

Chest Radiography for Tuberculosis Screening: A Valuable Tool

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Although tuberculosis (TB) has been an effective treatment for over 50 years [1], it is still a major cause of morbidity and mortality worldwide, with an estimated 1–3 million unnecessary deaths occurring every year, particularly in developing countries [2].

The prompt diagnosis of TB is essential for public health infection control as well as for ensuring the appropriate therapy for infected patients. In the United States and Western Europe more than half of all active TB cases occur in foreign-born individuals [3]. Israel is a good example of this phenomenon, with the overall TB incidence having decreased in the last decade [4]. In contrast, the contribution of migrants from countries with a high TB prevalence continues to rise: 87% of all TB cases detected in Israel during the year 2010 were foreign-born individuals [5]. Screening of immigrants can be done in their country of origin shortly before their departure to the developed country of destination. This strategy is practiced by the U.S. government, which runs an overseas TB screening that includes medical examination and chest radiography (CXR) of U.S.-bound immigrants and refugees, coupled with follow-up evaluation after their arrival in the USA [3]. Similarly, Ethiopians who immigrated to Israel were screened in Ethiopia and followed for a year after their arrival [6]. Screening before

departure may prevent further transmission during air travel or after arrival in the host countries.

Illegal trans-border migration is a different immigration challenge that enforces rapid effective detection of active TB cases at the ports of entry. In this issue of *IMAJ*, Mor and co-authors [7] report the yield of screening CXR of undocumented migrants who arrived illegally to Israel from the Horn of Africa (Sudan, Eritrea, Ethiopia). These migrants were kept in a temporary detention center, where they were screened for TB by a short interview and CXR. Patients with radiological findings suggestive of TB underwent sputum analysis for smear microscopy and culture, and received complete treatment if needed. Mor et al. report that 11 active TB patients were identified from among the 62 CXRs with radiological findings suggestive of TB within the examined sample of 1078 CXRs (17.7% of all TB-suspicious CXRs), leading to a TB point-prevalence of 1000 cases per 100,000 migrants (1.0%). Questioning them regarding symptoms was non-contributory. The authors conclude that the policy of CXR, rather than interview, is both valid and cost effective. However, despite rigorous screening efforts, 132 of 100,000 migrants were diagnosed in the community within 3 years after their discharge from detention. This was most likely the result of reactivation of a latent TB infection; it is possible that some might have been new infections or were missed in the initial screening. Radiological findings of latent TB (i.e., apical fibrosis, scar) were included in the suspicious findings in this series, but the authors did not provide the number of CXRs with latent TB findings alone. This interesting follow-up with

regard to TB morbidity after discharge from detention highlights the need for further improvement of this screening program, since theoretically if it was as effective as expected and enforced on every migrant, there would have been no new TB cases among those discharged.

Many East African migrants (mostly illegal workers and refugees) eventually settled in central Israel. When they are hospitalized for unrelated conditions, such as trauma or giving birth, or when accompanying a family member during their hospitalization, there is increased risk of other hospitalized patients and health care workers being exposed. Our hospital (Tel Aviv Sourasky Medical Center) has faced several large-scale nosocomial exposures to TB from these allegedly asymptomatic patients with active TB. We intervened using the same tool that was used at the border, namely, CXR, which was obtained before the admission of every immigrant from high prevalence countries and immediately categorized by the radiologist as either having a “low probability” or “possible active TB.” Based on the radiographic findings, active TB was possible in 9.4% of subjects and confirmed in a quarter of them. Patients with possible TB were placed in airborne isolation and evaluated accordingly. We found this strategy effective, with significant reduction of nosocomial exposure events related to migrants with active TB [8].

In 1974 the World Health Organization (WHO) called for cessation of mass screening for TB using CXR, since compared to sputum smear CXR could not be used alone for establishing the diagnosis of TB and was too costly [9]. Recently, CXR, along with questioning about symptoms,

has been revived as one of the principal tools recommended by the WHO as a targeted approach in high risk populations [10]. The radiographic technology used today has greatly advanced, enabling the acquisition, at relatively low cost, of low radiation dose radiographs that have improved image quality and are rapid and easy to perform [11,12]. A systematic review cited by the WHO on the accuracy of symptoms and CXR when using positive bacteriological sputum smear as the standard of reference reveals that CXR screening has greater accuracy compared to symptom screening, with a sensitivity of 87% and specificity of 89% [13]. Compared to interviewing, it does not require trained medical staff and translators. Moreover, the radiation exposure is extremely low [14]. Cost-effectiveness analysis usually favors it [4,10]. However, persons with culture-confirmed TB can have a normal CXR with an overall rate of 1–9%, which is significantly higher among persons infected with human immunodeficient virus (HIV) than non-HIV-infected/unknown persons (22% vs. 5%) as reported in a recent series from the USA [15].

In addition, the interpretation of the CXR depends on its technical quality and on factors related to the reader. The reported intra- and inter-observer agreement varies widely between studies, from fair to good [16,17], and also depends on the experience of the reader, and the complexity of the interpretation code. Simplification of the reading code may improve agreement among readers [18,19]. We used the Center of Disease Control guidelines for evaluating CXR for active TB and found them useful and simple [20].

The other major initial screening alternative or supplement to CXR is the symptom questionnaire, which is also recommended by the WHO [10,13]. Mor et al. [7] traced the questionnaires of the migrants with confirmed TB but found them non-contributory. The symptom-

atology interview was ineffective due to language and culture barriers. In addition, due to the problematic civil status of these migrants [4], under-reporting of symptoms (like cough for example) that may put the local population at risk is expected.

In conclusion, the struggle for TB control is ongoing, with constant change along with the technological improvements and according to the specific characteristics of the screened groups. Currently CXR is a useful, valid and cost-effective tool for the initial screening for active TB in high risk populations. The experience gained in Israel with active screening of the special subgroup of undocumented migrants using CXR upon arrival at the border, as well as on entrance to closed public institutions like a hospital, strongly supports its continued use. Further search for the sources of new active TB patients presenting among the previously screened migrants and methods to prevent their spread into Israel is necessary.

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“The secret of getting ahead is getting started”

Mark Twain (1835-1910), American author and humorist. He wrote *The Adventures of Tom Sawyer* and its sequel, *Adventures of Huckleberry Finn*, the latter often called “the Great American Novel”