Early Major Surgery After Streptomycin In the Treatment of Acute Pulmonary Tuberculosis*

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Acute pulmonary tuberculosis has always presented a problem in management of seriously ill patients. Before the use of streptomycin the usual treatment consisted of a long period of bed rest in the hope that toxicity would subside and the lesions would be stabilized. Early mortality was always high, approximating 80 per cent. In the surviving cases the clinical course has been long drawn out and with a residual of considerable fibro-caseous cavitary disease. The length of time required before stabilization of the lesion with disappearance of the toxic symptoms was frequently nearly two years, and seldom less than one year. When this stage of chronicity in the disease had been reached the patient was considered ready for major surgery. Other methods of treatment during the acute phase of the disease, such as early pneumothorax or early thoracoplasty, have given unsatisfactory results.¹ ² Pneumoperitoneum also has not been markedly successful.³ Before streptomycin all forms of therapy used during the acute phase of the pneumonic tuberculosis have left much to be desired.

With the introduction of streptomycin we have received an opportunity for another try at controlling this most serious form of pulmonary tuberculosis. Unfortunately, most of our patients come to us more than a month after the onset of such an acute illness. The golden opportunity for treatment within the first two weeks, before the establishment of caseation, has generally been lost. It has been our experience that most of these patients will show rather prompt decrease of cough, expectoration and general toxicity. They will have a rather slow improvement radiologically and likewise will show a delayed fall of temperature. One factor in delaying admission and treatment of cases of acute tuberculous

*Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration. Read before the Texas Tuberculosis Association, Austin, April 7, 1950. Photographs by Manual Training Division, Veterans Administration Hospital, Kerrville, Texas. (Courtesy M. Fred Faucett). †Tuberculosis Service, Veterans Administration Hospital, Kerrville, Tex. ‡‡Consultant in Thoracic Surgery, Veterans Administration Hospital, Kerrville, Tex.

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pneumonia is the frequent incorrect diagnosis as non-tuberculous pneumonia, with ineffective treatment for a period up to two or more weeks. If treatment with streptomycin could be started promptly, improvement should be much more rapid.

The pathologic process takes much the same course as was seen in pre-streptomycin days but the acute phase is about one-fourth as long with present treatment. Whether the length of time for radiologic and clinical improvement is shorter or longer, the early result of treatment is a sub-acute caseous pneumonic pulmonary lesion, usually with cavitation. Further progress has then been with some degree of fibrosis, partial atelectasis, and the development of chronicity. The difference between pre-streptomycin days and the present then, lies in the length of the period required for stabilization of the acute lesions.

At this time the case is somewhat analogous to that of chronic pulmonary tuberculosis with recent spread, perhaps from open cavity with or without hemorrhage, which has been treated with streptomycin. Improvement has been observed radiologically in about 70 per cent of such patients. Unfortunately, follow-up of these patients has shown relapse or recurrence of disease in 25 per cent of those improved, during the first year following streptomycin and by the end of the second year some 40 per cent of those previously improved under treatment have relapsed. Moyer, at Oteen, treated 37 cases of massive tuberculous pneumonia with streptomycin, followed by pneumoperitoneum in 27, with maximum clearing of the pulmonary lesion in 16, moderate clearing in 12, and sputum conversion in 22. Late reports are not available to us to determine the rate of relapse in the cases improved under this treatment.

Kirby, Simpson and Creger report relapse after improvement in 11 of 15 adult Negroes treated with streptomycin for acute tuberculous pneumonia, without surgery; they consider properly timed adequate surgical collapse essential for permanent improvement. Obviously, the persistently open disease process has not been controlled more than temporarily, by antibiotics alone. Something more has been required to consolidate the improvement, and to prevent the late relapses and late spreads of disease that have nullified the effect of good medical treatment. In an attempt to hold the gains, and to approach the end-result of arrested disease, we adopted the policy of offering surgical therapy to such patients, when the disease process had been brought under control, as evidenced by disappearance of general toxicity, and by radiologic evidence of stabilization of the lesion or (presumably) maximum early improvement. In none of these patients with acute caseous-pneumonic pulmonary tuberculosis have we seen complete clearing,
or "healing" of the lesions under streptomycin and medical treatment. Recently it has been our policy not to await complete clearing or complete stabilization of disease in our patients treated for massive tuberculous pneumonia or other acute caseous pneumonic tuberculosis. Instead, we are inclined to apply permanent (surgical) collapse or other major surgical procedure as soon as we believe that the disease is under control, or that the immediate maximum of improvement has occurred. Early thoracoplasty has been used at Fitzsimons General Hospital7 in the management of such cases. Their report includes 12 cases, all of whom had surgical collapse measures instituted from four to 12 months following acute onset of disease, with satisfactory results. (Eight of 12 had sputum conversion, as of December 1948, from four to 15 months post-operatively).

