Ambulatory Treatment of Pulmonary Tuberculosis*

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I. INTRODUCTION

Ambulatory treatment of tuberculosis with antituberculosis chemotherapy has increased tremendously in the last five years, while sanatorium treatment has declined. Chemotherapy is the most important therapeutic tool in the management of patients with tuberculosis in hospitals and out-patient clinics. It is still desirable to start most active cases with antituberculosis drugs in a sanatorium, even with the present out-patient care.

The tuberculosis program of the Boston Health Department has under ambulatory care 805 chemotherapy and 572 post-chemotherapy cases, for a total of 1377. The breakdown of the clinics: 626 patients in Chemotherapy Clinic (nonsurgical); 248 in Post-Chemo Clinic (nonsurgical); and 503 in Surgical Clinic (out-patient follow-up of all surgical procedures). At present, there is no patient under our care upon whom pneumothorax or pneumoperitoneum is performed.

The clinics are conducted by ten chest physicians. Education of the patients and proper supervision of their homes is performed by 76 staff nurses; occupational readjustment by one rehabilitation counselor and one social worker. Continuity of treatment is assured because of properly supervised nursing and social services, and excellent cooperation by the welfare agencies. Eighty per cent of the case load is on welfare status and must come to the clinics for periodic examination at specified times as requested by the Boston Welfare Department. The Boston Health Department has been designated as the only dispenser of free drugs for the treatment of tuberculosis.

Until 1956, it had been the policy of the Boston Health Department to treat only those patients who had been discharged from hospitals with medical approval. Since 44 per cent of the patients left against medical advice, and many were discharged for disciplinary reasons and were unable to return because of hospital rules prohibiting immediate readmission, these patients became a great and imposing health problem. Approximately 35 per cent of this group were problem alcoholics. It was, therefore, decided to treat all patients with chemotherapy who left the hospitals regardless of the type of discharge.

In 1955, Boston had 757 new cases reported, with a case rate of 92.7 per 100,000 and a death rate of 19.2 per 100,000, with 157 deaths. In the south end, a section of Boston which includes skid row, with a population of 54,000 there were 181 new cases with a case rate of 332.0 per 100,000 and a death rate of 86.1 per 100,000, with 46 deaths. These figures compare with a death rate of 9.1 per 100,000 in the United States, and a death rate of 9.4 per 100,000 in the Commonwealth of Massachusetts. Obviously, Boston's tuberculosis problem is more serious than the nation's as a whole, and even more serious than Massachusetts' problem.

In 1955, the city of Boston had the unenviable position of having the highest new case rate and death rate among all the cities of the United States of 500,000 population or greater. In addition, there was no menace law in the Commonwealth of Massachusetts that would enable public health officials to hospitalize cases of tuberculosis that were considered health menaces. Such a law was enacted four years later and was used for the first time by our Health Department in 1960.

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Evaluation of our statistical data was done in order to obtain an accurate appraisal of the out-patient method of treatment with a patient population which resists hospital care and advice. Statistics were obtained on the first 384 patients to attend the clinics since August 1, 1960. The patient sample includes the following:

- Chemotherapy Clinic: 150
- Post-Chemo Clinic: 105
- Surgical Clinic: 100
- Cycloserine Group: 14
- Prophylactic Chemotherapy: 15

All clinic patients were visited regularly by the visiting nurses. X-ray films of the chest were taken at one, two, and three month intervals. Sputum and gastric cultures were done regularly for acid-fast bacilli. Guinea pig inoculations were performed when necessary. We have been unable to test the urines for PAS and INH because of the shortage of staff nurses and physicians.

II. AIMS OF STUDY

It was the considered opinion of our chest physicians that these patients did well clinically on this ambulatory regimen. The purpose of this paper was to document this impression in a pilot study of this method of treatment.

We were concerned with the following questions relative to ambulatory treatment of tuberculosis, questions which others have raised as well:

1. Would the patient leave the hospital prematurely if drug treatment were available on an out-patient basis?
2. Would ambulatory treatment spread resistant organisms throughout the community?
3. Would the tuberculosis in these patients remain stable and non-infectious?

