The Handling of the Poor Risk Patient with Pulmonary Tuberculosis: Antimicrobial Therapy, Cardio-Pulmonary Function and Surgery*

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I. Introduction

The remarkable development of antimicrobial therapy for pulmonary tuberculosis, either as the sole modality of treatment or in preparing and covering the patient who is to undergo surgery, has resulted in alteration of our concepts of the treatment of this disease. The prompt clearing of the inflammatory process of the more acute forms, under the influence of antimicrobial agents combined with surgical extirpation of fibrocavernous residua, has resulted in a shortened period of hospitalization.

The so-called “salvage” case is a challenge to the profession both in the evaluation and the employment of refined methods of treatment. Today, we are reluctant to settle for the so-called “good chronic” with quiescent disease. Instead, we are constantly striving for the inactive state.1

In this communication, we propose to discuss the “team concept” of management and the ever-broadening horizons for the patient with far advanced pulmonary tuberculosis.

II Pathogenicity of the Tubercle Bacillus and Present Protocols of Treatment

More recently, observations in our laboratory involving the changed metabolism and pathogenicity of isoniazid-resistant tubercle bacilli have led us to formulate new protocols of antimicrobial therapy,2 particularly in regard to broadening the indications for surgery.

At the National Jewish Hospital, we use essentially three protocols of treatment: (1) Isoniazid as the sole agent which is started initially at eight mgm. or more/kilo/day dose level (with pyridoxine). This protocol is used only for the patient who has had streptomycin and/or PAS treatment before admission and whose organisms in sputum and body fluids are resistant to one or both of these drugs or when previous streptomycin was of sufficient duration and toxicity to justify single drug treatment. (2) A combination of streptomycin, one gram every third day, and isoniazid, eight mgm. or more/kilo/day (with pyridoxine). Both of these drugs are continued until two consecutive negative sputa (concentrate and culture) are obtained. When this goal is achieved, isoniazid is often decreased to four mgm./kilo/day. Streptomycin is discontinued at the

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end of six to 12 months; however, isoniazid is continued for no less than 18 months. If reversal of infectiousness is not obtained, we continue with isoniazid indefinitely. When bacterial resistance to isoniazid at 10 mcg./ml. of medium occurs and the tubercle bacilli isolated give a negative catalase reaction,² isoniazid is continued alone but often at a four mgm./kilo/day dose. The criteria for selection for this protocol are as follows: (a) The patient who has had isoniazid and/or streptomycin and/or PAS before coming to the hospital. (b) The absence of obvious cavitation. (c) When organisms are still streptomycin sensitive. If the patient is scheduled for surgery, pre-operatively, he is given streptomycin, one gram every day, and PAS, 12 grams daily, for seven days; this regimen is continued for six weeks post-operatively and then reversed to the established protocol. (3) The third protocol is used for the fresh case of pulmonary tuberculosis who has had no antimicrobial drugs and whose tubercle bacilli are sensitive to them. This regimen consists of streptomycin, 25 mgm./kilo/day for 90 days; then streptomycin is discontinued. Isoniazid is started in an eight mgm. or more/kilo/day dosage (with pyridoxine) with the streptomycin, and the former is decreased to four mgm./kilo/day only if and when two consecutive negative sputa (concentrate and culture) are obtained; or if complete bacterial resistance to isoniazid and catalase negativity develop. It should be noted that in all the protocols, isoniazid is continued for at least 18 months. To obviate the problem of peripheral neuritis we also add thiamine hydrochloride, 100 mgm./day, and, most importantly, pyridoxine, 25-100 mgm./day.³ In this regimen we utilize the known bactericidal synergism of streptomycin and isoniazid as well as taking advantage of the information collected from clinical observations when streptomycin was the only effective antimicrobial agent available and rapid clearing of the lesions occurred on large doses of streptomycin before bacterial resistance developed.