Treatment in such cases must be individualized. We believe, from the course of the disease in the eight cases described, that early major surgery following treatment with streptomycin offers the best prognosis for the patient with acute spread of disease, with or without hemorrhage. We believe, also, that delay is needless and dangerous in such cases, because of the danger of relapse of these insufficiently stabilized lesions.

We are reporting eight cases subjected to major surgery after treatment for acute tuberculous pulmonary disease. Of these, six had onset with acute pneumonic disease and were admitted to this hospital acutely ill with moderately high fever and extensive confluent disease of broncho-pneumonic distribution and one had a large tension cavity in the left upper lobe with recent increase of disease, following influenzal respiratory infection. Treatment with streptomycin was given and permanent surgical collapse measures instituted as soon as it was thought that maximum improvement had been secured, or that stabilization had occurred. Six cases received thoracoplasty, One case was treated with extra-pleural plombage and one with total pneumonectomy. First stage of thoracoplasty was done from one and one half to five months, the extra-pleural plombage three months and the pneumonectomy two weeks after beginning of streptomycin treatment. At present, with follow-up from seven to 32 months post-operative, seven of these eight have negative sputum, and all are in good condition.

The exact surgical procedure to be employed is not the issue at this time. We feel it is most important that advantage be taken of the stabilizing and bacteriostatic effect of antibiotic therapy, and that at the proper time in each case, when early improvement shall be judged to have reached its maximum, adequate surgical treatment should be employed. Thus we may secure stabilization of the disease, and only in this way can we avoid the relapses and
recurrences of disease, that may at any moment place the patient beyond the help of any method of treatment whatever.

A.C.: This 25 year old Latin American Veteran had onset about a month before admission (August 17, 1946) with pain in the chest and between the shoulders, fever, productive cough and slight weight loss. He had also had anorexia and weakness for about two weeks. Temperature on admission was 103 degrees F., he was sweaty, weak and toxic. By physical examination including x-ray inspection he had evidence of involvement of the entire left lung with positive sputum. X-ray film showed a completely cloudy left chest with suggestions of multiple cavitation, and a slight fibrotic infiltration in the right second anterior interspace.

On bed rest over a period of three months he remained acutely ill. His temperature declined but still reached 100 degrees F. daily. His expectoration varied from three to six ounces of thick muco-purulent sputum daily and there appeared deviation of the trachea and mediastinum toward the left, suggesting either atelectasis or broncho-stenosis of high grade. Bronchoscopic examination December 18, 1946 revealed only inflamed left lower lobe bronchial mucosa. Sputum remained persistently positive. A bronchogram revealed saccular dilatations throughout the left upper lobe and streptomycin was begun on January 31, 1947, preparatory to surgical excision of the left lung.

Weight was 101 pounds, temperature was about 102 degrees F. when left pneumonectomy was done February 14, 1947. The specimen showed total destruction of the left lung with caseous pneunonic tuberculosis.

FIGURE 1: August 21, 1946. Admission Film. Onset of acute pneunonic disease 1 month before admission. Small contralateral infiltration indicated by arrow.
### TABLE I: SUMMARY OF TREATMENT AND RESULTS