III. EVALUATION OF TREATMENT

**Epidemiology:** The patient sample was not randomly selected from the whole year’s admissions, but we believe it is representative of the general patient population. The findings cited are derived from the chemotherapy group, but are similar to the post-chemotherapy group.

Regarding race, the large majority of patients (79.3 per cent) are white; 17.3 per cent are colored and 3.3 per cent fall into other racial group categories. Some 72.7 per cent of our chemotherapy patients have been married, but only 40 per cent of the total group remained married, with 12.7 per cent widowed, 14.0 per cent separated, and 6.0 per cent divorced. The remainder (27.3 per cent) have never been married. Many of our patients live alone (40.7 per cent); another 34.7 per cent live with their spouses, and 17.3 per cent live with a relative. The average age for the men in our sample is 57 years and for women it is 41 years. The age range for the whole group is 20 to 80.

The current picture on alcohol drinking practices indicates that 40.7 per cent are abstainers and 59.3 per cent acknowledge drinking. Of the total group, 30 per cent of the males are excessive drinkers or suspected of excessive drinking. Half as many women (15 per cent) are in the same category.

Considering all of these factors together, the emerging picture of the patient coming to the Boston Health Department clinics is one of a person of advanced age, essentially beyond the most productive years, an isolated and deprived individual dependent upon the community, and a person who has been unable to achieve success in marriage. This general picture is most typical of our male patients, but our female patients also tend to approximate it.

**Previous Hospitalizations:** Ninety per cent of our patients have been hospitalized at one time or another for their tuberculosis previous to their attendance at the Out-Patient Department. Of the 135 patients previously hospitalized 76.3 per cent have been hospitalized once; 15.6 per cent twice; and 8.1 per cent three or more times. In their previous hospitalizations approximately 93 per cent have received some sort of drug treatment. Viewing the discharge picture, we find that of the previously hospital-
ized sample 54.8 per cent had approved discharges, 37.8 per cent disapproved discharges, and 6.7 per cent had a mixed discharge record.

Taken together, it can be seen that in the main our patients have had previous medical attention in hospitals for their tuberculosis which included drug treatment. It is also obvious from the large percentage of irregular hospital discharges on the patients have not been as cooperative as we would ideally hope. Nevertheless, these are the realities we have to cope with and if we are to avoid a community health menace, we have to recognize the social disorganization and instability of the patients, and treat them as best as we can on an out-patient basis.

Attendance: Despite the earlier noted characteristics of our sample, we have been pleasantly surprised to find that only 5.3 per cent are very irregular in their attendance. Attending regularly are 78.7 per cent of the patients and 9.3 per cent somewhat irregularly. On the average, the patients reported on have been in out-patient treatment for 16 months. Some 32 per cent of the group have been coming for treatment for two or more years. Thus, our clinical evaluation is based on a sizeable group whom we have seen over a relatively lengthy period of time.

Diagnosis: Table 1 summarizes in percentages the diagnosis of the patients. The largest number of cases (47.3 per cent) have moderately advanced tuberculosis. The number of minimal (26.7 per cent) and far advanced (21.9 per cent) cases are about equally distributed. It is interesting to note the sex differences in diagnostic status. There were fewer males (20.9 per cent) than females (42.5 per cent) with minimal disease. Correspondingly, there were more males than females in the moderate and far-advanced groups. Four per cent of the cases consisted of non-pulmonary disease, e.g. genito-urinary, bone, and adenitis.

Drug Treatment: Table 2 summarizes the prescribed drug treatment dosage, and Table 3, drug treatment combinations.

