, completely devoid of oil, has refilled and remains sterile and the radiological appearances have returned to those seen originally (fig 16*b*).

Discussion

Infection is the commonest present day complication of plombage. Whether acute or tuberculous, infection of a solid plombe is likely to present as an empyema necessitans. Complete resolution may not be achieved without removal of the plombe and thoracoplasty. The infection is first controlled by

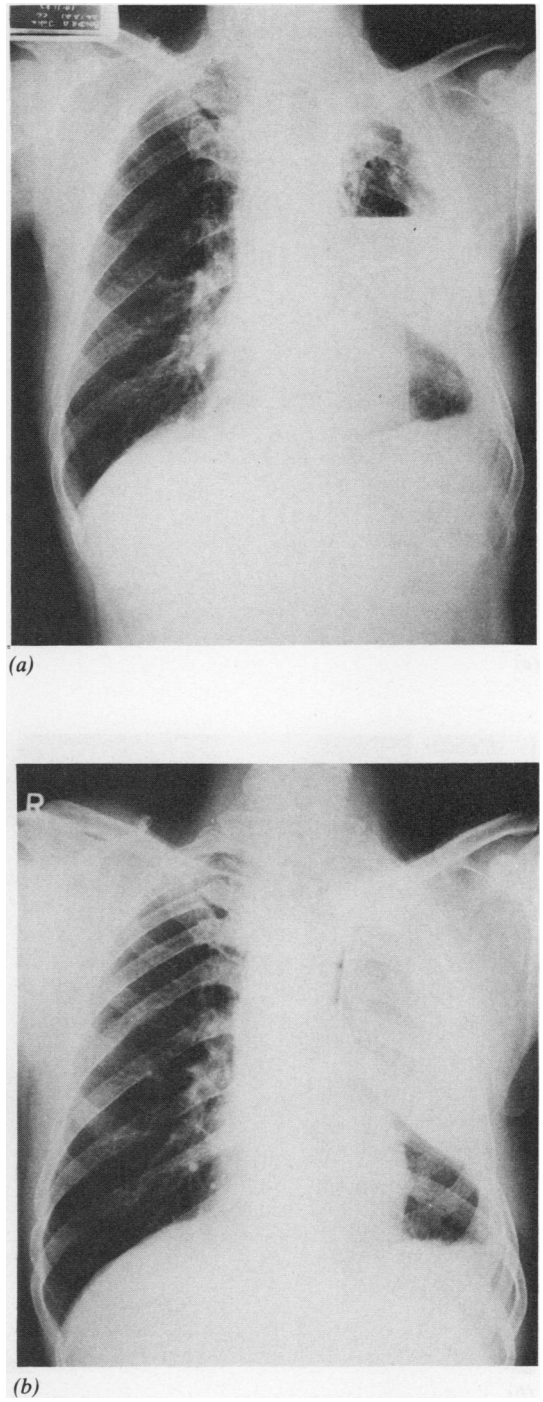


Fig 16 *Case 4: (a) Infected oleothorax space with bronchopleural fistula. (b) Final appearance after conservative management of the infection.*

