

Prevalence of pulmonary tuberculosis in Karachi juvenile jail, Pakistan

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معدل انتشار السل الرئوي في سجن لليافعين في كراتشي، باكستان
شاه أشرف علي، ميرزا آصف، كاكار غلام نبي، قطب الدين

الخلاصة: يتعرض المساجين لخطر أكثر من غيرهم للإصابة بالسل، وقد درسنا 386 مسجوناً، وسطي العمر بينهم 17.7 عاماً في سجن كراتشي لليافعين لتحديد معدل انتشار السل بينهم وعوامل الخطر المحتملة للعدوى بالسل. وقد وجد أن معدل انتشار السل بين المسجونين 3.9% وهو أعلى بشكل واضح من المعدل المقدر لانتشار السل بين عامة السكان في باكستان (1.1%). وقد كان وجود سوابق الإصابة بالسل في العائلة من عوامل الاختطار الهامة، كما لوحظ ضعف امتثال المرضى الذين شخصت إصابتهم بالسل سابقاً. وتوضح دراستنا مدى سرعة تأثر المساجين بالسل بسبب وجود حالات شديدة العدوى مع الظروف البيئية مثل الازدحام وسوء التهوية. وتشير هذه الدراسة بوضوح إلى الحاجة لبرامج فعالة للمعالجة في السجون وفي المجتمع بشكل عام.

ABSTRACT Jail inmates may be at increased risk of contracting tuberculosis (TB). We studied 386 detainees (mean age 17.7 years) in Karachi juvenile jail to determine the prevalence of TB and possible risk factors for contracting TB. We found a 3.9% prevalence of TB among the inmates, significantly higher than the estimated 1.1% prevalence in the general population of Pakistan. Positive family history of TB was a significant risk factor for TB. Poor adherence of previously diagnosed patients to anti-TB treatment was found. Our study highlights the vulnerability of inmates to TB owing to the presence of highly infectious cases, along with environmental conditions such as overcrowding and poor ventilation. This study strongly indicates the need for an effective treatment programme in the jails as well in the general community.

Prévalence de la tuberculose pulmonaire dans le centre de détention pour mineurs de Karachi (Pakistan)

RESUME Les détenus peuvent être exposés à un plus grand risque de contracter la tuberculose. Nous avons étudié 386 détenus (âge moyen 17,7 ans) dans le centre de détention pour mineurs de Karachi afin de déterminer la prévalence de la tuberculose et les facteurs de risque éventuels pour contracter la tuberculose. Nous avons trouvé que la prévalence de la tuberculose parmi les détenus était de 3,9 %, significativement plus élevée que la prévalence dans la population générale du Pakistan estimée à 1,1 %. Les antécédents familiaux positifs de tuberculose étaient un facteur de risque important pour la tuberculose. Nous avons constaté que les patients diagnostiqués antérieurement ne suivaient pas bien le traitement antituberculeux prescrit. Notre étude souligne la vulnérabilité des détenus face à la tuberculose en raison de la présence de cas très infectieux et des conditions environnementales comme la promiscuité et une mauvaise aération. Cette étude souligne fortement la nécessité d'un programme de traitement efficace dans les centres de détention ainsi que dans l'ensemble de la communauté.

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Introduction

Available data around the globe suggest that jail inmates are at increased risk of contracting pulmonary tuberculosis (TB) [1–3]. Factors such as overcrowding, malnutrition and limited access to health care services put prison inmates at high risk. Children and adolescents are even more vulnerable. There is increasing recognition that the high risk of TB in settings such as prisons, remand centres, police stations, detention centres for asylum seekers, penal colonies, and prisoner-of-war camps poses a problem for those imprisoned and for the wider society [2]. A study conducted in Mwanza, Tanzania, revealed that 40.7% of the prisoners studied had smear-positive TB [3].