<table>
<thead>
<tr>
<th>TABLE 2—DRUG REGIMEN</th>
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<tr>
<td><strong>Drug</strong></td>
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<tr>
<td>Isoniazid</td>
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<tr>
<td>Pyridoxine</td>
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<tr>
<td>PAS Sodium</td>
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<tr>
<td>Streptomycin</td>
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<td>Cycloserine</td>
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<td>INH Prophylactic</td>
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<th>TABLE 3—DRUG COMBINATIONS</th>
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<tbody>
<tr>
<td><strong>Drugs</strong></td>
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<tr>
<td>PAS and INH</td>
</tr>
<tr>
<td>PAS, INH and Pyridoxine</td>
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<tr>
<td>INH alone</td>
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<tr>
<td>SM, PAS and INH</td>
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<tr>
<td>SM, PAS, INH, and Pyridoxine</td>
</tr>
<tr>
<td>SM, INH, Pyridoxine</td>
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<tr>
<td>Other combinations</td>
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</tbody>
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Pyrazinamide was not used because of the possibility of liver damage. Viomycin was not used because of possible renal complications, and kanamycin because of the possibility of deafness.

Isoniazid is the most important drug because of low toxicity, low cost, ease of administration, and proved effectiveness against active disease. All positive tuberculin reactors, under the age of six, without x-ray evidence of activity, are treated with INH 5-7 mg./kg. Recent tuberculin converters (approximately 1 year), including groups such as nurses and medical students, without x-ray evidence of activity, are given INH alone—300 mg. daily. INH is used alone and with PAS in minimal and moderately advanced tuberculosis in which there is no cavity demonstrated. PAS is recognized to produce hypersensitivity reactions to INH and streptomycin. PAS is a frequent sensitizer. There would be fewer patients failing to take their medication if
it consisted of INH alone. When PAS is added, with all its reactions, such as gastrointestinal disturbances, urticaria, etc., many patients will omit all drugs. Continued use of INH alone is recommended after completion of other regimens in special cases of far advanced inactive disease, cases of post-gastrectomy syndrome, pneumoconiosis, severe virus pneumonias, and diabetes mellitus. It is our experience that after the target point is achieved, even those patients with "open" cavities and negative cultures usually do well clinically if treated with isoniazid indefinitely. The work of Auerbach et al. supports our clinical impression.\(^4\)

Insofar as drug idiosyncrasies are concerned, we found 28.7 per cent had reactions of different types. Breaking this down it was found that 2.1 per cent had reactions to INH alone, 17.6 per cent to INH and PAS, and 9.0 per cent to streptomycin and PAS. Seventy per cent had no reactions and there was no information on 1.3 per cent.

It is of interest to note that a great deal of the PAS reactions were due to gastrointestinal complaints the first year of our treatment. Subsequent decrease of dosage to 7 to 9 gm. daily allowed the patient to tolerate the drug. In addition, some alcoholics with their multiple vitamin deficiencies experienced numbness and tingling of the extremities on INH, and by the additional use of pyridoxine and other vitamins, improved.

Results of Treatment: Our x-ray findings showed that 16.0 per cent definitely improved, 72 per cent remained stable and inactive, 7.3 per cent worsened, and 4.6 per cent were inconclusive because of lack of total information.

Results of sputum and gastric cultures showed that 60.7 per cent were always negative, 24.7 per cent changed from positive to negative, 1.5 per cent changed from negative to final positive, and we were unable to obtain conclusive information from 13.3 per cent of the patients because they could not raise sputum and did not come in for scheduled gastric aspirations. Resistant organisms were present in 1.3 per cent of the patients, no resistant organisms for 56.7 per cent of the patients, and resistance studies were not obtained from 42 per cent because the patients were improving clinically and were negative. Relapses were 3.9 per cent and were subsequently rehospitalized.

Table 4 shows the work tolerance for the chemotherapy and post-chemotherapy groups. It can be seen that 32.7 per cent of the patients in the chemotherapy group had four to eight hours daily work tolerance as compared to 72.6 per cent in the post-chemotherapy group. This indicates the rehabilitation results of ambulatory treatment.

