Directly Observed Therapy for Tuberculosis: The Harlem Hospital Experience, 1993

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ABSTRACT

Objectives. A directly observed therapy program was established at Harlem Hospital, New York, NY, in 1993 to promote high tuberculosis treatment completion rates.

Methods. The Harlem program used an on-site surrogate family model. Treatment completion rate, visit adherence rate, human immunodeficiency virus seroprevalence, and time to sputum culture conversion were assessed.

Results. Out of 145 enrolled patients with suspected and confirmed tuberculosis, 95 (92 confirmed and 3 suspected) continued treatment. The visit adherence rate was 91.1 ± 7.9%, with one patient (1%) lost to follow-up.

Conclusion. High rates of treatment completion and visit adherence were achieved because of unique program characteristics. Thus, directly observed therapy is advocated as a means of ensuring treatment completion. (*Am J Public Health.* 1996;86:1146–1149)

Introduction

Until recently tuberculosis in the United States was considered a disease of the past. However, its incidence in New York City over the past 15 years has risen markedly. From 17.2 cases per 100 000 persons in 1979, it rose to 49.8 cases in 1990.[1] In 1992, 17.1% of all cases of tuberculosis in the United States were reported from New York City,[2] which also reported 61.4% of cases of multidrug-resistant strains in the United States in the first quarter of 1991.[3,4] Studies have shown that resistance to antituberculosis drugs is associated with prior therapy.[3,4]

It is not currently possible to identify in advance nonadherent patients,[5,6] so targeting patients for directly observed therapy has not been feasible.[7] Accordingly, universal directly observed therapy has been advocated as the only guaranteed means of treatment completion,[8] and its benefits have been underscored by decreasing drug-resistance rates[9] and improving survival among human immunodeficiency virus (HIV)–infected patients with tuberculosis.[10]

New York City's Harlem community has one of the highest tuberculosis rates in the United States, with a case rate per 100 000 persons of 221.7 in 1992 compared with 10.5 nationwide.[11] Yet a disturbingly low rate of treatment completion (11%) was reported in a study of 178 tuberculosis patients discharged from Harlem Hospital in 1988.[12] Therefore, in February 1993, we established a directly observed therapy program at Harlem Hospital to promote high treatment completion rates.

Methods

Program Characteristics and Staff Training

The Harlem program is based on a surrogate family model.[13] Every effort is centered around developing a sense of family among the program staff and the patients. The program primarily uses on-site treatment supervision with home visits limited to homebound patients and to patients who missed visits.

Group activities (including daily hot meals, celebration of patient accomplishments, group trips, etc.) are emphasized to reinforce the family atmosphere. Patients receive transportation tokens, meal coupons, refreshments, toiletries, and clothes. A weekly patient support group also provides patients with encouragement and education.

The program staff includes a program manager, a medical director, an administrative assistant, a nurse, a health educator, and five therapy outreach workers. The staff has experience in community outreach, a positive attitude toward patients with tuberculosis and HIV, and a commitment to the control of tuberculosis. Several of the staff had themselves been treated for tuberculosis. In addition, the staff received training in the management of tuberculosis, impact of HIV on tuberculosis, outreach techniques, confidentiality, and communication skills. Staff motivation is emphasized through continuing education, group events, and the rewarding of excellence.

Patient Enrollment, Follow-Up, and Assessments

All patients initiated on antituberculous medications at Harlem Hospital from February 1, 1993, through November 30, 1993, were approached for recruitment into the directly observed therapy program through a daily review of mycobacteriology laboratory data and pharmacy records and participation in hospital rounds.

Hospitalized patients were visited daily by an outreach worker and, at

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discharge, were accompanied to the program site. The schedule of treatment visits was outlined, and the patients were escorted to their residence. Patients' tracking was initiated by their workers via a telephone call or a home visit immediately upon the patient's failure to appear for a treatment visit. Off-site treatment visits were also conducted for homebound patients. The New York City Bureau of Tuberculosis was informed within 24 hours if the program was unable to locate a patient.