<table>
<thead>
<tr>
<th>CASE</th>
<th>Onset to SM O-day to Surgery</th>
<th>Operation</th>
<th>Post-operation Period</th>
<th>Complications</th>
<th>Present Condition Clin.</th>
<th>Bact.</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEF</td>
<td>13 mo. 5 mo.</td>
<td>THplst.</td>
<td>9 mo.</td>
<td>none</td>
<td>VG</td>
<td>neg.</td>
<td>(G)</td>
</tr>
<tr>
<td>JA</td>
<td>7 mo. 1½ mo.</td>
<td>THplst.</td>
<td>13 mo.</td>
<td>none</td>
<td>VG</td>
<td>neg.</td>
<td>(G)</td>
</tr>
<tr>
<td>HCW</td>
<td>7 mo. 5 mo.</td>
<td>THplst.</td>
<td>7 mo.</td>
<td>none</td>
<td>VG</td>
<td>neg.</td>
<td></td>
</tr>
<tr>
<td>SS</td>
<td>4½ mo. 4 mo.</td>
<td>THplst.</td>
<td>10½ mo.</td>
<td>Atelect. RLL between stages</td>
<td>VG</td>
<td>neg.</td>
<td>(G)</td>
</tr>
<tr>
<td>FA</td>
<td>4 mo. 3 mo.</td>
<td>ExtrPl.</td>
<td>8½ mo.</td>
<td>Pleural effus. at 5 mo. post-op. on oper. side</td>
<td>G</td>
<td>neg.</td>
<td>(G)</td>
</tr>
<tr>
<td>CG</td>
<td>3 mo. 7 wks.</td>
<td>THplst.</td>
<td>8½ mo.</td>
<td>none</td>
<td>G</td>
<td>pos.</td>
<td>(G)</td>
</tr>
<tr>
<td>JB</td>
<td>2 mo. 5 wks.</td>
<td>THplst.</td>
<td>11½ mo.</td>
<td>none</td>
<td>G</td>
<td>neg.</td>
<td></td>
</tr>
<tr>
<td>AC</td>
<td>5 mo. 2 wks.</td>
<td>PNecktomy.</td>
<td>32 mo.</td>
<td>Spread post-op.</td>
<td>VG</td>
<td>neg.</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND:**
- THplst.: Thoracoplasty.
- ExtrPl.: Extrapleural pneumonolysis with lucite ball plombage.
- Pnx.: Pneumothorax.
- Condition: Clin.: G, Good; VG, Very good.
- Bact.: G, Gastric content (culture); Unspecified: 24 hr. sputum concentrate, culture.
Following operation a spread appeared throughout the right lung and streptomycin was continued until April 9, 1947, a total of 70 days and 140 grams of streptomycin. It was discontinued when the patient's white cell count dropped to 6000 with 53 per cent polys which was considered a dangerous leukopenia. After a slight further drop, white count and polymorphs percentage increased and recovery thereafter was uneventful. The spread in the right lung cleared. The patient's condition improved markedly immediately following the operation. He gained 10 pounds of weight within the first two weeks and maintained a continuous improvement thereafter. His sputum following operation was consistently negative and on May 7, 1947 he weighed 120 pounds.

In August 1948, 16 months post-operatively, there was x-ray evidence of a recurrence of disease in the right anterior second interspace but he was asymptomatic. He was re-admitted to the hospital. On bed rest this man has improved and his sputum has remained negative. He is now in good condition with negative sputum (including gastric cultures). He is 32 months post-operative. Concentrates were negative October 24, 1949 and cultures were started.

W.E.F.: A 20-year old white male had intermittent pleural pain in October 1947. He had cough productive of about one half ounce of sputum, night sweats and loss of 30 pounds weight in four months, sore throat for approximately a month before admission (July 11, 1948) and a hemoptysis that persisted for about a week in the month preceding admission to this hospital. His sore throat had been treated with penicillin without improvement and when admitted he ran a low grade fever up to 100 degrees F.

Examination revealed bilateral upper lobe infiltration with a moderately large cavity in the left upper lobe below which appeared a fairly fresh spread of disease of an apparently caseous pneumonic character. In addition to bed rest care, pneumothorax, right, was initiated July 21, 1948 and streptomycin 1 gram, for 42 days beginning July 27, 1948 was

![FIGURE 2a](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21204/)

**FIGURE 2a**

*Fig. 2a:* July 14, 1948. Admission film. Ten months after onset and 3 weeks after hemoptysis; acute illness with spread.—**FIGURE 2b:** December 15, 1948. Three months after 42 gms. SM. First stage 8 days later. Discharged—Arrested 15 months later.
given for tuberculosis of the larynx. The laryngeal disease improved rapidly and the right pneumothorax was satisfactory.

