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RESEARCH PAPER

DIAGNOSIS OF TUBERCULOSIS IN A HIGH TB-HIV ENVIRONMENT USING MICROSCOPY AND CULTURE: THE EXAMPLE OF KAKIIKA PRISON-KYAMUGORANI, MBARARA, UGANDA

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ABSTRACT
There is growing concern about the high transmission of tuberculosis (TB) in prisons posing a risk to the outside community. There are high levels of overcrowding in the Uganda Prisons Service (UPS) with some prisons accommodating 4 times above their designed capacities. Our objective was to determine the prevalence of active pulmonary tuberculosis among prisoners. In addition we assessed the accuracy and reliability of TB smear microscopy using culture as gold standard and determined TB-HIV co-infection. Using a cross-sectional survey, we enrolled 140 male inmates in Kakiika prison-Kyamugorani, Mbarara. TB diagnosis was performed using direct sputum smear microscopy (DSSM) and culture for mycobacteria. HIV results were obtained from the clinical register with consent from the study participants. The prevalence of active pulmonary MTB was 2.9% based on culture findings. Microscopy had no smear positive results. However, there was no evidence that culture is different from microscopy in this sample (P= 0.13). The overall HIV prevalence was 15.7% and TB-HIV co-infection was 25%. TB prevalence in this prison was greater than that of other prisons in Uganda at 0.7% and the general population at 0.4%. This is because the social and economic conditions that increase vulnerability to TB also increase vulnerability to criminal behavior and imprisonment. In addition, the high TB burden is due to the high HIV prevalence in prisons. The study recommended the use of a more sensitive technique for TB diagnosis especially in settings where the level of transmission is presumed to be high.

Keywords: *Culture, Microscopy, Prisons, Tuberculosis, TB/HIV co-infection*

INTRODUCTION

Prisons constitute a high risk environment for acquisition of Mycobacterium tuberculosis (MTB) infection and the development of tuberculosis (TB) as compared to the general population due to overcrowding, closed living conditions, insufficient ventilation, generally low socio-economic status, poor nutrition and poor health of prison inmates (Noeske *et al*, 2011). Prisoners are often highly mobile circulating

within the prison system and they may be released after sometime. On top of this, the prisons' health service delivery system is inadequate in almost all developing countries and, particularly in Sub-Saharan Africa (SSA). To make matters worse, prison populations have high human immune deficiency virus (HIV) sero-prevalences (UNODC/WHO/UNAIDS, 2006).

Despite the fact that the global focus on TB control is on early diagnosis and treatment of people in high TB and TB/HIV-endemic countries, people in prisons are often neglected as reservoirs for TB transmission threatening those in the outside community (Valway *et al.*, 1991). TB in prison facilities is therefore a public health concern, not only affecting inmates, but also the wider community (Larouze, *et al.*, 2008). Generally, the prevalence of TB in Sub-Saharan African prisons is estimated to be 6 to 30 times higher than that in the general population (Noeske *et al.*, 2006).

As there are no studies conducted in the prisons of the Southwestern part of Uganda, this study was planned to investigate the prevalence of TB among prison inmates and assess the accuracy of the routinely used diagnostic technique, sputum smear microscopy.

METHODS

A cross sectional study was carried out at Kakiika prison, Kyamugorani, a government prison located in Mbarara District, Southwestern Uganda. At the time of the study it was accommodating 520 male inmates instead of the planed capacity of 144. The prison has a clinic for the prisoners and the prison staff. All prison inmates who had history of cough for at least a week were included in the study. Morning and spot sputum samples were collected from suspected inmates and transported to the Laboratory.

A short structured questionnaire was used to collect socio-demographic data. Laboratory diagnosis was carried out on two sputum samples from each prisoner to detect acid-alcohol fast bacilli (AAFBs) using a light emitting diode (LED) fluorescence microscopy. Of the two specimens collected from each participant, culture was done on one specimen using both mycobacteria growth indicator tube (MGIT) and Lowstein-Jensen (LJ) culture media. TB identification was carried out using TB Ag MPT64 Rapid.

The HIV status was obtained with consent from HIV counseling and testing register. The HIV status of the inmates had been identified serologically using HIV test strips soon after entry into the prison.

The study was conducted after ethical approval was obtained from the faculty research and ethics committee of Mbarara University of Science and Technology and after informed consent was obtained from study subjects.