Pakistan contributes 43% of the disease burden in the Eastern Mediterranean Region of the World Health Organization, and thus ranks sixth among the countries with the highest burden of disease for TB [4], but unfortunately there are limited data available regarding prevalence of TB among jail inmates in general, and juvenile detainees in particular. Through this study we proposed to determine the prevalence of pulmonary TB and the associated risk factors among juvenile detainees in Karachi in order to complement national and international efforts to control TB in the community in general and in prisoners in particular. The city of Karachi was selected for the study because it is the most populous city of the country, with a population of more than 10 million, and has residents from all parts of the country. The juvenile prison in Karachi reflects the same characteristics as the city, housing prisoners from all parts of the country and even from neighbouring countries.

The proposal for this study was approved by the Ethical Research Committee of Sindh AIDS control programme, Kara-

chi, Pakistan. Study participants were recruited after obtaining informed written consent and all study participants diagnosed with TB were provided with free treatment through the government of Sindh directly observed treatment short course (DOTS) programme.

Methods

A cross-sectional study was conducted in the juvenile prison in Karachi during the calendar year 2002. The medical officer of the prison and technicians were trained in laboratory techniques, clinical diagnosis and management of TB with the DOTS strategy at Ojha Institute of Chest Diseases, Karachi, for 2 weeks. The technician and the prison dispenser also received training in sputum microscopy at the Institute of Chest Diseases.

All participants were interviewed using a structured questionnaire which included questions on sociodemographic characteristics, past and family history of TB, and other risk factors. They were then clinically examined by the medical officer.

Prisoners were suspected of having TB on the grounds of clinical findings, past history of diagnosis of TB infection and family history of the illness.

Individuals identified as suspected TB cases were investigated for acid-fast bacilli (AFB) in their sputum. A TB suspect was defined as any person who presented with symptoms or signs suggestive of TB, in particular cough of long duration (more than 2 weeks) [5].

Three specimens of sputum were then collected from the suspects and examined by microscopy using the Ziehl–Neelson method of staining. The first specimen from a suspected inmate was obtained on the first day of examination after coughing and clearing the back of throat (1st spot).

The inmates were given a container to bring the second (overnight) specimen next day. The third and final specimen was collected on the second day (2nd spot).

Individuals with at least 2 positive smear results were diagnosed as sputum smear-positive active pulmonary TB cases, and were registered for the DOTS programme with Sindh TB control programme.

Diagnostic criteria for sputum smear-negative pulmonary TB cases were: at least 3 sputum specimens negative for AFB, no response to a course of broad-spectrum antibiotics and a decision by a clinician to treat with a full course of anti-TB chemotherapy.

Neither X-ray nor culture facilities were available in the jail and were therefore not included in the case definition.

This programme was carried out under the auspices of the government of Sindh with the assistance of the World Health Organization. Efforts were also made to transfer patients to the nearest DOTS programme after their release from prison.

Risk factors for contracting TB infection in prison were studied by random selection of 60 controls among non-suspect individuals and comparing them to the 15 cases.

The Z-test was used to compare the prevalence of TB in prisoners and in the general population. Univariate and multivariate analyses of risk factors for contracting TB in prisons was performed by calculating the odds ratio and 95% confidence interval. Data management was carried out using *Epi-Info*, version 6.04 and *SPSS*, version 10.0 statistical packages.

Results

We enrolled 386 single male juvenile detainees in the study. Mean age \pm SE was 17.7 \pm

1.3 years (range 15–23 years) though the official age limit for juvenile jail inmates is 18 years. Pakistanis accounted for 357 (92.5%) detainees. The rest were from India or Myanmar (Table 1). Most (87.9) were residents of Karachi. The average family size for the detainees was 8 (range 1–25). They were all imprisoned in 10 barracks, averaging 35.0 \pm 11.7 prisoners per barrack (range 10–59 prisoners).

In 14.7% (53) of cases, the father of the inmate was dead. In the rest of the cases 25.4% (98) of the fathers were labourers, 18.9% (73) self-employed, 12.7% (49) in public or private service, 24.4% (94) had other professions and 4.9% (19) were unemployed. Of the inmates themselves, 1.0% (4) were unemployed, 47.7% (184) were labourers, 17.1% (66) were self-employed, 13.2% (51) were in service, and the remaining 21.0% (81) had other professions. About 60% (228) of participants were illiterate, and none had higher secondary school or above education (Table 1).

