The rate of tuberculin reactivity in health care workers a cross sectional descriptive study

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ABSTRACT

Background:" Tuberculosis (TB) is one of the oldest diseases known to affect humans, it caused by bacteria belonging to *Mycobacterium Tuberculosis (M.TB)* complex". *M.TB* is commonly transmitted from a TB infected person to other person by "droplet nuclei which are aerosolized by coughing, sneezing or speaking. Health care workers (HCWs) are exposed to a variety of infections, including TB, as they perform their job responsibilities". "The standard test for detecting latent TB infection (LTBI) is tuberculin skin test (TST) (Mantoux test) using purified protein derivatives (PPD) of *M.TB*."

Objectives: The aim is to study the rate of TB transmission from patients with active disease to the HCWs, and also studying the relation of deferent variables to the transmission risk including (Gender, Vaccination, and Duration of contact or work duration).

Methods: Cross sectional descriptive study done in Al Diwaneya teaching hospital (medical department) between September and December 2017.122 HCWs were included in this study their age ranging between 24-40 years mean 32year,100 (82%) were male and 22 (18%) female.

"0.1 ml (5) tuberculin units had been injected intradermally to the volar surface of forearm to be seen within 48-72hours".The test was considered positive if (>=10mm induration) developed .

Results: The study shows the rate of tuberculin reactivity among HCWs 24.6% (30/122) a significant relationship between duration of work in hospital and tuberculin reactivity among HCWs. Word nursing staff

>10years work duration shows the higher rate (43.8%) followed by emergency nursing staff (30.8%) and then senior house officer (S.H.O) (20.8%), service workers shows (15%) while all joiner house officers included in the study shows (0%) with <2years work duration.

Conclusion: HCWs have high rate of LTBI. Their positivety correlated With the duration of their jobs. this should draw attention for better isolation for patients with TB to minimize the risk of transmission to the HCWs.

Keywords: Mycobacterium Tuberculosis; Health Care Workers; Tuberculin Skin Test; Latent Tuberculosis infection

INTRODUCTION

Tuberculosis (TB) is one of the oldest diseases known to affect humans; it caused by bacteria belonging to Mycobacterium *Tuberculosis (M.TB)* complex, the disease usually affects the lungs although in up to one third of cases other organs are involved.[1,2]

"It's a curable disease if treated properly if untreated the disease can be fatal within 5 years in more than half cases".

Tuberculosis is a significant occupational problem among health workers (HCWs) in Low and middle income countries."More than 3.8 million new cases of TB in all forms were reported to World Health Organization (WHO) in 2001(90%) of them were in the developing countries 1.8 million death from TB occur in 2000 (98%) in developing countries" .[2,3,4]

"Mycobacterium Tuberculosis is a rod shaped non-spore forming thin aerobic bacterium are often neutral on gram staining however once stained with fuchsin dyes the bacilli cannot be decolorized by acid alcohol a characteristic justifying their classification as acid-fast bacilli". "The organism is most commonly transmitted from a patient with infectious pulmonary TB to other persons by droplet nuclei which are aerosolized by coughing, sneezing or speaking .the tiny droplets dry rapidly; the smallest one (<10*M*m) may remain suspended in the air for several hours and may gain direct access to the terminal air passages when inhaled it".

Other rout of transmission such as skin and trasplacental routs are uncommon and has no epidemiological significance.[5,6]

"Health care workers are exposed to a variety of infections, including TB, as they perform their job responsibilities .Transmission of *M.TB* is a recognized risk in health care facilities. It is most likely to occur from patients who have unrecognized pulmonary or laryngeal TB, who are not on effective anti-TB therapy and who are not placed in isolation".[7]

WHO standardized a tuberculin purified protein derivative(PPD) for diagnosis of TB as a skin test (tuberculin skin test, TST) . "The TST should be administered by the Mantoux method, which consists of intradermal injection of 0.1 ml of (PPD) tuberculin containing 5 tuberculin units (TU) into the volar or dorsal surface of the forearm, using a disposable tuberculin syringe. The TST should be evaluated by a trained health care worker within 48-72 hours of injection".

"False-positive reactions may include, but are not limited to infection with non-tuberculosis mycobacteria, previous BCG vaccination, incorrect method of TST administration, incorrect interpretation of reaction".

