Pulmonary Resection
in Mental Patients with Tuberculosis*

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Introduction

In institutions for the mentally ill active tuberculosis occurs with dis-
maying frequency. Twenty-seven to 40 cases have been found per thou-
sand examinations and the death rate due to tuberculosis in such hospitals
is 19 times the death rate due to this disease in the general population.8 The
disease threatens every inmate of these crowded hospitals and there
is, in addition, a more general menace for the patients form an important
“seed bed” of tuberculosis which may infect those who care for the men-
tally ill, and indirectly, many others.

The seriousness of this problem in Minnesota was recognized early in
the operation of such institutions. In 1897 H. M. Bracken,3* executive
officer, Minnesota State Board of Health, published a medical classic titled
Should the Tuberculous Insane be Isolated from Other Inmates in Our
Asylums and Accommodations Provided for Them in Separate and De-
tached Buildings. The seriousness of the problem and the best known
solution were emphasized. By 1907 two state hospitals had small tuber-
culosis units which were occupied mainly by hopeless cases. It was not
until 1934 that the true tuberculosis situation in institutions for the men-
tally ill was determined. That year H. A. Burns5 personally examined in-
mates and personnel of these institutions. He found that 82 per cent of
the inmates had primary tuberculosis as manifested by the tuberculin
reaction. Suggestive x-ray shadow-casting lesions were found in 11.2 per
cent of whom 21.3 per cent had tubercle bacilli in the sputum. Testing of
employees revealed 72 per cent with primary tuberculosis of whom 5.2 per
cent had demonstrable pulmonary lesions.

In 1942 Doctor Burns was appointed chief of a new tuberculosis control
unit for the express purpose of solving the tuberculosis problem in state
institutions. He immediately established isolation units in four of the institu-
tions where tuberculous mentally ill patients from all of the state hos-
pitals could be segregated. He then arranged for examinations including
x-ray films of the chests of the inmates and personnel of all institutions.
Inmates found to have tuberculosis were transferred to the isolation units.
This was followed by adequate examination including x-ray film inspection
of the chests of all patients on admission and pre-employment examinations
for personnel. Thereafter patients and personnel alike received excellent

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annual examinations for tuberculosis. The establishment of four isolation units was only a temporary expediency as Doctor Burns visualized a single unit large enough to house all of the tuberculous mentally ill of the state with expert professional personnel administering the best known methods of treatment under strict contagious disease technic. He conferred with Doctor Edmund W. Miller, superintendent and medical director of the Anoka State Hospital, and other officials. It was decided that this unit should be located at the Anoka State Hospital where adequate facilities could be provided and also because of its proximity to the Medical School of the University of Minnesota. An affiliation with the Medical School was visualized whereby faculty members of appropriate departments would participate in the care of the mentally ill tuberculous patients.

Provisions were made for the remodeling of a building later described by Doctor Miller. The remodeling was well underway and Doctor Burn's far-reaching vision was being realized when he died in 1949. The unit was opened in 1950 and was dedicated to his memory under the name, Herbert A. Burns Memorial Hospital in November, 1952. Since his death periodic examinations of patients and personnel in all state institutions for the mentally ill has continued.

The present routine provides for 14 x 17 inch chest x-ray films of all new patients admitted to the hospitals for the mentally ill of the state, all re-admissions and all new employees. Most of the institutions also do tuberculin tests on new admissions and employees. In November, 1953, the Department of Public Welfare began making 70 mm. photofluorographic surveys of all patients and employees of these hospitals twice each year. Individuals whose photofluorograms are unsatisfactory or abnormal, and patients or employees not included in the survey are checked by 14 x 17 inch chest x-ray films within a period of 30 days after the survey. The patients whose x-ray films show suggestive evidence of tuberculosis, with or without clinical findings, are recommended for transfer to the tuberculosis unit at the Anoka State Hospital, even though they do not have positive bacteriological findings. Those presenting tubercle bacilli, except for the dangerously insane and a small group in one of the institutions for the mentally defective, are immediately transferred to the tuberculosis unit. Plans are recommended for specially designed quarters at the tuberculosis unit also for these two groups of patients.

The tuberculosis unit now consists of the Burns Hospital and three supplementary cottages with a bed capacity for 475 patients.

Since 1952 when an affiliation was started with the Surgical Department of the University of Minnesota and a surgical resident was assigned to the Burns Hospital, surgery has assumed an important part in the treatment of these patients.

