The Journal of Emergency Medicine, Vol. 45, No. 5, pp. 658–665, 2013

0736-4679/$ - see front matter

ELSEVIER

http://dx.doi.org/10.1016/j.jemermed.2013.05.002

Original Contributions

PATIENT FACTORS ASSOCIATED WITH FAILURE TO DIAGNOSE TUBERCULOSIS IN THE EMERGENCY DEPARTMENT

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□ **Abstract—Background: Emergency department (ED) presentation of pulmonary tuberculosis (TB) can be highly atypical and an ED visit might be the only health care interaction for high-risk patients. Objective: Our objective was to identify patient factors associated with discharge without a diagnosis of TB during an infectious ED visit. Methods: The study population consisted of 150 patients from 2000 to 2009 with 190 infectious ED visits. Patients were initially identified from the state registry of confirmed TB cases and epidemiological characteristics were identified prospectively during case investigation. A retrospective review was performed for clinical characteristics of visits dichotomized according to whether the diagnosis of TB was made during the ED visit. Results: Analysis revealed that 77% of all infectious-patient visits ended with a diagnosis of TB. A TB diagnosis was more likely when patients presented with pulmonary or infectious chief complaints, endorsed cough, subjective fever, chills, dyspnea, previous TB infection, or had an abnormal lung examination or chest x-ray study. Patients were significantly less likely to be diagnosed with TB when they were unresponsive during clinical evaluation or when they reported a history of both homelessness and any substance abuse during the last year. In addition, these characteristics were independent predictors of nondiagnosis when traditional TB risk factors or abnormal vital signs were considered. Conclusions: Patients with atypical presentations, as well as those who were unresponsive or reported a history of homelessness and substance abuse, were at greater risk for nondiagnosis of TB during an infectious ED visit.** © 2013 Elsevier Inc.

□ **Keywords—tuberculosis; emergency department; public health; infectious disease; homeless; substance abuse**

INTRODUCTION

Tuberculosis (TB) is a highly infectious communicable disease and a major public health challenge. The organized campaign against TB in the United States (US) had achieved significant gains during the last 20 years, yet rates of TB infection appear to be stabilizing as the limits of current interventions are realized (1). Although an abundance of general information about TB incidence, clinical presentation, and associated risk factors is readily available from the Centers for Disease Control and Prevention (CDC), little is known about the specific subset that presents to the Emergency Department (ED) (2). This uncertainty can contribute to underdiagnosis of TB in the ED, placing the community at risk for infection from patients who were not identified during their ED visit.

Emergency physicians face unique challenges when evaluating ill patients, particularly when social or psychiatric co-diagnoses are likely. For example, the large homeless and substance-abusing or other at-risk populations in the ED have a much higher prevalence of certain diseases, such as human immunodeficiency virus (HIV),

RECEIVED: 13 December 2011; FINAL SUBMISSION RECEIVED: 25 January 2013;
ACCEPTED: 1 May 2013

TB, and mental health disorders, which can confound diagnosis (3,4). In addition, the ED visit might be the only health care encounter for certain groups at increased risk for TB, such as immigrants from TB-endemic nations (5,6). As patients presenting to the ED with acute pulmonary TB frequently lack the classic pulmonary and constitutional symptoms and associated physical examination findings of TB, identification and inclusion of relevant epidemiological factors is crucial for risk stratification and evaluation of the appropriateness of additional workup (7).

Determination of relevant risk factors enables targeted screening and disease identification, even in patients with atypical presentations. Certain health care environments, by virtue of being enriched for particular diseases or disease-associated risk factors in their target populations, have the opportunity to employ screening mechanisms that might not be warranted with lower-prevalence populations. This approach has been adopted for various crucial ED-based public health interventions, such as vaccination campaigns, HIV screening, and identification of patients who need referrals for substance abuse treatment (8–10). Previous efforts to identify TB patients in the ED have demonstrated program feasibility, while advocating a more targeted approach to patient identification because as many as 75% of ED patients have at least one risk factor for TB (11). In a busy ED, it is impractical to screen patients based on the current understanding of TB risk factors. This study was conducted utilizing a novel methodology to examine the clinical and epidemiological determinants of presentation to an ED for diagnosis of TB along with the factors associated with ED discharge without a diagnosis of TB during an infectious visit. The purpose of this study was to identify novel characteristics among the TB patients presenting to the ED that are associated with failure to diagnose TB.

METHODS

Study Design

This is a retrospective analysis of all infectious patients diagnosed with acute pulmonary TB who visited the study-site ED. Patients were identified through the statewide TB reporting system and prospectively collected demographic data resulting from the TB case investigations were included in this analysis. This study was approved by the Institutional Review Board of the Maricopa Integrated Health System.

Study Setting and Population

The Maricopa Medical Center ED has an annual census of approximately 60,000 patients and also houses an emergency medicine residency program. This ED serves the greater Phoenix community with a mission to the underserved, and also receives patients arriving by both air and ground ambulance and patients from county and state correctional facilities. It is located near both the geographic and population center of Maricopa County, a rapidly growing metropolitan area of approximately 3,700,000 (2006 data, the approximate midpoint for the study period). The case rate for TB in Arizona was 5.0/100,000 in 2006. The study population consists of patients residing in Maricopa County, Arizona who were reported to the Arizona Department of Health Services as verified cases of TB from 2000 to 2009.

Study Protocol

During the investigation of a reported case of TB, public health workers collected demographic data from the patient utilizing the CDC Report of Verified Case of Tuberculosis (RVCT) form. Individual RVCT records were entered into a secure database (Microsoft Access; Microsoft, Redmond, WA) by public health department staff in the course of their standard investigation of reported cases of TB, which was exported for records included in the study period into Microsoft Excel© (Microsoft). From this group, patients presenting to the ED at the study site were identified by name search of the electronic medical record and confirmed by date of birth.

Infectious ED visits were classified as described previously by others, with slight modification (7). An ED visit was classified as infectious if any of the following criteria were met: 1) a positive sputum culture for *Mycobacterium tuberculosis* was obtained during the subsequent hospital admission; 2) any visit after the positive culture collection but < 2 weeks after beginning antimycobacterial therapy; and 3) any visit within the 3 months before the eventual confirmation of acute pulmonary TB. The 3-month time period reflects current CDC guidelines for estimation of the minimum infectious period in a TB patient before diagnosis (12).

A senior emergency medicine resident familiar with the institution's clinical documentation system was trained in the study protocol with a brief information session and then obtained clinical data through chart review utilizing a standardized data collection form that was not piloted before implementation. This person was blinded to the specific aims of the study. Data sheets were then abstracted and entered into Excel™ (Microsoft) by a separate research associate who was also blinded to the specific aims of the study.

Chief complaints were taken from the triage notes and were classified as pulmonary (e.g., dyspnea, cough, hemoptysis), infectious but nonpulmonary (e.g., fever),