The period of imprisonment was 1–6 months for 52.3% (202) of jail inmates, 6–12 months for 20.2% (78), more than 1 year for 16.3% (63) and less than 1 month for 11.1% (43). In addition, 12.7% (49) of inmates had a previous record of imprisonment. We found that 42.6% (164) of jail inmates were smokers and 21.5% (83) were drug users. Among the drug users, 83.6% were inhaling the drugs and only 1.4% had a history of injecting (Table 2).

Nine jail inmates had previously been diagnosed with TB; 3 had received the full 6 months treatment, 2 did not receive any treatment, and 4 received irregular treatment, but all of them were symptomatic on clinical examination during our study (Table 3). One of the 3 cases who had received 6 months treatment was also positive for AFB. All had been symptomatic for TB for more than a month. Among the 6 patients who received no or irregular treatment, 3

Table 1 Sociodemographic characteristics of juvenile jail detainees (n = 386)

Characteristic	No.	%
Age		
15–16 years	58	15.0
17–18 years	239	61.9
18 + years	89	23.1
Education		
Uneducated	228	59.1
Primary	79	20.5
Secondary	79	20.5
Nationality		
Pakistani ^a	357	92.5
Non-Pakistani	29	7.5
Residence		
Karachi	320	82.9
Outside Karachi	66	17.1
Father's occupation		
Died	53	13.7
Unemployed	19	4.9
Labourer	98	25.4
Government service	23	6.0
Private service	26	6.7
Self employed/business	73	18.9
Driver	29	7.5
Farmer	26	6.7
Fisherman	31	8.0
Other	8	2.2
Detainee's occupation		
Unemployed	4	1.0
Labourer	184	47.7
Service	51	13.2
Self employed/business	66	17.1
Fisherman	38	9.8
Student	30	7.8
Other	13	3.4
Family members in the household		
1–4	50	13.0
5–8	187	48.4
9–12	123	31.9
> 12	26	6.7

^aArea of origin: Karachi (82.9%); interior Sindh (1.3%); Punjab (4.1%); North-West Frontier province (2.6%); Balochistan (1.3%); northern areas (0.3%).
s = standard deviation.

complained of cough, fever, weight loss and haemoptysis. One had a history of fever and cough while the other 2 were suffering from chronic cough.

Forty-eight (12.4%) prisoners had been suffering from 1 or more symptoms (cough, fever, weight loss and haemoptysis) for more than 1 month (Table 4).

Seventy-three jail inmates (18.9%) were initially suspected for TB on the basis of clinical symptoms, family history and past diagnosis of TB. Of these, 48 had clinical signs and symptoms suggestive of TB, 33 had a family history of TB, while 8 had

Table 2 Risk factors for tuberculosis (TB) among juvenile jail detainees (n = 386)

Characteristic	No.	%
Duration of stay in jail		
< 1 month	43	11.1
1–6 months	202	52.3
> 6–12 months	78	20.2
> 1 year	63	16.3
Past history of imprisonment		
Yes	49	12.7
No	337	87.3
Family history of TB		
Yes	29	7.5
No	347	89.9
Don't know	10	2.6
Smoking history		
Smoker	164	42.6
Non-smoker	222	57.5
History of drug use		
Drug user	83	21.5
Non-drug user	303	78.5
Method of drug use		
Inhalation	61	15.8
Ingestion	9	2.3
Inhalation + ingestion	2	0.5
Inhalation + ingestion + injection	1	0.3
Didn't reply	10	2.6

Table 3 Aspects of previous treatment for tuberculosis (TB) among juvenile jail detainees (n = 386)

Characteristic	No.	%
<i>History of TB</i>		
Yes	9	2.3
No	377	97.7
<i>History of treatment for TB</i>		
Yes	7	1.8
No	2	0.5
<i>Course of treatment</i>		
Completed	3	0.8
Not completed	4	1.0
<i>Duration of incomplete treatment (months)</i>		
3	2	0.5
3.5	1	0.3
5	1	0.3
<i>Duration of interruption to treatment (months)</i>		
< 1	1	0.3
≥ 1	3	0.8

symptoms suggestive of TB in addition to family history of the disease.