There is a school of thought which feels that the two most potent antimicrobial agents should not be used together in a new case.⁴ However, we believe, the most effective combination of drugs is streptomycin in adequate dosage combined with isoniazid. It is also our belief that bacterial resistance to isoniazid is different in its clinical significance from bacterial resistance to streptomycin. We, and others,⁵ ⁶ have observed that catalase-deficient tubercle bacilli (resistant to isoniazid) are moderately or markedly attenuated for the guinea pig, rabbit, monkey and probably for most human beings. We have no evidence of progressive extension of tuberculous disease into previously uninvolved areas of the lungs, or elsewhere, in patients on adequate dosage of isoniazid—even in the face of complete bacterial resistance to this drug. It has been noted that in most cases where the patient is on both isoniazid and streptomycin and develops isoniazid-resistance, streptomycin sensitivity is usually maintained. In attempting to explain this phenomenon, it has been shown that DNA (desoxyribonucleic acid) inactivates streptomycin by simple acid base binding.⁷ It has been demonstrated that the DNA is present in open cavities where autolysis of leukocytes is taking place. This may well
account for the prolonged streptomycin susceptibility of the tubercle bacilli appearing in the sputum. Therefore, we continue to use streptomycin and isoniazid under these circumstances because some streptomycin may become therapeutically available, especially in higher and daily doses. When using large doses of streptomycin and isoniazid simultaneously, we have occasionally seen rapid sterilization of cavities which remained as open, cystic structures. Indeed, the pathologist oftines can no longer unequivocally state that the cavity is tuberculous. It must be recognized that the antimicrobial agents are active only against multiplying (living) organisms. This fact serves as a theoretical basis for our practice of long-term chemotherapy with isoniazid and for our abandonment of long-term rest.

III. Pulmonary Function Determination and Evaluation

Patients with pulmonary tuberculosis are poor risks for surgery not only because of their tuberculous lesions (except in rapid fulminating and toxic phases of this disease) but rather because of respiratory deficiency.8, 9

Pulmonary function studies, therefore, assume an even greater importance in evaluating the poor risk patient and fall into two large categories: (a) ventilatory function and (b) interchanges of gases. For practical purposes, the ventilatory function determinations perhaps are of most clinical significance. However, oxygen saturation and perfusion, and shunt determinations are important and occasionally mandatory in assessing the poor risk patient. We, of course, also rely on the internist's clinical appraisal of the patient's cardio-respiratory reserve.10, 11 Ventilatory function is tested by timed vital capacity, maximum breathing capacity, residual air volume and ventilatory reserve. Surely, when vital capacity is below 50 per cent of predicted normal, more pulmonary function studies are indicated. Frequently, differential studies by bronchspirometry are extremely useful and necessary. In general, a patient with maximum breathing capacity of 30L/min. or less is not a likely candidate for any type of major thoracic surgical procedure. The residual capacity is an important determination of the degree of obstructive emphysema and must be closely correlated with the other tests of ventilatory function. We interpret anything greater than 35 per cent volume of residual air indicative of obstructive emphysema and consider the residual air over 50 per cent volume as a grade IV risk. The ventilatory reserve as described by Courmand and Richards11 is very useful. The normal determination being 90 per cent and anything below 80 per cent indicates rather marked ventilatory deficiency.

The determination of interchanges of gases, although technically more complex and necessitating a rather elaborate cardio-pulmonary staff and physical set-up, is frequently necessary for the critical evaluation of the patient with impaired ventilatory function. These determinations are divided into two major categories: The first, distribution effect, alludes to the mechanical factors as responsible agents for decreasing the arterial oxygen saturation. This effect is commonly noted in emphysematous blebs,
complete bronchial obstruction and pulmonary fibrosis. In the second, _diffusion effect_, the factor is one of thickening of the alveolar wall with decrease in diffusion of the oxygen across the barrier into the blood stream.

It is especially important that patients with marginal cardio-respiratory reserve have an expert anesthesiologist as part of the surgical team; also, it is more important to have a skilled anesthesiologist than to quibble about the anesthetic agent. This alert member of the team also carries out the meticulous replacement of fluids and blood. A clean air way during and following operation is of paramount importance in obviating carbon dioxide retention.

**IV. Surgical Considerations**

As for the surgical considerations, we are firmly convinced of the peculiar safety of isoniazid coverage and have extended our surgical indications and recommendations of definitive procedures for more patients.