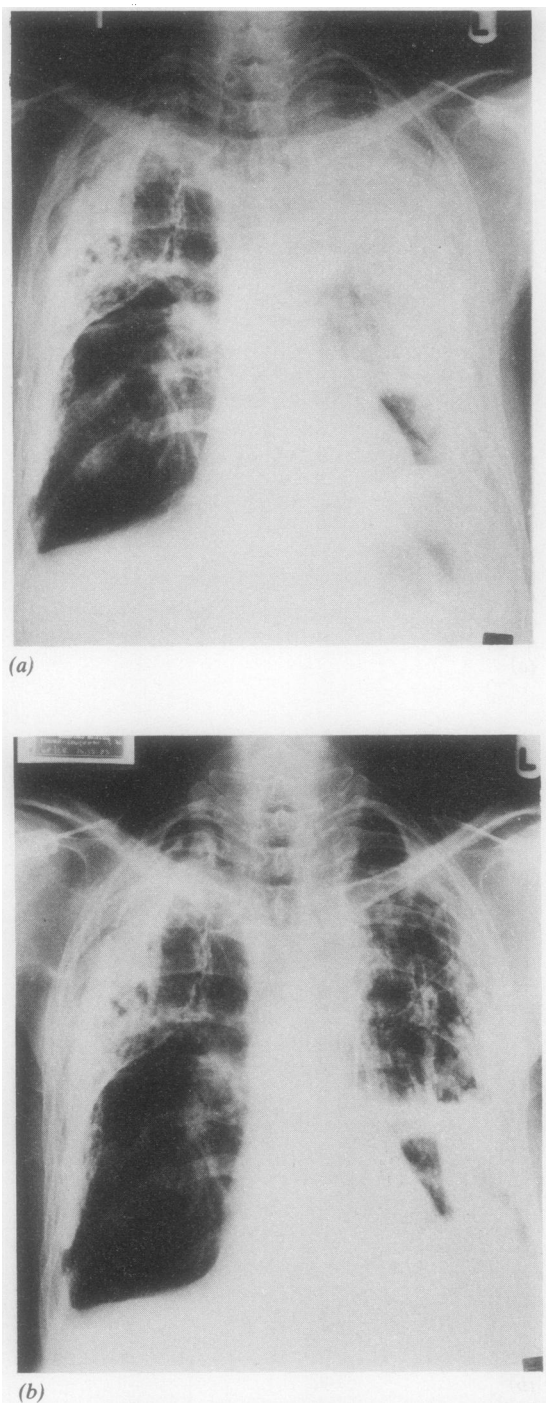


Fig 17 *(a) Recent radiograph of an infected left artificial pneumothorax space. (b) The same patient with drainage catheter in situ.*

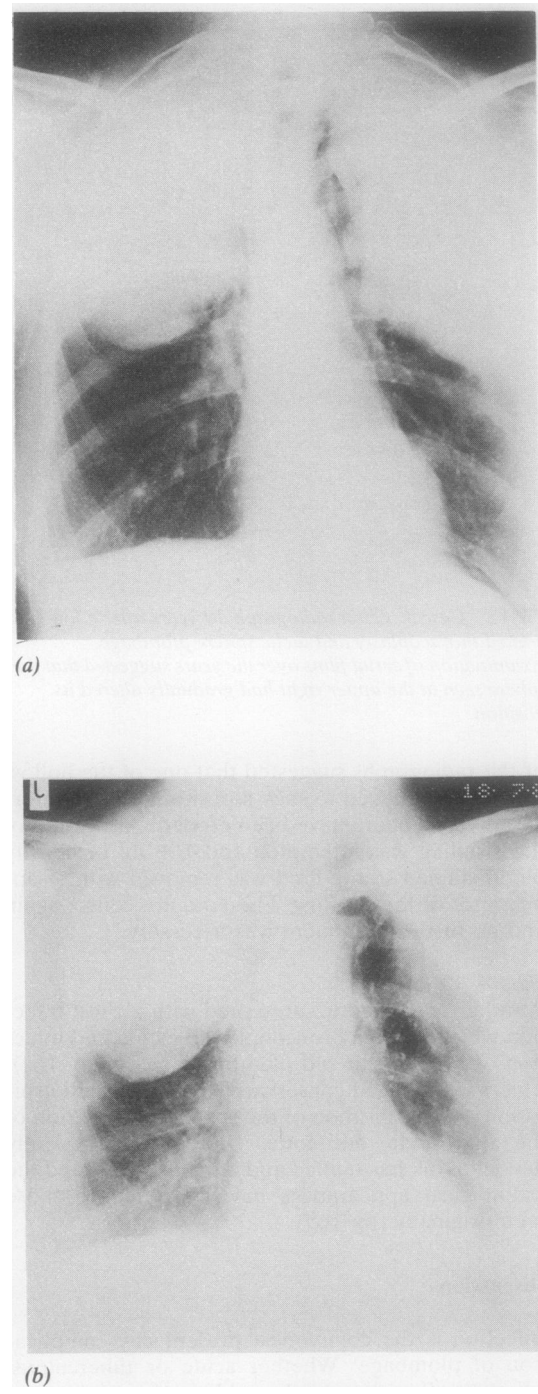


Fig 18 *(a) Chest radiograph at the time of extrusion of a left polystan pack plombage into the axilla 12 years after insertion. (b) The same patient 19 years after removal of the plombe and thoracoplasty.*