Baseline and ongoing assessments included review of the locator information, treatment schedule, comorbid conditions, laboratory and radiological results, intolerance to medications, and response to therapy. All patients were offered HIV testing. Social assessments were regularly done to seek information on the patient's support system, income, housing situation, level of knowledge, and need for psychiatric or drug treatment.

Treatment Regimen and Program Outcomes

Patients were treated with recommended regimens according to drug susceptibility patterns.[14] The main outcome of interest was treatment completion, defined as the proportion of patients who completed the planned treatment course. Other outcomes included the visit adherence rate (the proportion of scheduled visits successfully completed within 24 hours), the time to sputum conversion, and the proportion of patients who underwent HIV testing.

Statistical Methods

The statistical package SAS, Version 6.04,[15] was used. Descriptive statistics were computed, including the mean and one standard deviation, and the median. The chi-squared test was used to measure the association of categorical data. Fisher's Exact Test was applied for small sample sizes. Means of continuous data were compared with the *t* test or the Wilcoxon rank-sum test for non-normal distribution. *P* values were based on two-tailed tests.

Results

Patient Characteristics

In the first 10 months of its operation, the Harlem directly observed therapy program enrolled 145 patients with confirmed or suspected tuberculosis. Five additional patients refused therapy. Of the 145 enrolled patients, 92 had confirmed tuberculosis; an additional 3 patients with negative cultures were continued based on clinician judgment.

Among the patients with culture-confirmed tuberculosis, 35 (38.0%) were women and 57 (62.0%) were men. Eighty-three patients (90.2%) were African American, five (5.4%) were Latino, and four (4.3%) were foreign born. The mean age was 42.7 ± 10.3 years (median = 40; range = 22 to 77). Injection drug use was reported by 46.2% of the patients; crack use, by 16.5%; alcohol, by 8.3%; and multiple substance use, by 28%. Homelessness was reported by 10.3%.

Table 1 presents the results of HIV testing among different age and sex groups. Among all enrolled patients, 57.9% were HIV infected. HIV testing was accomplished among 90 (97.8%) of the 92 patients with confirmed tuberculosis, and HIV was confirmed among 52.2%.

TABLE 1—HIV Infection among Tuberculosis Patients Enrolled in the Harlem Hospital Directly Observed Therapy Program, 1993

	All Patients (n = 145)					Patients with Confirmed Tuberculosis (n = 92)				
		HIV Tested[a]		HIV Infected			HIV Tested[a]		HIV Infected	
	No.	No.	%	No.	%	No.	No.	%	No.	%
Sex										
Women	57	54	94.7	37	68.5	35	33	94.3	20	60.6
Men	88	88	100.0	47	53.4	57	54	94.7	27	50.0
Age, y										
20–29	11	11	100.0	6	54.5	6	6	100.0	1	16.7
30–39	56	55	98.2	37	67.3	36	36	100.0	26	72.2
40–49	49	48	98.0	31	64.6	30	29	96.7	15	51.7
50–59	18	18	100.0	9	50.0	10	9	90.0	4	44.4
60+	11	10	90.9	1	10.0	7	7	100.0	1	14.3

Note. HIV = human immunodeficiency virus; DOT = directly observed therapy.
[a]Data were missing for three patients, all known to be HIV negative.

Clinical Characteristics

Of the 92 patients with confirmed tuberculosis, 83 (90.2%) had pulmonary tuberculosis and 9 (9.8%) had extrapulmonary tuberculosis. Extrapulmonary tuberculosis occurred among 6 HIV-infected and 3 HIV-uninfected patients (*P* = .50). Extrapulmonary sites included spinal TB (2 patients), pleural (2 patients), lymph node (3 patients), and peritoneum (2 patients).