<table>
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<tr>
<th>Hours of Work Tolerance</th>
<th>Chemotherapy per cent</th>
<th>Post-Chemotherapy per cent</th>
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<tbody>
<tr>
<td>None</td>
<td>64.7</td>
<td>24.2</td>
</tr>
<tr>
<td>2</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>4 - 8</td>
<td>32.7</td>
<td>72.6</td>
</tr>
<tr>
<td>No information</td>
<td>2.0</td>
<td>3.2</td>
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IV. Discussion

In our out-patient clinics, we have specialized in the treatment of patients who were irregularly discharged from tuberculosis sanatoria. Our own study showed that 80 per cent of the patients were on welfare and that 30 per cent of the men and 15 per cent of the women had excessive drinking problems. It is interesting to note that tentative figures compiled by the Division of Tuberculosis, Massachusetts Department of Public Health, for the year 1960, indicated that about 35 per cent of all admissions to all tuberculosis hospitals had some form of drink problem.\(^5\)

Despite the recalcitrance of this group and their environmental and personal hardships, they came for out-patient treatment rather regularly. They not only obtained drugs, but also received help with their social and economic problems from the social worker and rehabilitation counselor.

The abnormal home conditions and the need for social adjustment appeared to be
the determining factors for irregular discharge. These factors were similar to those discussed elsewhere as being responsible for patients leaving the hospitals against advice. The percentage of these patients who left hospitals against medical advice in 1955 before our program was initiated was 45 per cent and it decreased to 40.8 per cent in 1960. This indicates that the introduction of ambulatory treatment did not increase the irregular hospital discharge picture as some had expected.

The finding that 1.3 per cent of the patients had tubercle bacilli resistant to INH and streptomycin compares favorably with Chaves et al. the results of 2.0 per cent during the year 1955. Thus, it appears that our ambulatory treatment has not contributed to an increase in resistant organisms in our tuberculous patients.

The third question we were concerned with was whether tuberculosis in these patients remained stable and noninfectious. Our x-ray results revealed that 16 per cent definitely improved and 72 per cent remained stable and inactive. Infectiousness in these patients decreased as the sputum was intermittently positive and negative in 24.7 per cent and permanently positive in 13 per cent.

In general, the findings of this pilot study showed that ambulatory treatment with antituberculosis chemotherapy in the Boston Health Department led to clinical improvement. Comparison of daily work tolerance level for the chemotherapy and post-chemotherapy groups showed that with continued treatment there is progressive rehabilitation, as shown by an increase in work tolerance.

Since 1955, a tremendous improvement occurred in the tuberculosis problem in the city of Boston as shown by the statistics for 1960. For the city of Boston for the year 1960, there were 442 new cases with a case rate of 63.1 per cent per 100,000 and 76 deaths with a death rate of 10.9 per 100,000. For the south end, for the year 1960, with a population of 54,000, there were 106 new cases with a case rate of 193 per 100,000 and 17 deaths with a death rate of 31.5 per 100,000.

**Summary**

A pilot study of 384 patients, out of a total of 1377 patients under ambulatory treatment for pulmonary tuberculosis with chemotherapy by the tuberculosis program of the Boston Health Department, is described. Socio-economic factors are presented along with medical management.

Results have been good because of continuity of treatment, properly supervised nursing and social services, and excellent cooperation by the welfare agencies.

Relapses were present in only 3.9 per cent, resistant organisms in 1.3 per cent, x-ray improvement and stability in 88 per cent.

This ambulatory group, 80 per cent of whom were on welfare, and a sizeable percentage of whom were alcoholic, attended clinic regularly and improved clinically despite all the disadvantages of their environment.

**Resumen**

Se hizo un estudio piloto de 384 enfermos de un total de 1377 bajo tratamiento ambulatorio por tuberculosis con quimioterapia dentro del plan del Departamento de Salubridad de Boston. Los factores socio-económicos son presentados así como el tratamiento médico.

Los resultados han sido buenos por la continuidad del tratamiento, la vigilancia por el servicio social y de enfermeras, y la excelente cooperación de los organismos de beneficencia.