Of the collapse procedures, we feel as others that the extrapleural method produced the least loss of pulmonary function; however, this procedure was discontinued at National Jewish Hospital more than three years ago because of the serious complication of broncho-extra-pleural fistula. Our procedure of choice today is the extra-periosteal plombage. This operation preserves the good features of the extra-pleural type but usually avoids the serious complications. In the occasional case when it becomes necessary to remove the plombage, we feel the combination of plombage followed by rib resection gives a better collapse with less deformity and less loss of pulmonary function than does the classical thoracoplasty. Frequently, we use plombage collapse not as a definitive procedure but as a preliminary to future excisional surgery. This serves three functions: (1) it allows maximum stabilization of the active disease; (2) frequently obviates residual post-resectional spaces; and (3) prevents over-distention, of whatever importance this may be. From July, 1951, to July, 1958, we employed the Ivalon sponge; however, due to a complication rate of 8.9 per cent of apparently allergic nature, we have changed to Polystan* (polythene) sponges (A/S Ferrosan, Manufacturing Chemists, Copenhagen, Denmark). In the past 11 months, we have inserted 22 of these with only one complication (a tuberculous infection in the sponge space).

When practicable, all significant residual cavitary disease is resected with the purpose of eliminating foci for reactivation and rendering the sputum negative for tubercle bacilli. Furthermore, we believe that resectional surgery conserves pulmonary function to a greater degree than any type of "collapse" therapy. In stable disease, primary resection with tailoring thoracoplasty, if necessary, is becoming the procedure of choice without resorting to preliminary thoracoplasty.

In addition to the common features of anemia, low blood volume, hyperproteinemia, and so forth, we feel that the patient with pulmonary tuberculosis can be classified as a poor risk for surgery because of one or more of the following conditions:

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1. Reduced pulmonary reserve.
2. Highly positive sputum with marked or complete antimicrobial resistance.
3. Infected pleural space with bronchopleural fistula.
4. Extensive bilateral cavitary disease.
5. Extensive pulmonary tuberculosis associated with other serious non-tuberculous diseases.

V. Case Reports

We are presenting a small selected series of cases which serve as illustrative examples of the above categories and will briefly summarize the therapeutic regimen and results.

Dr. M. E. M.: This 56 year old, white physician's first wife died of tuberculosis many years ago. He had a moderately productive cough for many years. In April, 1952, he developed a "cold" with a fever; he was treated conservatively with antimicrobials; however, shortness of breath, increasing productive cough, weight loss and anorexia continued. In July of 1952, chest x-ray film revealed extensive bilateral destructive cavitary tuberculosis and positive sputum. He was treated with streptomycin and PAS until August, 1952; and he was admitted to National Jewish Hospital in September of 1952. X-ray films revealed advanced disease involving all lobes of both lungs with multiple cavitation and pneumonitis replacing the left upper lobe. There was also possible active cavitary disease in the right upper lobe (Fig. 1). Sputum was positive 5/field with 4 plus resistance to isoniazid, but sensitive to streptomycin and PAS. Sedimentation rate was 85 mm./hour corrected. He was continued on streptomycin, PAS and isoniazid (4 mgm./kilo/day); however, he tolerated all drugs poorly (nausea, persistent vomiting, and severe pruritus) and medication was only intermittent. Pulmonary function studies revealed maximum breathing capacity 57 L/min., residual air volume 41 per cent, oxygen saturation 87 per cent at rest, 92.5 per cent after exercise. When he failed to show any appreciable improvement, it was felt some stabilizing procedure should be done. Accordingly, on March 4, 1953, a left Ivalon plombage thoracoplasty (seventh rib posteriorly and third rib anteriorly) was performed. Post-operatively, he did well and was completely ambulated by the 10th day; however, three weeks post-operatively he developed evidence of arteriolo-occlusive disease of his right foot which was treated vigorously with para-vertebral sympathetic blocks and priscoline with marked improvement. Sympathectomy was refused. In spite of his dramatic subjective improvement, his sputum remained heavily positive; and it was felt that definitive resectional surgery could convert his sputum to negativity and thus hasten earlier discharge. Accordingly, on September 23, 1953, resection of the apical posterior and anterior segments of the left upper lobe and superior segment of the left lower lobe was carried out (Fig. 2). Pulmonary functions prior to this second
procedure were essentially unchanged from previous determinations. Post-operative course was uneventful until the 10th post-operative day when he again developed progressive arterio-occlusive disease of his right foot. Conservative measures were of little avail and lumbar sympathectomy was decided on. This was attempted under spinal anesthesia on October 13, 1953; however, cardiac arrest occurred; resuscitation was carried out but the patient remained in coma and expired 13 days after cardiac resuscitation. This case presents a patient with extensive bilateral cavity pulmonary tuberculosis associated with a serious non-tuberculous disease in whom a stabilizing plombage thoracoplasty brought about marked subjective improvement. The unfortunate accident occurred during the attempt to deal with the serious complicating non-tuberculous disease. This serves as an example of a case in whom efforts were directed toward a cure rather than accepting a so-called "good chronic."