**Indications for Surgery**

Some authors have recommended that the indications for major surgery in the psychotic patient be the same as they are in the non-psychotic. This is a reasonable idea but indications for surgery in the non-psychotic
are, at present, so unsettled that the use of a comparison offers no specific guidance. For example, in one report advocating identical indications for the sane and the insane, pneumothorax was the most commonly used procedure and only eight patients had excisional surgery.7 We, too, at least to begin with, had the same general idea about treating tuberculosis in the insane, but in contrast we have used pneumothorax in no patient and have treated 131 with excisional surgery.

At the Burns Hospital we have used excisional surgery almost to the exclusion of other types of surgery and far more frequently than others who have written recently about the treatment of mental patients with tuberculosis.1, 7, 8, 15, 16, 17. In treating these patients we have tried, first of all, to obtain arrest of the disease in the conventional sense, but beyond this we have sought to bring each patient to a state of health where he could safely be removed from the tuberculosis section and returned to the general wards of the hospital. For such a program careful selection is necessary in order to avoid further spread of the disease. We have concluded that patients about to be removed from isolation should be not only consistently free of the tubercle bacillus in gastric cultures, but that they should show no remaining evidence of tuberculosis on chest x-ray films, or at most, merely minimal, residual scarring. Even an infrequent, positive sputum arising from an apparently inactive caseous nodule could be dangerous if it were produced by an irresponsible individual in a ward. The contagious nature of the disease in this population is well recognized. Since with excisional surgery these potentially dangerous caseous nodules can be removed, we have recommended this type of surgery for all mental patients in whom the roentgenologically evident disease could apparently be taken out without undue risk. This means that some patients have had excisional surgery who, if they had been mentally competent, would doubtless have been discharged without it. In our hands the indications for surgery have not been the same in the psychotic and in the non-psychotic patient. Instead, excisional surgery has been used more liberally among the insane.

Preoperative Preparation

Preoperative treatment has depended, in some respects, upon the attitude of the patients. Mental patients usually fail to develop an understanding of their disease and though some may accept treatment passively, others may meet parts of the treatment with resistance. Bed-rest, for example, is impractical for most patients.

Fortunately, administration of drugs usually offers no problem and all the patients have had streptomycin twice a week and para-aminosalicylic acid or isoniazid daily before surgery for a period from a few weeks to more than a year. Recently three to four months has been the minimum length of preoperative antimicrobial administration.

Routine examinations and roentgenographic studies are not difficult to carry out though general anesthesia may occasionally be necessary for bronchoscopy, bronchograms, or planigrams.
Segmental resection is preferred whenever possible. Other authors have adequately described the technique of doing this as well as more extensive resections\textsuperscript{6, 12, 13} and hence it will not be detailed here. Final decision as to the extent of the resection cannot be made until the lung has been inspected and palpated. The commonest one has been segmental resection of the apical and posterior segments on the right or of the apical-posterior segment on the left. Often a wedge of the superior segment has been removed in continuity though occasionally the entire superior segment of the lower lobe has been taken. If the lingula as well as the apical-posterior segment is diseased, lobectomy has usually been done.

Thoracoplasty has been avoided, if possible, with segmental resections and it has not always been necessary with lobectomies. We prefer to do thoracoplasty simultaneously if it is used. Eleven of our 25 patients who have had unilateral lobectomies have had simultaneous thoracoplasties and three others have had thoracoplasty at a second operation.

For bilateral resections in which both sides have been done at the same operation an anterior incision has been used.\textsuperscript{14} In males the incision is placed just above the nipples while in females it is located below both breasts and the breasts are reflected upward. The sternum is divided transversely and both pleural cavities are entered through the third interspaces. Through this incision satisfactory exposure of both upper lungs may be obtained without difficulty.

**Postoperative Care**

Intercostal drainage tubes are stitched in place with heavy, fishline silk so that they may not be dislodged easily if the patient becomes disturbed. Suction to these tubes is set at a negative pressure of about 20 cm. of water though stronger suction may be used if the lung does not expand to the chest wall promptly. Air leaks commonly stop in a day or two though in some cases they may persist for a week without late sequelae.

Of course, intrapleural suction alone will not bring about rapid re-expansion if the respiratory tree is blocked, and among our patients this has often been troublesome. A clear airway has been more difficult to maintain than effective intrapleural suction. If transnasal, intratracheal suction does not produce satisfactory coughing, we have promptly resorted to tracheotomy. In retrospect, we recognize that our most serious errors have been failures to use tracheotomy or bronchoscopy early enough. This has occurred in spite of the fact that we have been impressed, even from the first, with the value of these procedures in the postoperative care of the insane.