A two-stage, seven-rib thoracoplasty, the first stage on December 23, 1948, 150 days after beginning of streptomycin was completed January 2, 1949. This patient has gained weight, all sputum examinations since operation have been negative, and he is in good general condition. His pneumothorax is being continued and he is on our convalescent service. Culture of gastric specimens taken in July 1949 have been reported negative. He is now nine months post-operative.

*Fig. 3a*: July 17, 1948. Outside film 1 month before admission to hospital and 2 weeks after positive sputum and induction of Pnx. right by patient's LMD. — *Fig. 3b*: August 16, 1948. Admission film—acute caseous pneumonic disease under right Pnx. *(Not Atelectasis).* Bronchoscopy w/aspirations 5 times. Also Br. Pn. extension into RLL Pnp. instituted at end of SM and Thplsty. First stage 3 months later. Discharged arrested 13 months after completion of Thplst. and 20 months after admission.

*Fig. 4a*: Acutely ill 2 weeks with fever. Hemothysis day before admission. Bedside film—2 months later. Patient acutely ill. SM 42 gms. begun for progressively increasing disease which responded well, leaving residual cavity.—*Fig. 4b*: Four months later and improved before thoracoplasty. Discharged "Arrested" 1 year later—20 months after admission.
J.A.: This Latin American male of 24 years had a "bad chest cold" in February 1948 with fever, cough, sore throat and chest pain. In March he had increased productive cough and hemoptysis and lost about 20 pounds weight. X-ray film of the chest at that time showed pulmonary tuberculosis and he was admitted May 26, 1948 to Brooke General Hospital where streptomycin treatment was begun on June 2. On transfer to this hospital June 17, streptomycin was continued, and he received 1 gram daily for 42 days.

On admission his sputum was positive for tubercle bacilli, and there was x-ray evidence of pneumatic disease involving the entire right upper lobe with some honeycombing and slight infiltration in the left upper lobe. His toxic symptoms subsided and a two-stage, seven-rib thoracoplasty was done. The first stage was 120 days (September 9, 1948) from beginning of streptomycin therapy. The second stage was on September 30, 1948. His post-operative course was entirely uneventful. Sputum examinations including cultures were negative, except for one positive culture on March 15, 1949, and clinically the patient has been in good condition. Culture of gastric washings of August 10, 1949 (10 months post-operative) was reported negative for tubercle bacilli.

H.C.W.: This white male of 26 years, when admitted August 10, 1948 was acutely ill with temperature of 101 degrees F. He had loss of weight and strength for the preceding year or more and productive cough for two months. One month before admission, positive gastric washings were obtained by his physician and right pneumothorax was begun immediately and continued up to admission to this hospital.

A review of his case showed evidence of acute caseous pneumatic tuberculosis in the right upper lobe with broncho-pneumonic extension in the lower half of the lung, for which streptomycin was given, 1 gram daily for 42 days (September 3 to October 27, 1948). The pneumothorax was abandoned and the expanded lung showed marked improvement in the right upper lobe, but with a cavity adjacent to a consolidated apical segment. Because of persistent active infiltration in the right base, pneumoperitoneum was begun November 9, 1948 with improvement in the following three months so that a three-stage, nine-rib thoracoplasty was

FIGURE 5a  FIGURE 5b

Fig. 5a: February 15, 1948. Acute pneumatic infiltration R.U.L. duration 1 month.—Fig. 5b: August 2, 1948. After 96 gms. SM—Marked improvement.
performed February 12, 1949, the first stage 191 days after beginning of streptomycin treatment. The second and third stages were done on March 5 and 25, 1949. Post-operative course was uneventful. He promptly gained weight and all sputas have been reported negative. His general condition is good. He is now six months post-operative.