S. L.: This 26 year old, white female had contact with a friend who died of tuberculosis in 1948. She had pleurisy with effusion in 1950 and developed moderately productive cough, weight loss, fatigue and anorexia. Chest x-ray film in 1950 in Israel revealed cavitary tuberculosis of left upper lobe. She was admitted to a sanatorium for seven months where she received streptomycin and PAS for 30 days. Radical collapse was recommended since new huge cavities were noted in the right upper lobe. She refused surgery. Sputum was heavily positive and the sedimentation rate was 74 mm./hr. corrected. Intrapleural adhesions precluded pneumothorax and extrapleurale pneumothorax on left was begun and refilled for over a period of a year. She was admitted to the National Jewish Hospital on November 27, 1952, where x-ray film revealed extensive involvement with fibrocavernous disease of the left upper lobe and apparent residual of an extrapleural pneumothorax and multiple fibrocalcific seedlings on all lobes bilaterally (Fig. 3). Sputum was positive 40/field; sedimentation rate was 75 mm./hr. corrected; and there was 4 plus resistance to streptomycin and isoniazid. In the hospital she ran an intermittent febrile course with spikes up to 104° F. Aspiration of the extrapleural space revealed no significant bacteriologic findings. She was started on isoniazid and PAS. Pulmonary functions shortly after admission revealed vital capacity of 1460 cc. (40 per cent of normal), a maximum breathing capacity of 47 L/min. (56 per cent of normal), residual air volume of 60.6 per cent, alveolar nitrogen (seven minutes of breathing oxygen) 4.3 volume per cent (normal, less than 2½ per cent), alveolar CO₂ 8.1 volume per cent (normal, less than 6 per cent), arterial oxygen saturation 92 per cent (rest), 96 per cent (exercise). On March 30, 1953, left extrapleuroosteal Ivalon plombage thoracoplasty (sixth rib posteriorly and second rib anteriorly) was done. During the next 10 days, massive fluid accumulated in the sponge space with pain, fever, and increase in cough; multiple aspiration with penicillin-streptomycin instillations were to no avail. Aspirated fluid after many cultures was finally positive for tuberculosis. The sponge was removed and collapse maintained with a six and one-half rib resection and partial scapulectomy. She then did well with the right upper lobe lesion controlled; however, an open cavity in the left upper lobe beneath the thoracoplasty remained causing positive sputum, 15/field. Bronchospirometry at this time showed practically no pulmonary function on left. Isoniazid was increased to 8 mgm./kilo/day; and a left pneumonectomy on April 14, 1954, converted her to

![Figure 3](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21275/)

![Figure 4](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21275/)
negativity for the first time (Fig. 4). Her pulmonary function studies after the last procedure revealed a slight decrease in all determinations. This case characterizes one with extremely poor pulmonary function and heavily positive sputum with complete antimicrobial resistance. Careful evaluation of the pulmonary function determinations led us to believe that she would successfully withstand surgery.