For the AFB smear test, of 73 suspected cases, in 19 (26.0%) cases we were able to obtain sputum while the rest had saliva and blood in their specimen but no sputum. Of the 19 whose sputum was tested, 5 (26.3%) showed AFB on microscopy.

On the basis of the AFB smear results, previous diagnosis of the disease and signs and symptoms strongly suggestive of TB, 15 (3.9%) jail inmates were identified as suffering from TB and selected for the DOTS regimen. Inmates who had tested negative for AFB and had no history of earlier diagnosis were selected for the DOTS regimen mainly on the clinical judgement of the treating physician.

Table 5 shows the risk factors for contracting TB. There was elevated risk

among patients who were illiterate, Karachi residents, those whose father was unemployed, smokers or drug users; the results were not, however, statistically significant. However, there was a 7-fold increased risk among those reporting a family history of TB, and this was statistically significant.

Table 4 Rates and clinical features of tuberculosis (TB) infection among juvenile jail detainees (n = 386)

Characteristic	No.	%
<i>Registered for DOTS</i>	15	3.9
<i>Symptoms suggestive of TB</i>		
Cough > 4 weeks	20	5.2
Cough + fever > 4 weeks	10	2.6
Cough + fever > 4 weeks + weight loss	1	0.3
Cough + fever > 4 weeks + weight loss + haemoptysis	4	1.0
Cough + fever > 4 weeks + haemoptysis	1	0.3
Cough > 4 weeks + haemoptysis	2	0.5
Fever > 4 weeks	4	1.0
Weight loss + haemoptysis	1	0.3
Haemoptysis	5	1.3
<i>Sputum smear microscopy</i>		
<i>Specimen 1</i>		
Positive sputum	1	0.3
Negative sputum	17	4.4
Fresh blood	5	1.3
Saliva	50	13.0
<i>Specimen 2</i>		
Positive sputum	3	0.8
Negative sputum	16	4.1
Fresh blood	4	1.0
Saliva	50	13.0
<i>Specimen 3</i>		
Positive sputum	3	0.8
Negative sputum	16	4.1
Fresh blood	4	1.0
Saliva	50	13.0

Table 5 Risk factors for contracting tuberculosis (TB) infection in prison

Risk factor	Cases (n = 15)		Controls (n = 60)		Crude OR	95% CI	Adjusted OR	95% CI
	No.	%	No.	%				
<i>Education</i>								
Uneducated	10	66.7	36	60.0	1.33	0.35–5.24	1.33	0.36–5.60
Educated	5	33.3	24	40.0				
<i>Nationality</i>								
Pakistani	15	100	57	95.0	ND		ND	
Non-Pakistani	0	0	3	5.0				
<i>Residence</i>								
Karachi	14	93.3	52	86.7	2.15	0.23–50.6	2.14	0.25–102.3
Outside Karachi	1	6.7	8	13.3				
<i>Father's occupation</i>								
Died or unemployed	3	20.0	7	11.7	1.89	0.23–10.20	1.87	0.27–9.84
Employed	12	80.0	53	88.3				
<i>Number of family members in household</i>								
> 6	9	60.0	45	75.0	0.50	0.13–1.94	0.51	0.13–2.03
6 or less	6	40.0	15	25.0				
<i>Duration of stay in jail (months)</i>								
> 6	5	33.3	18	30.0	1.17	0.29–4.53	1.16	0.27–4.42
≤ 6	10	66.7	42	70.0				
<i>Past history of imprisonment</i>								
Yes	0	0	11	18.3	ND		ND	
No	15	100	49	81.7				
<i>Family history of TB</i>								
Yes	4	30.8	3	5.2	8.15	1.22–58.59	7.78	1.12–62.48 ^a
No or don't know	9	69.2	55	94.8				
<i>Smoking history</i>								
Yes	9	60.0	29	48.3	1.60	0.44–5.96	1.59	0.44–5.37
No	6	40.0	31	51.7				
<i>History of drug use</i>								
Yes	7	46.7	20	33.3	1.75	0.48–6.42	1.74	0.43–6.40
No	8	53.3	40	66.7				

OR = odds ratio.