While false-negative reactions may be due to "cutaneous anergy (*anergy* is the inability to react to skin tests because of a weakened immune system)" recent TB infection (within 8-10 weeks of exposure), very old TB infection (many years), very young age (less than 6 months old), recent live-virus vaccination (e.g., measles and smallpox), malnutrition, some viral illnesses (e.g., measles and chicken pox), malignancy and immunosuppressive drugs, sarcoidosis.[8,9,10,11,12]

Tuberculosis infection can be classified to:

Primary TB: refers to the infection of previously uninfected (tuberculin-negative) individual. A few patients develop a self-limiting febrile illness but clinical diseases only occur if there is a hypersensitivity reaction or progressive infection.

Post-primary TB:" pulmonary TB is the commonest form. The onset is typically insidious and developed slowly over several weeks".

MiliaryTB:" blood borne dissemination gives rise to this type which may present acutely within few weeks of fever, night sweats, anorexia, weight loss and a dry cough, headache".[13,14,15]

Table A- Persons at increased risk who should be tested for latent Tuberculosis infection

Risk	Examples of persons with risk
Increased risk of exposure to	" • Persons with recent close contact with persons known to have active infectious cases tuberculosis."
Increased risk of tuberculosis Infection	" • Health care workers • Foreign-born persons from countries with a high prevalence of tuberculosis. • Homeless persons. • Persons living or working in facilities providing long term care."
Increased risk of active tuberculosis once infection has occurred	" • HIV-infected persons." " • Persons with recent tuberculosis infection". " • Injection-drug users". " • Patients with end-stage renal disease." " • Patients with silicosis."

" • Patients with diabetes mellitus."
" • Patients receiving Immunosuppressive therapy."
"• Patients with hematological cancers."
"• Malnourished persons"
• Persons who have undergone gastrectomy or jejunoileal bypass.

Table B- Criteria for a positive tuberculin skin test

Size of Reaction	Persons in whom reaction is considered positive
>=5mm	• HIV-infected persons Close contacts of persons with active TB • Persons with chest radiograph consistent with previous TB • Immunosuppressed patients, steroid dependents
>=10mm	• Foreign persons from countries endemic in TB • Medical conditions that increase risk of TB† • Injection drug users • Low income, homless persons • Residents and staff members of long term care facilities • Health care workers • Children <4 yr. of age • Persons with recent tuberculin test conversion
>=15mm	• All others[16,17]

Managment of Latent Tuberculosis Infection

Baseline Evaluation

Medical history risk factors for TB like immunosuppression, comorbid conditions, drugs history, pregnancy.

Targeted examination "for systemic signs of active TB disease (e.g., fever, night sweats, weight loss, pulmonary findings)".

Chest radiographs "Any individual with a newly identified positive test for TB infection should be evaluated for active TB disease . If the initial CXR is negative for active TB disease and the person has no symptoms consistent with active TB, then treatment of LTBI can be started".

If a CXR was done within 3 months of start of LTBI treatment and was normal, a repeat CXR may not be necessary.

HIV counseling" and testing is strongly recommended for all TST positive persons (if not done previously) since HIV co-infection significantly increases the risk of developing active TB".[17,18,19,20]

Indications of treatment

"Treatment of LTBI should be given for all TST positive persons regardless age and when no medical contraindications to treatment exist or previous adequate treatment has not been provided".

Higher priorities should be given to:

- HIV infected inmates
- Immunosuppressed patients
- Recent converters

The two standard treatment of LTBI are:

• "**Isoniazid (INH): 6 to 9 months** by mouth is the preferred treatment regimen for LTBI and should be prescribed unless other medical or logistical reasons warrant an alternative regimen. Nine months of isoniazid should be administered for all HIV co-infected inmates and, whenever feasible, for all other inmates. INH can be administered daily or twice weekly".

• **Rifampin (RIF): 4 to 6 months**, efficacy data for this regimen are not as strong as for INH.

Pregnant women should receive a test for TB infection only if they are in a high-risk category. The preferred regimen for treatment of LTBI in pregnant women is INH.[21,22,23,24,25]

PARTICIPANTS AND METHOD

Cross sectional descriptive study done in AL-Diwaniyah teaching hospital (medical department) between September and December 2017.