W. A.: This 24 year old, white female's father was in a tuberculosis hospital at the time of her admission to National Jewish Hospital. Her mother died of tuberculosis in 1934, and one brother died of tuberculous cervical adenitis. At the age of 10 (1940), following an appendectomy, chest x-ray film revealed infiltration in both apices. A diagnosis of pulmonary tuberculosis was made and she was sent to a state sanatorium for six months and treated with bed rest. She was relatively well until 1946 at which time she married, and shortly thereafter developed chronic productive cough with left pleurisy. Annual x-ray films were presumably negative until 1951 when cavitary disease was noted on the left. She was then sent to another state sanatorium for seven months and treated intermittently with streptomycin and PAS. She entered National Jewish Hospital in September, 1952, where x-ray film revealed far advanced bilateral tuberculosis with a large cavity of the right upper lobe and a huge cavity occupying the left upper lobe (Fig. 5). She had heavily positive sputum, was 1 plus resistant to streptomycin, showed clubbing of fingers and the sedimentation rate was 90 mm./hr. corrected. Treatment consisted of streptomycin, PAS and isoniazid. She ran an intermittent fever up to 103°F. In order to gain control of the disease, a left plombage thoracoplasty (seventh rib posteriorly and third rib anteriorly) was done in January of 1953. She then developed marked reaction with fluid formation in the sponge space, necessitating removal of the sponge and rib resection (Fig. 6). Following this, she gradually and progressively improved, became completely ambulatory in six weeks following surgery, has since turned sputum negative and is now on a six hour daily work tolerance. The right-sided cavitory lesion has improved to the point where by tomography no demonstrable cavity is noted. Pre-operatively her pulmonary functions showed a maximum breathing capacity of 61 L/min., vital capacity of 1600 cc., and a residual air volume of 54 per cent; bronchospirometry revealed equal function bilaterally. Oxygen saturation at rest was 87.9 per cent and 90.8 per cent after exercise. Post-operatively her pulmonary functions showed no appreciable change after plombage; however, her maximum breathing capacity fell to 48 L/min. after the rib resection. The vital capacity after the rib resection was 1300 cc. with a 55 per cent residual air volume. This case represents an individual with extensive bilateral cavitory disease which responded with a salutary effect after a stabilizing procedure and antimicrobials.

E. L.: This 37 year old, white male was admitted to National Jewish Hospital on December 22, 1951, with a history of having a diagnosis of tuberculous bronchiectasis of the right upper lobe confirmed with a bronchogram in 1941. He was treated with bed rest for a period of about nine months at that time; his sputum was negative. He was discharged to work and gradually increased his activity. He had been actively working for about 10 years prior to admission; however, he had never felt well since the original disease. In June of 1950 he broke down with right upper lobe disease and
also had new spread to the left upper lobe. At that time he had positive sputum. Treatment consisted of streptomycin and PAS for a period of about 14 months, and also pneumoperitoneum for four months; on this regime he improved. He was admitted to National Jewish Hospital for more definitive therapy on December 22, 1951. Shortly after admission, he had one bout of two ounce hemoptysis; he was placed on streptomycin, PAS and thione. X-ray film revealed extensive bilateral cavitary pulmonary tuberculosis with multiple seeding throughout all lobes both lungs (Fig. 7). The pneumoperitoneum was continued for a short time and later abandoned. He improved slightly on this conservative therapy but still had a heavily positive sputum, 65/field. Pulmonary functions revealed maximum breathing capacity of 113 L/min., with vital capacity of 2950 cc.; bronchospirometry revealed right-sided vital capacity to be 48 per cent and oxygen consumption on the right 78 per cent with a minute volume of 47 on the right. Several surgical procedures, consisting of bilateral plombage with possible bilateral resection of the cavitary residua, were recommended to bring the disease under control and act as definitive therapy. On August 25, 1952, extraperiosteal plombage thoracoplasty on the right (sixth rib posteriorly and second rib anteriorly) was carried out. His sputum remained heavily positive and four months later left-sided extraperiosteal plombage thoracoplasty (sixth rib posteriorly and third rib anteriorly) was done. His sputum still remained heavily positive; accordingly, two months later, right upper lobectomy was performed (Fig. 8). Following this procedure he became negative on February 5, 1953 and remained so until discharge in June of 1953. His pulmonary functions after all these procedures were markedly preserved with only a slight drop in all determinations. This case presents one with extensive bilateral cavitary pulmonary tuberculosis in whom a long-range multiple surgical program was outlined and satisfactorily concluded with remarkable preservation of pulmonary functions.

DISCUSSION AND SUMMARY

At the National Jewish Hospital, we have observed a marked decrease in the percentage of patients with minimal to moderately advanced exudative disease. Those with far advanced fibrocavernous lesions are now our principal concern. These changes in the patient population of our institution together with the more perfectionistic demands as to the results of treatment have necessitated development of the "team concept" of therapy with close coordination between the internist, bacteriologist, physiologist, and surgeon.

As a result of recent advances in chemotherapy, many poor risk patients can now more safely be submitted to definitive major surgical procedures aimed at completing the control of tuberculosis which cannot be achieved.
by drugs alone. It is our experience that in the patient with isoniazid-resistant, catalase-negative tubercle bacilli, the risk of serious post-operative spread of disease is minimal or absent.