RESULTS

The overall prevalence of pulmonary tuberculosis among prisoners in Kakiika prison, Kyamugorani, Mbarara was 2.9% (4 cases of active TB among the 140 inmates evaluated). These four were detected by culture on both liquid and solid media. However none of these four was positive by the fluorescence microscopy. Statistically, there was no evidence that culture was different from microscopy in this sample (P= 0.13). In the current study, a total of 22 (15.7%) inmates were found to be HIV infected amongst whom 1 (4.5%) had TB co-infection. The prevalence of HIV infection in the TB infected inmates was calculated to be 25%. The prevalence of pulmonary TB in this prison was high in the age group of 16-25 (young adults) with a frequency of 2 and equally distributed in two age groups between 26 and 45 years (Fig. 1).

DISCUSSION

TB prevalence in this prison was greater than that of other prisons in Uganda and the general population at 0.7% and 0.4% respectively (UPS/UNODC, 2008). The findings of the pre-

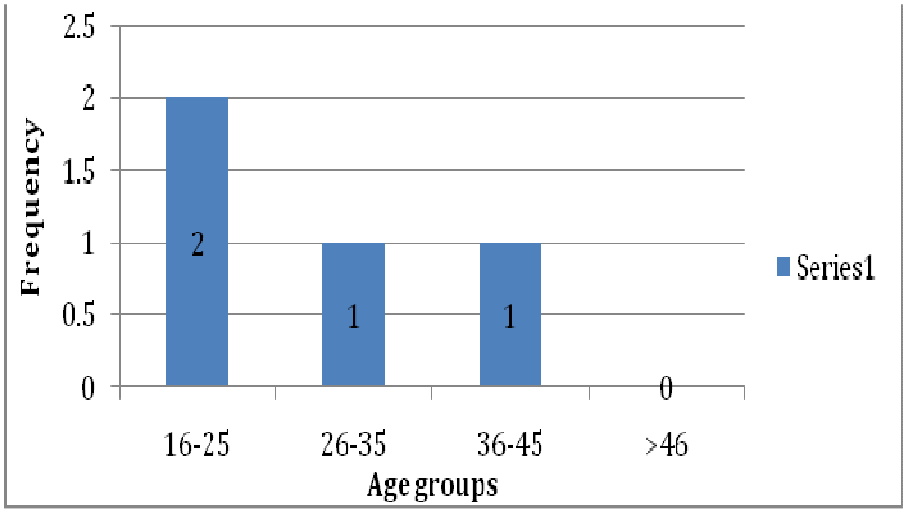

Fig. 1: **TB prevalence by age group (16 - <26), (26 - < 36), (36- 46), (> 46)**

sent study correlated with results from other studies done in other parts of Africa. For instance, in the central prison of Douala, Cameroon, the prevalence of pulmonary tuberculosis was reported to be 3.5% and the HIV seroprevalence in inmates with pulmonary tuberculosis amounted to 25% (Noeske, *et al.*, 2006). A cross-sectional cell-to-cell survey conducted in 18 out of 22 prisons in Malawi to determine the period the prevalence of smear-positive pulmonary tuberculosis (PTB) was reported to be 0.7%, lower than the current study (Banda, *et al.*, 2009). The prevalence of smear positive tuberculosis in the prison population of Bouaké prison camp, Ivory Coast was relatively high (5.8%). Human immunodeficiency virus (HIV) infection was observed in 30% of the TB cases (Koffi *et al.*, 1997).

Co-infection with HIV in prisoners with active or latent TB is a well-documented phenomenon (WHO, 2007) and this presents considerable diagnostic and management challenges to prison health systems. The HIV prevalence among the TB cases in the current study was comparable to reports from Tanzanian prisoners that showed 26% TB/HIV co-infection (Marco *et al*., 1998) while it was lower than the Malawian prisoners who had HIV in up to 73% of the TB cases (Rutta *et al*., 2001).

The standard method of TB diagnosis is AFB direct microscopy of sputum smears. The sensitivity of AFB microscopy of sputa specimens for the diagnosis of TB is variable, and may be as low as 25%. Even with the use of centrifugation to concentrate the bacteria and fluorescent microscopy to increase sensitivity, the sensitivity remained approximately 65%.

Age is also an important predictor of risk. Risk of active TB in our study peaked in the 20s, as in other studies (Donald, 2004).

CONCLUSION

This study suggested a risk of an active transmission and development of TB disease in such a setting. Use of culture to improve TB diagnosis should be implemented especially in settings where the level of transmission is presumed to

be high. More specific, accurate and fast TB diagnostics such as the Xpert MTB/RIF diagnostic technique should also be assessed in this population and be adopted for TB screening. This is because Xpert MTB/RIF is more sensitive than routine smear microscopy and results are ready in one day unlike culture, which is the gold standard for TB diagnosis.

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