S.G.S.: This Latin-American male of 21 years had fever for two weeks and hemoptysis for one day before admission on April 3, 1948, at which time he was toxic, with temperature of 101 to 102 degrees F. He had evidence of extensive soft infiltration in the right upper lobe, with sputum positive for tubercle bacilli. Pneumothorax, right, was attempted unsuccessfully. Following a pulmonary hemorrhage his temperature ranged from 102 to 104 degrees F. and streptomycin was given, 1 gram daily for 42 days (June 16 to July 27, 1948), for increasing disease. The acute disease process subsided and thoracoplasty, right, was performed, first stage on October 12, 1948, 120 days after beginning streptomycin. The second stage was delayed by a pleural effusion on the operated side requiring aspiration on two occasions. Fever with atelectasis in the right base was relieved by bronchoscopic aspiration of the right middle lobe and the second stage of thoracoplasty was performed December 8, 1948. Marked subcutaneous emphysema developed over the chest, abdomen and acrotum which subsided shortly and his course thereafter was uneventful. Sputum examinations have been negative since the second stage, including cultures and guinea pig of sputum six months post-operatively. His general condition is good; he has been gaining weight and is on increased activity.

F.A.: A Latin-American male of 28 years had acute pneumonic disease in February 1948 and was treated unsuccessfully with sulphamamide or sulfonamide and penicillin, following a one month history of fever, productive cough, and weight loss of 24 pounds. At Brooke General Hospital he was extremely toxic with temperature ranging from 102 to 104 degrees F. and was treated with streptomycin, 1 gram daily for 96 days.
He was transferred to this hospital on June 15, 1948, where sputum was positive, and he ran a slightly elevated temperature to 99.6 degrees F. The right lung contained an extensive confluent broncho-pneumonic lesion involving the entire right upper lobe with cavity, with disease also in the right base. After six weeks in this hospital he was afebrile.

The right basal spread had improved after four months and thoracoplasty, right, was recommended. On October 15, 1948 there occurred a sudden hemoptysis of three to four ounces, apparently from the right side, which ceased following pneumothorax, right. Increase of disease in the right lung was treated with streptomycin, 1 gram daily for 42 days (November 4 to December 15, 1948), with some clearing and with considerable improvement in temperature, cough and expectoration. The left lung now appeared clear. Because of some diminution of renal function and findings suggestive of amyloid degeneration, one-stage procedure was considered preferable, and on February 5, 1949, three months from the beginning of the second course of streptomycin, this patient had an extrapleural pneumonolysis on the right with lucite ball filling. The post-operative course was satisfactory and he gained 10 pounds soon after surgery.

About the end of June 1949, four and one half months post-operatively, he again began to run temperature up to 101 degrees F. and was found to have a fairly large effusion in the pleural cavity below the extrapleural space. This was aspirated of 1500 cc. of clear fluid, positive for tubercle bacilli on culture. His temperature fell to normal after 10 days and has remained so. There was some evidence of continued active disease in the right base below the extrapleural space. Sputum cultures, however, reverted to negative after March 1949 and have remained so up to six months post-operative. Three cultures (gastrics) about August 8, 1949 were negative. His clinical condition is fairly good but his weight is somewhat low.
Fig. 7a: June 11, 1948. Small infiltration L.U.L.—Fig. 7b: July 20, 1948. Six weeks later—acute spread of disease, left, with high fever, SM 1.0/42 begun.—Fig. 7c: September 21, 1948. Showing moderate clearing at close of SM course, which was followed promptly by thoracoplasty next day. Result: Sputum culture negative—patient AWOL 7 months post-operative (completion of thoracoplasty). In good general condition.
C.G.: This Latin-American male of 26 years had fever, weakness and easy fatigability beginning August 1948, after a weight loss of 20 pounds in the preceding six months. On several occasions during September 1948, he had hemoptysis. Pulmonary tuberculosis was reported from x-ray inspection of chest in September 1948. He complained of pain about the right scapula with occasional nausea and vomiting following severe cough. His temperature was elevated to approximately 101 degrees F. daily on admission (October 25, 1948). A diagnosis was made of acute caseous pneumonic tuberculosis involving the entire right upper lobe and he was treated with bed rest plus streptomycin (0.5 gram daily for 42 days) administered from November 4 to December 15, 1948. Some improvement was noted by x-ray inspection.

A three-stage, seven-rib, right thoracoplasty was begun on December 22, 1948 when it was thought that maximum early improvement and some degree of stabilization had occurred. The first stage was performed on the 49th day following the beginning of treatment with streptomycin. The second and third stages were done on January 10 and February 1, 1949. Sputum concentrate examinations were negative. A culture of sputum on May 11, 1949 was positive with organisms sensitive to 10 mcgm. of streptomycin, and culture of gastric contents taken July 12, 1949 was reported positive. Clinically he is in good condition and he is now eight months post-operative.