CI = confidence interval.

^aYates corrected chi-squared = 5.21; Fisher exact P-value = 0.018.

ND = not determined.

Discussion

We found a 3.9% (15/386) prevalence of TB among the prisoners in Karachi juvenile

jail. This high prevalence of the disease in the inmate population may be related to overcrowding, poor ventilation and malnu-

trition in the jail environment. Furthermore, poor health care facilities jeopardize adequate treatment of the infection and could possibly result in the development of resistant strains in prisons.

Our study highlights one of the important aspects of *M. tuberculosis* infection in the community—a high rate of poor compliance and the possible emergence of multidrug resistant strains. Of 9 cases diagnosed with TB, 4 had received partial treatment and only 3 had completed their treatment. But all these cases, irrespective of whether they received treatment or not, were symptomatic. The detection of 5 AFB positive cases during our study suggests a high vulnerability of jail inmates to TB. The presence of AFB in the sputum suggests a high level of infectivity. Coughing, overcrowding and poor ventilation produce conditions which allow the bacteria which cause TB to remain viable for a long time, thus exposing everyone who comes into the barracks, whether a prisoner, member of staff, visitor or an investigator, to infection.

Family history was identified as a major risk factor for TB, with 33 (8.5%) prisoners reporting history of TB in the family. Of these, 8 (24%) were initially suspected of having TB on the basis of signs and symptoms. Later, 4 (50%) were selected for the DOTS programme; 2 of them were AFB-positive and 2 had a history of cough, fever, and haemoptysis for more than 1 month.

Poverty was stated as a major reason for not receiving treatment following diagnosis in 14% (17) of previously diagnosed, but not treated, prisoners. Similarly, in 14% (17) ignorance of the consequences of the disease may have been the reason, as those prisoners failed to give any explanation for not receiving treatment. Poor compliance to the anti-TB regimen appeared to be re-

sponsible for treatment failure in 42% (37) of cases, circumstances which may favour the emergence of multidrug resistance.

Our study identified a limitation in using the AFB test as the sole criterion for diagnosing TB infection. It certainly improves the specificity of the diagnosis, but at the cost of poor sensitivity. No AFB-positive prisoner was found asymptomatic, suggesting no false positive diagnosis, using this criterion. Many patients suffering from TB infection were, nevertheless, AFB-negative, suggesting the possibility of some false negative results, perhaps due to undetectable levels of AFB in the smears, or poor quality of specimen collection, staining and microscopy. This may be related to indiscriminate use of antibiotics, including antimycobacterial drugs.

Another limitation noted in the study was the language barrier. There were prisoners from the whole of south-east Asia, speaking different languages and dialects. This may be the reason that compliance of the prisoners with regard to sputum collection was poor, even among the prisoners who were complaining of a productive cough. Difficulty was also noted in taking the clinical history of the patients. It was also noted that 2 weeks training of technicians with regard to AFB staining and microscopy may not be sufficient to carry out these procedures independently.

In our study, owing to the absence of radiological support and culture facilities in the jail environment, the treating physician was left with no option but to use his clinical judgement and start the DOTS regimen for 7 previously diagnosed patients who had symptoms and for 3 clinically suspect cases who tested negative for AFB and had no history of the disease. For the effective and rational use of DOTS in prisons, it may be appropriate to have facilities for radiog-

raphy and microbial culture in clinically suspected but AFB smear-negative cases before making any judgement regarding treatment.

The finding of this study that jail inmates are at increased risk for TB infection is in line with earlier studies conducted in prisons in other parts of the world [1–3].

It is suggested that a TB control programme be introduced in the jail environment, ensuring regular screening of prisoners for TB infection and the early and effective management of cases. Special attention should be given to those reporting a positive family history of TB as they have proved to be more likely to be infected. There is also a need to ensure that all prisoners who were receiving DOTS during their prison term continue to do so after their release until the course of treatment is

completed. Overcrowding and poor sanitation and ventilation provide *M. tuberculosis* an opportunity to persist for long periods and infect others. There is a need to improve ventilation, sanitation and overall living conditions in the jail environment.

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