Of the 95 patients treated for tuberculosis, 2 HIV-infected patients failed and 1 had a relapse.

Resistance Rate

Among the 92 patients with culture-confirmed tuberculosis, 70 (76.1%) had pansusceptible organisms and 22 (23.9%) were resistant to at least one drug. Among the 47 HIV-infected patients with confirmed tuberculosis, 9 (19.2%) had organisms resistant to at least one drug, compared with 10 (23.3%) of 43 patients without HIV infection (*P* = .43). Isoniazid monoresistance was detected among 17 (18.4%) of the patients. Nine (9.8%) of 92 patients had strains resistant to isoniazid and rifampin, 3 were HIV infected, and 6 were not. There was no significant difference in resistance rates by HIV status.

Patient Outcomes

Table 2 indicates the outcome for all enrolled patients. Fifty-three patients were culture negative; 50 were discharged from therapy. Ninety-five patients continued treatment for tuberculosis; of those, only one (1.1%) was lost to follow-up and 10 (10.5%) patients with confirmed tuberculosis, all of whom were HIV infected, died.

Table 3 compares treatment completers with noncompleters. The association between noncompletion, HIV infection, and injection drug use reflects that all deaths—the main reason for noncompletion—occurred among HIV-infected patients.

The mean visit adherence rate was 91.1 ± 7.9%; the median adherence rate was 92%. A visit adherence rate of 80% or greater was achieved among 94.6% of

TABLE 2—Outcome of All Patients (n = 145) Enrolled in the Harlem Hospital Directly Observed Therapy Program, 1993

	No.
Presumed tuberculous	53
Confirmed tuberculous	92
Total treated for tuberculosis[a]	95
Completers	84
Noncompleters	11
Expired	10
Lost to follow-up	1

Note. DOT = directly observed therapy.
[a]Includes three patients who were treated for tuberculosis based on strong clinical suspicion and their response to therapy.

TABLE 3—Characteristics of Completers and Noncompleters of the Harlem Hospital Directly Observed Therapy Program

	Completers (n = 84)	Noncompleters (n = 11)	*P*
Age, y	42 ± 10	38 ± 8	.22
Men	48 (57%)	7 (64%)	.12
HIV+	37 (44%)	10 (91%)	.003
Injection drug use	19 (23%)	8 (73%)	<.001
Crack	9 (11%)	2 (18%)	.25
Alcohol	7 (8%)	0	.40
Multidrug-resistant TB	8 (10%)	1 (9%)	.45
Extrapulmonary TB	9 (11%)	0	.31

Note. HIV = human immunodeficiency virus; TB = tuberculosis.

patients, and 57.9% had a rate of 90% or greater. Visit adherence was not associated with HIV status ($P = .49$).

Culture Conversion

The mean time to sputum culture conversion was 11.2 ± 8.5 weeks (range = 0.6 to 47.5). This did not differ significantly between HIV-infected (10.8 ± 8.3 weeks) and noninfected patients (11.7 ± 8.9 weeks) ($P = .62$). The time to culture conversion among those with pansusceptible organisms was 10.9 ± 8.5 weeks, compared with 12.9 ± 6.8 weeks among those with multidrug-resistant tuberculosis ($P = .52$).

Discussion

Through a multifaceted approach and a uniquely supportive environment, the Harlem directly observed therapy program achieved high completion rates among an inner-city patient population, with loss-to-follow-up rate of 1%. This was all the more remarkable given the high mobility and great social challenges of this population.[12,16]

We believe the success of the program was largely due to its design. Because the literature shows that patients who lack strong family support are less likely to adhere to treatment,[17,18] the first step in the development of the program was to confront the social isolation of our patients. For many of our patients, the program became the only family they had. In addition, the program addressed the patients' social and educational needs. Specially designed educational materials were provided, and referrals were made for supportive services.