local measures—for example, aspiration or drainage—with systemic administration of the appropriate antibiotic. Removal of the plombe is done electively only after adequate preparation of the patient as the one stage operation can be extensive. Removal of a polystan plombe is often tedious and time consuming, whereas infected spheres are readily taken out. The thoracoplasty which follows may or may not require the excision of the first rib, and tailoring of eroded, unstable ribs can be technically difficult.

Infection of an oleothorax may be accompanied by a bronchopleural fistula. Attempts should be made to avoid major surgery in these patients as decortication could prove a difficult procedure in the presence of heavy calcification and thoracoplasty may also be required. One case of infected oleothorax reported presented with superior vena caval obstruction. This probably resulted from rapidly rising tension in the rigid walled space, causing pressure on the mediastinum. Initial decompression is urgently necessary. One comparable set of circumstances, in a case I saw, arose with infection in a fluid filled artificial pneumothorax space with calcified walls (fig 17*a*). Decompression in this case was achieved by the insertion of an indwelling fine catheter, which allowed rapid aspiration as well as the instillation of the appropriate antibiotics. Such a cannula can remain in place indefinitely if poor respiratory function precludes major surgery. This one has been in situ for two years (fig 17*b*).

Haemorrhage has been reported, presenting with haematoma formation or haemoptysis. Any structure lying adjacent to a solid plombe, or even the irregular calcified walls of an oleothorax, is at risk. The clinical manifestation will depend on the vessel affected. Study of serial radiographs, which are invariably available, gives guidance. Not all cases of haemorrhage call for major surgery but if it occurs in the presence of infection a more aggressive approach is necessary and treatment can prove hazardous.[18]

Extrusion of the plombe is not confined to the sphere types and is not always associated with infection. An oleothorax may be coughed up and an uninfected polystan pack may escape from the confines of the rib cage. One case report described a polystan pack presenting in the axilla 12 years after insertion as a result of extreme disorganisation of the overlying ribs (fig 18).

Bronchopleural fistula has occurred only in relation to oleothorax. One report of paraffin wax appearing in the sputum was received but the other cases were associated with infection in the space. In this type of case, the fistula may close when the local infection has been eliminated. There has been no instance of direct erosion of a bronchus by a solid plombe, though it was seen with spheres in the early days.

Pain does not seem to be a presenting symptom. If, however, pain is a dominant complaint, as occurred in one case, a search should be made for erosion or pressure effects on appropriate structures—for example, vertebrae or brachial plexus—especially if a lucite plombage with little distortion of the spheres is present. Infection should also be sought. The results of removal of a plombe for pain alone may not be entirely satisfactory and, in the absence of infection, removal may prove a very difficult technical exercise.[12]

Conclusions

The number of people still alive with plombage is small, although there are probably more than this review suggests. The occurrence of complications of plombage today is therefore rare. If, however, a patient who has had a plombage does develop a chest problem, the plombe should always be considered implicated until proved otherwise. If it is shown to be infected, then resolution may not be possible without its removal. Should this be necessary, surgery should be carried out electively, after careful preparation of the patient, whenever possible.

This paper is presented to alert clinicians to the potential difficulties in diagnosis and management of patients with complications of plombage, to endeavour to give some guidance on how such clinical problems may be safely and satisfactorily resolved, to refresh memories about the plombage procedure, and to review some of the radiological appearances of plombage 30 years on.

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