Thus, careful evaluation of the cardio-respiratory system as to the type and extent of pulmonary insufficiency takes on an even greater importance in selecting patients for major thoracic surgical procedures. In other words, the “tuberculous process” per se is no longer of as much importance as a contraindication for surgery.

Our experience with a wide variety of surgical procedures indicates that broader application of resectional surgery under coverage of isoniazid is now possible and, indeed, definitely indicated to control pulmonary tuberculosis more completely so that a maximum number of patients can be returned earlier to useful lives.

RESUMEN

Se ha notado una disminución de enfermos de tuberculosis mínima o moderadamente avanzada en el National Jewish Hospital.

Los enfermos con tuberculosis fibrocavernosa muy avanzada son ahora nuestra principal preocupación.

Estos cambios en la probación así como las demandas perfeccionistas de resultados del tratamiento han necesitado el desarrollo de un “concepto de equipo” de tratamiento con colaboración muy estrecha entre el internista, el bacteriólogo, el fisiólogo y el cirujano.

Como resultado de los adelantos recientes en quimioterapia muchos enfermos que eran malos riesgos pueden ahora ser sometidos con seguridad a la cirugía mayor encaminada a controlar la tuberculosis que no puede dominarse por las drogas solas.

Según nuestra experiencia el enfermo con isoniacido-resistencia catalásas-negativas al bacilo de Koch, el riesgo de diseminación grave post-operatoria es mínimo o nulo.

Así, la valuación cuidadosa de los aparatos respiratorio y circulatorio en lo referente al tipo y extensión de la insufficiencia pulmonar tiene mucho mayor importancia para escoger los enfermos para la cirugía mayor torácica. En otras palabras, el “proceso tuberculoso” per se ya no es una contraindicación de gran importancia para la cirugía.

Nuestra experiencia con una gran variedad de procedimientos quirúrgico indica que ahora es posible y sin duda definitivamente indicado el controlar la tuberculosis más completamente de manera que un número máximo de enfermos pueden reintegrarse más pronto a la vida útil.

RESUME

A l’hôpital National Israélite, les auteurs ont observé un déclin marqué du pourcentage des malades atteints de lésions exsudatives, allant d’une atteinte minime à une forme modérément avancée. Les malades atteints de lésions fibro-cavitaires très denses constituent maintenant leur principal souci. Ces modifications dans le type de malades de leur établissement
ajoutées aux nécessités de perfectionner encore davantage les résultats du traitement, ont exigé le développement du "concept d'équipe," avec collaboration étroite entre le médecin, le bactériologiste, le physiologiste et le chirurgien.

Par suite des récents progrès de la chimiothérapie; beaucoup de malades sérieusement atteints peuvent maintenant subir avec beaucoup plus de sécurité les interventions de grand chirurgie. Leur but est d'obtenir une guérison de la tuberculose qui n'a pas pu être réalisée par les drogues seules. D'après l'expérience des auteurs, les bacilles résistants à l'isoniazide catalase-négatives ne font courir au malade qui en est porteur qu'un risque minime ou même inexistant de dissémination post-opératoire.

L'étude minutieuse du système cardio-respiratoire pour évaluer le type et l'étendue de l'insuffisance pulmonaire, prend même une importance de plus en plus marquée pour décider quels malades sont justiciables de la grande chirurgie thoracique. En d'autres termes, le "processus tuberculeux" en lui-même n'est plus d'une importance telle qu'il puisse être une contre-indication à la chirurgie.

L'expérience des auteurs portant sur une grande variété de méthodes chirurgicales, démontre qu'une plus large application de la chirurgie d'excérèse sous le couvert de l'isoniazide est maintenant possible et même définitivement indiquée pour juguler plus complètement la tuberculose pulmonaire. Ainsi sera rendu plus précocemment à une existence utile le plus grand nombre possible de malades.

ZUSAMMENFASSUNG


Zur Auswahl der Patienten für grosse chirurgische Eingriffe ist eine sorgfältige Prüfung der cardio-respiratorischen Funktion erforderlich, um Art und Ausdehnung einer respiratorischen Funktionsbehinderung zu beurteilen. Mit anderen Worten ist der "tuberkulöse Prozess" an sich nicht mehr von so grosser Bedeutung als Kontraindikation gegen eine chirurgische Behandlung.

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