La recaidas fueron de solo 3.8 por ciento, la aparición de resistencia de los organismos fue de 1.3 por ciento y la mejoría radiológica y estabilización fue de 88 por ciento.

Este grupo ambulatorio del que el 80 por ciento eran casos de beneficencia y una parte importante de ellos eran alcohólicos, asistió a la clínica con regularidad y mejoró clínicamente a pesar de todas las desventajas del ambiente.

**Résumé**

L’auteur expose une étude-pilote de 384 malades sur un total de 1377 soumis à un traitement ambulatoire pour tuberculose pulmonaire avec chimiothérapie selon le programme antituberculeux de la Direction de la Santé de Boston. Les facteurs socio-économiques sont pris en considération parallèlement à l’attitude médicale.
Les résultats ont été bons par suite de la continuité du traitement, de la bonne surveillance des infirmières et des assistantes sociales, et de l'excellente collaboration des "welfare aencies."

Il n'y eut de rechutes que dans 3,9% des cas, des bacilles résistants dans 1,3% des cas, une amélioration radiologique et une stabilisation dans 88%.

Ce groupe de malades ambulatoires, dont 80% étaient en bon état, et dont un appréciable pourcentage étaient alcooliques, se firent surveiller en clinique régulièrement, et s'améliorèrent cliniquement, malgré tous les inconvénients de leur milieu social.

ZUSAMMENFASSUNG
Bericht über eine wegweisende Untersuchung an 384 von insgesamt 1377 Patienten in ambulanten Behandlung wegen Lungen-tuberkulose mit Chemotherapie durch die Tuberkulose-Abteilung des Bostoner Gesundheitsdienstes.

Wiedergabe von sozialen und wirtschaftlichen Faktoren gleichzeitig mit der internistischen Betreuung.

Die Ergebnisse waren gut dank der Kontinuität der Behandlung der korrekt geleiteten Pflage, der wirtschaftlichen Unterstützung und der ausgezeichneten Zusammenarbeit mit den Wohlfahrtsseinrichtungen.

Zu Rückfällen kam es in nur 3,9%, resistente Keime in 1,3%, röntgenlogische Besserung und Stabilisierung in 88%. Diese ambulante Behandlungsgruppe, von denen 80% Wohlfahrtsempfänger waren, darunter ein beträchtlicher Prozentsatz von Alkoholikern, suchte die Klinik regelmässig auf und erzielte klinische Besserung trotz aller Nachteile ihres Milieus.

REFERENCES
5 Personal Communication—Div. of Tuberculosis, Massachusetts Department of Public Health.

HYPERTENSION DUE TO UNILATERAL RENAL DISEASE
The prognosis for the cure of hypertension arising from unilateral renal disease by nephrectomy or renal arterial surgery as judged by published reports in the past four years is about 40 per cent of the cases operated upon. This improvement over previous results (26 per cent in 1956) is largely due to more careful selection of cases for surgery. Small, pyelonephritic kidneys and renal artery disease are the lesions most frequently found in successful cases. Renal artery disease in patients below the age of 40 years is almost always associated with a congenital arterial lesion, whereas, in patients over this age it is usually due to acquired atheroma and thrombosis. Radiographic estimation of renal size, intravenous pyelography, divided renal function studies, aortography and renal biopsy may all help in the diagnosis and assessment of renal hypertension amenable to surgery. The relative value of these investigations is discussed. Even where unilateral pyelonephritis or renal artery disease is discovered, it may be advisable to treat the patient with hypotensive drugs, rather than by operation. Surgical risks are high, particularly in older patients and the optimum chance of curing the hypertension is only 40 per cent. Surgical treatment may be the method of choice in young patients with severe hypertension, even if response to medical treatment is satisfactory. In the rare cases, refractory to medical treatment it may offer the only hope of relieving the hypertension. Hypertension of long duration may respond well to nephrectomy or to arterial surgery. A heavy albuminuria (up to 21 grams per 24 hours) may be present in cases with curable renal artery disease and may lead to a misdiagnosis of glomerulonephritis.