Streptomycin and para-aminosalicylic acid or isoniazid are continued for at least three months postoperatively. If the opposite side is to be done at a second operation, antibiotics are given continuously between the operations. Evaluation for discharge is done approximately one year after surgery.
RESECTION IN MENTAL PATIENTS

Discharge and Subsequent Observation

After patients have received maximum benefit from the treatment available at the tuberculosis hospital and if they are not infectious to others, they are returned to their home institution: The following criteria are used in recommending transfer.

1. Minimum of six negative gastric cultures. (Sputum or gastric cultures are done after the antimicrobial drugs have been withheld for a period of at least two months).

2. Satisfactory x-ray examinations for a period of not less than six months for all patients who have had resection surgery.

3. Satisfactory clinical condition for a minimum period of six months.

4. At least 12 months antimicrobial treatment from the time the patients is put on drugs.

Seventy mm. x-ray films are made on these patients at six month intervals as part of the regular survey, and in addition, 14 x 17 films are made twice yearly by the staff of the hospital in which the patient is resident. These 14 x 17 x-ray films are planned to fit in so that the patient will have an x-ray film of the chest every three months. A series of three successive gastric cultures is recommended at six month intervals for at least two years after the patient is discharged from the tuberculosis unit. The frequency of cultures after two years will be determined by the patient's clinical condition and x-ray findings at his routine examinations. Any patients showing unsatisfactory clinical, bacteriological, or x-ray findings are returned to the tuberculosis unit at Anoka State Hospital for further study, and treatment if necessary.

The group of patients who do not respond to tuberculosis treatment satisfactorily and have occasional positive cultures or periods of apparent clinical activity are kept at the tuberculosis unit indefinitely.

TABLE I

<table>
<thead>
<tr>
<th>Type of Resection</th>
<th>Number of Patients</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segmental</td>
<td>88*</td>
<td>1</td>
</tr>
<tr>
<td>Wedge</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Lobectomy</td>
<td>28**</td>
<td>7</td>
</tr>
<tr>
<td>Pneumonectomy</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>131</td>
<td>11 (8.4 per cent)</td>
</tr>
</tbody>
</table>

* Ten of these patients had staged bilateral resections and four had simultaneous bilateral resections.

** Two of these patients had staged bilateral operations and one had a simultaneous bilateral resection.

Clinical Material

Summary information concerning the resections that have been done is contained in Table I. The major resection done in each case is the basis for classification; this means that a number of the segmental patients have had additional wedge resections and some of the lobectomy
patients have had additional segmental resections. In fact, three lobectomy patients have had segmental resections of the opposite lung.

More than 100 of the operations were done by surgical residents who have served at the hospital.

Mortality: The deaths include all deaths both early and late. In the largest group, the 88 patients who had segmental resections, there was only one death even though 10 of these patients had staged bilateral resections and 4 had simultaneous bilateral resections. This one death was due to cardiac arrest during surgery in a patient undergoing a unilateral resection.

The one death in the wedge resection group was due to cirrhosis of the liver which had been undetected preoperatively.

There has been a higher mortality rate among the patients who had pneumonectomies or lobectomies. Of the seven deaths in the lobectomy group, two, one caused by a cerebrovascular accident and the other by pulmonary embolism, were probably unavoidable, and a third was a late death which occurred five months after surgery due to bilateral bronchopneumonia in a patient with an old wound infection. In a fourth patient, a 65 year old woman who died three weeks after surgery, no cause for death could be found at autopsy. Finally, three patients in this group died of causes clearly related to mistakes in surgical technic or judgment. One of these died during an operation to repair a bronchopleural fistula. In one laryngeal edema with obstruction was the main cause of death, and in the third postoperative atelectasis and pneumonia caused death on the 30th postoperative day. In both of these last two patients tracheotomies had been used but efforts to clear the respiratory tree were probably neither early nor determined enough.

The two deaths in the pneumonectomy group were due to respiratory failure. In one patient there was a massive aspiration pneumonia following surgery which led to death the following day. In the other a six-rib thoracoplasty done at the time of pneumonectomy, caused paradoxical respiration postoperatively which was never satisfactorily relieved. The patient died seven days after surgery.