The visit adherence rate could have also been adversely affected by HIV coinfection through a higher rate of adverse reactions to medications and added medical and social problems.[19] It is of interest, however, that HIV did not adversely affect visit adherence. The program staff made concerted efforts to visit the HIV-infected patients during hospitalizations and to escort them to HIV primary care visits.

Also crucial to a successful directly observed therapy program are the enthusiasm and concern of its staff. The patients identified with the staff, who served as their peers, a factor recognized to be important in treatment and prevention programs.[17,20,21] The program manager provided cohesion and was a prominent presence.

The on-site treatment model was a prominent feature of the Harlem directly observed therapy program. This allowed regular interactions between patients and staff members, and it eliminated the time-consuming need to locate members of this highly mobile group for off-site supervision of therapy.

The program also used various incentives and enablers to reinforce adherence to treatment.[21–23] These included celebration of birthdays, acknowledgment of perfect visit adherence rates, and presentation of certificates of achievement at treatment completers. These activities also promoted the surrogate family model and provided an opportunity for staff and patients to cultivate strong interpersonal ties.

The dramatic accomplishments described above in tuberculosis treatment completion and visit adherence rates in Harlem have been accomplished through a program of directly observed therapy developed to address specific patient and community needs. This model, when adjusted to local circumstances, may help to reduce the spread of tuberculosis and the emergence of resistant strains in other communities. □

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Mass Human Exposure to Rabies in New Hampshire: Exposures, Treatment, and Cost

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ABSTRACT

Objectives. This study assessed the rabies exposure and treatment that at least 665 persons in Concord, NH, received as a result of one proven rabid pet-store kitten in October 1994.

Methods. All treatment recipients were interviewed by person or phone.

Results. The median age of the treatment recipients was 14 years; 58% were female. The most common exposures were low risk (e.g., picking up, petting, nuzzling, or being scratched by a potentially rabid kitten). Local reactions to vaccine or immune globulin were reported by 76.5% of recipients, while 48.8% reported at least one systemic reaction. Cost for the biologicals was estimated at more than $1.1 million.

Conclusions. Because of the inadequacy of pet store records, the inconsistent application of treatment guidelines, and other factors, many people received postexposure treatment as a result of contacts that were unlikely to transmit rabies. The rates of local and systemic adverse reactions experienced were consistent with previous reports. (*Am J Public Health.* 1996;86:1149–1151)

Introduction

Although there have only been 25 human deaths from rabies in the United States since 1980, rabies remains a significant public health concern owing to continued human exposure from wild and domestic animals and the resultant costs of treatment. Postexposure treatment of previously unvaccinated persons involves administering either human diploid cell vaccine (HDCV) or rabies vaccine, adsorbed (RVA) with human rabies immune globulin (HRIG).[1] The overuse of postexposure treatment for insignificant exposures to potentially rabid animals has been recognized, and a national public health objective for the year 2000 is to reduce the number of such treatments by 50%.[2] In addition to the costs of postexposure treatment, local adverse reactions such as pain, erythema, and swelling or itching at the injection site have been reported among 19% to 74% of recipients. Systemic reactions, such as headache, nausea, abdominal pain, muscle aches, and dizziness, were reported among 5% to 40% of recipients.[1,3–6] Guillain-Barré syndrome has also been reported in at least three recipients.[7–9]

On October 22, 1994, a kitten from a pet store in Concord, NH, tested positive for rabies after a brief illness. As a result of potential exposure to this kitten or to other potentially rabid animals in the pet store, at least 665 persons received postexposure treatment. The previously reported record for treatment resulting from exposures to a single rabid animal was 70 persons; that treatment cost $105 790 and was associated with a rabid dog in California.[10] Only one situation, involving three rabid animals and a total of more than 1000 postexposure treatments in Switzerland in 1977, has ever reportedly resulted in more postexposure treatments (Dr Alexander I. Wandeler, personal communication). This study assessed the exposure histories and adverse reactions among individuals who received

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