A122 HCWs who works in the medical department were included in this study (doctors, nursing staff, and service workers).

Persons with active TB, history of TB infection, immunsuppression (DM, uremia, steroid dependent, HIV infection…) were excluded from this study. Data about (Age, Sex,

Occupation and department, Duration of occupation, Vaccination and scar status) were collected from participants and as required.

Any individual with positive history of vaccination and BCG scar is absent considered as negative vaccination.

Tuberculin skin test was done after taking an oral permition from the individuals who participates in this study.

0.1 ml (5) tuberculin units had been injected intradermally to the volar surface of forearm and the site of injection was labeled.

The test observed after 72 hours, if no indurations developed considered as (0mm). If an induration develop it was reported as either (>=10mm) and (<10mm) induration. Erythema of any size without indurations was considered as 0mm.

RESULTS

122 HCWs were included in this study. The sample was limited by the availability of PPD. their age ranging between 24-40 years with a mean age 32years, 100(82%) were male and 22(18%) female.

The sample distributed according to the duration of contact (occupational duration) with patients having TB infection were: 20(16.4%) junior doctors <2 years contact, service workers 2-5 years contact 20(16.4%) and 24(19.7%) senior house officer(S.H.O) >5 years contact, 26(21.3%) medical emergency staff whose contact 5-10 years and lastly 32(26.2%) medical word staff >10 years contact

90(73.8%) of the studied sample were vaccinated while 32(26.2%) were unvaccinated.

30(24.6%) of the tested sample developed >=10mm indurations and 5(4.1%) <10mm indurations, while the rest 87(71.3%) developed 0mm

induration. *TABLE 1*

Outcome:

The distribution of the sample according to gender with test results shown in *TABLE 2* Were 24(24%) of male sample and 6(27%) of female sample shows >=10mm indurations While 4(4%) of male and 1(4.5%) of female shows <10mm indurations. 72(72%) of male and 15(68.2%) shows 0mm indurations.

TABLE 3 shows the distribution of the studied sample according to the vaccination with test results were: 21(23.3%) of vaccinated sample and 9(28.1%) of unvaccinated developed >=10mm indurations, while 2(2.2%) of vaccinated and 3(9.4%) of unvaccinated developed <10mm indurations. No indurations developed in 67(74.4%) of vaccinated and 20(62.5%) of unvaccinated.

TABLE 4 shows the relationship between duration of contact (occupation duration) and test results and as follow: 5(20.8%) of S.H.O, 14(43.8%) of medical word staff, 8(30.8%) of

medical emergency staff and 3(15%) of service workers developed >=10mm indurations.

1(5%) of junior doctors, 2(8.3%) of S.H.O and 2(6.3%) of medical word staff all developed <10mm indurations.

While 19(95%) of junior doctors, 17(70.8%) of S.H.O, 16(50%) of medical word staff, 18(69.2%) of medical emergency staff and 17(85%) of service workers developed 0mm indurations.

Table 1. frequencies of the sample according to gender, duration, vaccination and test results

FREQUENCIES		**no.**	**%**
GENDER	**male**	100	82.0
	female	22	18.0
DURATION (OCCUPATION)	**Junior House officer <2 years contact**	20	16.4
	Senior house officer >5 years contact	24	19.7
	Word nursing staff >10 years contact	32	26.2
	Emergency nursing staff 5-10 years contact	26	21.3
	Service workers 2-5 years contact	20	16.4
VACCINATION	**Positive**	90	73.8
	Negative	32	26.2
TEST RESULTS	**>=10 mm skin indurations**	30	24.6
	<10 mm skin indurations	5	4.1
	no indurations	87	71.3

Table 2. Distribution of gender with test results

			GENDER		Total
			male	female	
TEST RESULTS	>=10 mm skin induration	No.	24	6	30
		%	24.0	27.3	24.6
	<10 mm skin induration	No.	4	1	5
		%	4.0	4.5	4.1
	no induration	No.	72	15	87
		%	72.0	68.2	71.3
Total		No.	100	22	122
		%	100.0	100.0	100.0

p=0.938

Table 3. Distribution of vaccination with test results

			VACCINATION		Total
			Positive	Negative	
TEST RESULTS	>=10 mm skin indurations.	No.	21	9	30
		%	23.3	28.1	24.6
	<10 mm skin indurations.	No.	2	3	5
		%	2.2	9.4	4.1
	no induration	No.	67	20	87
		%	74.4	62.5	71.3
Total		No.	90	32	122
		%	100.0	100.0	100.0

p=0.162

Table 4. Distribution of duration of contact (occupation duration) with test results