<table>
<thead>
<tr>
<th>Age Distribution by Decades</th>
<th>Resections for Tuberculosis.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Number of Patients</td>
</tr>
<tr>
<td>11-20</td>
<td>1</td>
</tr>
<tr>
<td>21-30</td>
<td>15</td>
</tr>
<tr>
<td>31-40</td>
<td>27</td>
</tr>
<tr>
<td>41-50</td>
<td>30</td>
</tr>
<tr>
<td>51-60</td>
<td>39</td>
</tr>
<tr>
<td>61-70</td>
<td>17</td>
</tr>
<tr>
<td>Over 70</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>131</td>
</tr>
</tbody>
</table>

Age: Tuberculosis, especially in the insane, is not limited to young adults. The average age of our patients was 47 and, as may be seen in
Table II the most frequent decade was the sixth. Many of our patients had carried relatively stable, active disease for years, perhaps since they were first admitted to the State Institutions as young people. It is worthwhile to know that even after they have grown old, excisional surgery may be used. There were 19 patients over 60 years of age, and among these there were three deaths, all in the lobectomy group. The oldest patient, a survivor, was 73.

Complications: The most troublesome and frequent, serious complication has been bronchopleural fistula; it occurred in eight and caused one death. Bronchopleural fistula has been distinguished from the less troublesome, postoperative air leak which has been persistent in 10 per cent of the segmental resections. With continuous intrapleural suction even persistent air leaks stop in a week or two without further trouble but bronchopleural fistula is accompanied by empyema, usually limited to the apex of the chest, and it demands thoracoplasty or occasionally muscle flap repairs (two cases).

Other non-fatal complications have been unremarkable except, possibly, for the occurrence of troublesome ileus in two patients. This complication was doubtless a consequence of chronic constipation and colonic distention which is common among mental patients.

Follow-Up: Early postoperative evaluation has been gratifying. Most of the operations reported here have been done less than two years ago and it will therefore be some time before a critical evaluation can be made, but because of the stable nature of the hospital population, an accurate, detailed follow-up will be possible.

Of the 120 patients (92 per cent) who are alive, 76 have had resections, or second resection if two were done, more than nine months ago. Among these 76 patients, 47 are classified as inactive, and 22 are probably inactive. The patients classified as probably inactive have satisfactory x-ray films but they have not yet had postoperative gastric, culture examinations. Seven remain who still have positive gastric cultures. The positive cultures apparently arise from the contralateral lung in three, from residual bronchial disease in two, and from an area of postoperative spread in two. We expect to obtain a satisfactory result ultimately in four or five of these seven patients.

Discussion

Excisional surgery can be successful in mental patients with tuberculosis despite the fact that their care must be unconventional in some respects. Most of what we have learned in treating these patients may be applicable only to other similar patients; nevertheless, this experience should call attention to some useful or at least provocative ideas concerning the treatment of all patients with tuberculosis.

For example, the withdrawn or indifferent attitude characteristic of many mental patients may disturb the attending staff, but it apparently need not have an adverse effect on the success of surgical treatment. It seems that neither an understanding of their disease nor a will to recover...
from it are necessary. This is in contrast to conventional opinion which has generally held that a proper mental attitude was of great value in patients being treated for tuberculosis.

It appears that a healthy mental attitude is not essential, nor, for that matter, is the most widely advocated ingredient in the treatment of tuberculosis—bed rest. Prolonged bed rest has not been used for most of the patients described here. At first we did not plan to do without bed rest but its omission was the only sensible course for it could not be used routinely without the unjustifiable measures of heavy sedation or restraints. Fortunately this omission has not been critical. Does this mean that antimicrobial drugs may replace bed rest in the treatment of tuberculosis? Our meager experience can not lead to an answer for the study was not, nor could it have been, a control study of the question. It can only be pointed out that bed rest hasn't been needed for the type of patient that we have treated, and that with drugs, it may not be needed for all sane patients either.

The aggressive approach that we have taken against bilateral disease among these patients has been rewarding and such an approach may be justified, as well, for mentally competent patients with tuberculosis. If significant disease has been evident bilaterally, we have resected both sides. Already 17 patients have had bilateral resections, five of whom had simultaneous bilateral resections, and the frequency of bilateral resection among them will go up as time passes. This is due to the fact that the first patients we operated upon were often selected for surgery because their disease was unilateral, and now there are few such patients left unoperated upon.