J.B.: This white male Veteran of 26 years was a prisoner of war for 42 months in Burma. When liberated in August 1945, he weighed 84 pounds. Following his discharge from the Army with a diagnosis of pulmonary tuberculosis, he was in three different tuberculosis hospitals for periods of a month or less with sputum smears and guinea pig inoculation of sputum reported negative. He was re-admitted to this hospital on April 27, 1948 following x-ray evidence of markedly increased disease but again left A.W.O.L.

On present admission, July 19, 1948, he had elevated temperature to 99.4 degrees F. and left chest pain with physical and x-ray evidence of spread of disease in the left lung. His temperature was irregular and

![FIGURE 8a](image1)  ![FIGURE 8b](image2)

*Fig. 8a:* June 18, 1948. Admission film—3 weeks of SM begun elsewhere for acute exudative disease RUL—after hemoptysis.—*Fig. 8b:* September 2, 1948. Six weeks after completion of 42 gms. SM. Discharged apparently arrested 10 months later—13 months post-admission.
ranged up to 101 degrees F. Pneumothorax was attempted unsuccessfully. On August 5, 1949 it was observed that there had been rapid spread in the left upper lobe since two months earlier. Sputum had been consistently positive for tubercle bacilli. There was a confluent bronchopneumonic disease process throughout the left upper lobe with excavation and the patient received streptomycin, 1 gram daily for 42 days, ending September 22, 1948. Bronchoscopy showed no endobronchial disease and three-stage, nine-rib thoracoplasty was done, the first stage (September 22, 1948) on the 42nd day following institution of streptomycin therapy. The second and third stages were done October 11 and November 9, 1948. Post-operative course was uneventful. His sputum was negative following surgical collapse, including cultures. Except for one positive culture on January 12, 1949, organisms being sensitive to 10 mcgm. of streptomycin. Subsequent sputum cultures were negative. This patient left the hospital A.W.O.L. on May 30, 1949 in good clinical condition when six months post-operative.

SUMMARY

In the past 36 months we have treated eight patients for acute tuberculous pulmonary disease with streptomycin, followed within five months by major surgery. Surgical therapy was employed as early as it was thought that the acute lesions had become stabilized, or when early maximum improvement was considered to have occurred. All patients are clinically in good condition. One patient only, at the last report, has had positive cultures of gastric contents.

The time from onset of disease to surgical collapse or excision averages less than six months, and in six of the eight, averages slightly over four months.

Follow-up on these patients now ranges from seven to 32 months post-operatively.

RESUMEN

En los últimos 36 meses hemos tratado ocho casos de tuberculososis pulmonar aguda con estreptomicina seguida después de cinco meses por la cirugía mayor.

La cirugía se empleó tan pronto como se consideró que las lesiones se habían estabilizado o cuando se consideró que se había obtenido el máximo de mejora pronta.

Todos los enfermos están en buenas condiciones clínicamente, solamente un enfermo, según el último informe, ha tenido cultivos positivos de contenido gástrico.

El tiempo desde el principio de la enfermedad hasta el colapso quirúrgico o resección, es por término medio de seis meses y en seis de los ocho, es ligeramente más de cuatro meses.

La observación ulterior de estos enfermos es de 7 a 32 meses después de la operación.
Dans les derniers trente-six mois, les auteurs ont traité huit malades atteints de tuberculose pulmonaire aigue par la streptomycine puis ils ont fait suivre ce traitement par une grande intervention chirurgicale moins de cinq mois après sa terminaison. Le traitement chirurgical a été utilisé dès que les lésions aigues paraient stabilisées. Il fut également utilisé dès qu'on eut l'impression qu'on était arrivé au point maximum de l'amélioration. Tous les malades sont cliniquement en très bon état. Un seul d'entre eux a eu, à la dernière observation, une culture positive sur tubage gastrique.

Le délai qui s'étend depuis le début de la maladie jusqu'au moment de la collapsothérapie ou de l'exérèse est inférieur à six mois en moyenne; dans bien des cas il ne dépassa pas quatre mois.

Révision des observations de ces malades avec un recul de sept à trente deux mois après l'opération.

REFERENCES