OCCUPATION			DURATION					Total
			Junior House Officer<2 years contact.	Senior House Officer >5 years contact	Word nursing staff >10 years contact	Emergency nursing staff 5-10 years contact	Service workers 2-5 years contact	
TEST RESULTS	>=10 mm skin indurations.	No.		5	14	8	3	30
		%		20.8	43.8	30.8	15.0	24.6
	<10 mm skin indurations.	No.	1	2	2			5
		%	5.0	8.3	6.3			4.1
	no indurations	No.	19	17	16	18	17	87
		%	95.0	70.8	50.0	69.2	85.0	71.3
Total		No.	20	24	32	26	20	122
		%	100.0	100.0	100.0	100.0	100.0	100.0

p=0.018

DISSCUSION

Tuberculosis is highly endemic in Iraq and its burden had fluctuated during the last 50 years. In the sixties the prevalence had been estimated to be about 3.4 %. Improvement in the control of TB had occurred in the seventies but cases of TB started to increase in the late eighties and it was reached to around (30000) in 1999. The latest WHO figures in 2006 estimated that the prevalence of all cases is about 78/100000 and the evidence of new cases to be 56/100000.

Tuberculin test is an important screening test for exposure of the persons to TB infection but it needs to be done by using a standard procedure to be interpreted properly.

In Iraq in a study done in early sixties showed the tuberculin reactivity in general population to be 17.7% in rural areas and 30.9% in urban areas.[14,26]

No recent data is available about tuberculin reactivity in Iraqi population HCWs have increased risk of exposure to TB and their risk is related to the prevalence of the disease in their community, no data is available for the prevalence of TB in HCWs also no data is available about tuberculin reactivity in them.

Many medical authorities recommend tuberculin test screening for all HCWs and then follow up with repeated testing. [26]

The current study shows the rate of tuberculin reactivity among HCWs to be 24.6%. Many studies found that the reactivity of tuberculin in HCWs reflect the prevalence of TB in the population for examples in Thailand were the prevalence of TB in their population is (142/100000) and the rate of tuberculin reactivity in HCWs was found to be 68 %.

While in United States the prevalence of TB in population is (5.2/100000) and tuberculin reactivity in their HCWs is 4 %.[25]

The significance of tuberculin reactivity in HCWs in our study will be of more value if it can be compared with tuberculin reactivity in the general population but no recent data available at the present.

The current study shows significant relation between the tuberculin reactivity and the duration of work in hospital as it was highest (43.8%) among word staff who are in job for >10 years and it was negative (0%) in all joiner doctor with < 2 years in their job. This relation is well recognized in many other studies.

BCG vaccination was found to have no effect on tuberculin reactivity in our study which is also the finding of other studies. It's well known that the effect of BCG vaccination on tuberculin test rarely exceeds 15 years and BCG in our country is usually done in the first week of life.

The risk of development of active TB is higher in people with reactive tuberculin and it's estimated that the risk reaches up to 7.5% during the life time of the person and the risk even higher in patient who developed an immunosuppressive condition.

Many authors advice treatment of latent TB in immunosuppressed patients and also in patients

treated by immunosuppressive drugs and also in recent converters.

No clear advice available regarding the best approach to healthy tuberculin positive persons in highly endemic areas were the persons is in continuous exposure to reification but follow up of those people is a reasonable advice.[24,25,26]

CONCLUSIONS AND RECUMONDATIONS

Health care workers have high risk of acquiring TB infection because of their prolonged and frequent contact with TB patients. Tuberculin testing at the start of their job and regular follow up after that is an important step to prevent active TB in them, also proper isolation procedure for patients with active disease might be implemented in our hospitals to decrease the infectivity to the HCWs, these procedures are of increasing importance with people of "multi-drug resistant TB and also actively-drug resistant TB".

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