If the disease, though bilateral, is predominantly in one lung, resection of the most diseased side may be enough. For that matter, it may not be necessary in many cases to resect either side—no one knows. The potential threat carried by a few caseous nodules is unknown, though it is a problem of great importance. It has been held that after a long course of drug treatment these nodules may become permanently harmless,11 but since this is not established yet, we have been cautious and prefer to remove the evident disease bilaterally before allowing our patients to return to the general population of the State Hospital.

Bilateral excisions done as staged operations require a long period of treatment and even with a long interval between operations the second operation may be a trying one. Respiratory function recovers slowly on the first side and this side may then have difficulty in carrying the load of the second operation. As a trial, we have used simultaneous bilateral excisions hoping to force a bilateral distribution of the postoperative respiratory load and thus avoid some of the difficulties of staged resections. In the five patients who have had simultaneous bilateral resections, the results have been gratifying. In four of them segmental resections were done on both sides while in the fifth it was necessary to do lobectomy on one side and segmental excision on the other. Further use of this operation for selected patients is planned.
SUMMARY

1. Pulmonary resections have been done in 131 mental patients with tuberculosis. Eighty-eight have undergone segmental resections, seven wedge resections, 28 lobectomies, and eight pneumonectomies.
2. The overall patient mortality rate was 8.4 per cent. Only one of the patients who had segmental resections succumbed.
3. Whenever possible bilateral disease has been treated with bilateral resections. Fourteen who have had segmental resections and three who have had lobectomies have had bilateral operations. In five both sides have been resected at the same operation.
4. The technical problems in pre- and postoperative care which are peculiar to withdrawn, sometimes hostile, mental patients increase the difficulties of doing this type of surgery but they are not serious enough to contraindicate its use.
5. With excisional surgery as part of the treatment a large proportion of the mental patients who have tuberculosis may be brought to a state of health where isolation for tuberculosis is no longer necessary.

RESUMEN

1. Se han hecho resecciones pulmonares en 131 enfermos mentales con tuberculosis. Ochenta y ocho sufrieron resecciones segmentarias, siete resecciones en cuña, 28 lobectomías, y ocho neumonectomías.
2. La mortalidad total fué de 8.4 por ciento. Sólo uno de resección segmentaria sucumbió.
3. Siempre que fué posible se trató, la afección bilateral con resección bilateral. Catorce de los que tuvieron resecciones segmentarias y tres de los que tuvieron lobectomías tuvieron operaiones bilaterales. En cinco, ambos lados se operaron en la misma intervención.
4. Los problemas técnicos en el cuidado pre y postoperatorio-que son peculiares a enfermos retraídos, a veces hostiles, por ser-mentales aumentan las dificultades para hacer este tipo de cirugía pero no son tan serios como para contraindicar su uso.
5. Con cirugía de excisión como parte del tratamiento una gran proporción de los enfermos mentales que tienen tuberculosis pueden-ser traídos a un estado de salud en el aislamiento por tuberculosis ya no es necesario.

RESUME

1. Les auteurs ont réalisé des résections pulmonaires chez 131 malades atteints d'affection mentale et de tuberclose. 88 ont subi une résection segmentaire, 7 une résection cunéiforme, 28 une lobectomie et 8 une pneumonectomie.
2. La mortalité moyenne a été dans l'ensemble de 8,4%. Il n'y eut aucun décès parmi les malades opérés de résection segmentaire.
3. Chaque fois que cela a été possible, les localisations bilatérales ont été traitées par des exérèses bilatérales. Ces interventions bilatérales furent exécutées chez 14 malades ayant subi une exérèse segmentaire et
sont 3 qui avaient été traités par lobectomie. Dans cinq cas, les deux côtés furent opérés en une seule séance opératoire.

4. Il convient d'utiliser dans la phase pré- et post-opératoire des soins particuliers, pour éviter les réactions parfois hostiles de ces malades atteints de psychose. Ces conditions augmentent les difficultés d'utiliser cette catégorie d'interventions, mais elles ne sont pas suffisamment graves pour être une contre-indication.

5. En faisant appel au cours du traitement à la chirurgie d'exérèse, une quantité importante de malades mentaux atteints de tuberculose sont susceptibles d'être amenés à un état de santé qui ne nécessite plus leur isolement en tant que tuberculeux.

REFERENCES
8 Committee on Hospitals of the Group for the Advancement of Psychiatry: "Control and Treatment of Tuberculosis in Mental Hospitals," Report No. 24, Jan., 1954, p. 16.