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Prevalence of Tuberculosis in Children

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Abstract

Background: Pulmonary TB is a relatively common disease in developing countries including Iraq . A relatively small proportion (5–10%) of the approximately 2 billion people infected with M. tuberculosis worldwide will develop TB.

Objective: To show the prevalence of T.B. among children in Abu-Ghraib city

Patients and Methods: A descriptive retrospective center-based study in the Abu-Ghraib health sector (chest and respiratory disease unit) was conducted to show the distribution of TB in children ≤ 18 years from the 1st January 2001 till the 31st December 2020.

Results: A total sample of 248 patients which represents 15.1% of all patients with TB in Abu-Ghraib (1642) from1st January 2001 till 31st December 2020. Female (152; 61.2%) and male (96; 38.8%). Most common age group affected was 13-18 years which represents 71.7% of patient. The prevalence of TB in Abu-Ghraib during the study period for children was (3.4/100,000).

Conclusion: The prevalence of all forms of TB in Abu-Ghraib during the study period was (3.4/100000). Females were affected more than males with a mean of 6.7+/-1.5 Extra-pulmonary TB was found to be more common than pulmonary TB.

Keywords: TB, Children, Epidemiology, Iraq

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Introduction

Estimating the global burden of TB disease in children is challenging due to the lack of a standard case definition. The WHO estimated 10 million incident cases of TB in 2018, of which approximately 1.1 million (11%) occurred among children; similar numbers of males and females were affected [1-3]. About 10% of children who have been infected with TB develop an active disease. Children < 5 years and HIV-positive children, as well as those with malnutrition, are at high risk of getting infected [4-6]. Iraq is one of the regions with a high burden of TB and accounts for 3% of the total number of cases. There are a predictable 20,000 TB patients in Iraq, with a death rate of 20% annually [2–4]. Iraq is one of the six countries (Egypt, Indonesia, Yemen, the Netherlands, and the UK) that compile 9% of the total incidence of TB worldwide [2–4]. The results show high incidence, prevalence, and mortality of TB-infected patients in the years 2003 and 2004,

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and this can be interpreted due to the bad and high shortage of health services in Iraq directly after the 2003 invasion war by the US army, while years after 2004 (2005–2017) show a decrease in incidence, prevalence, and mortality [2, 6]. Concerning the age groups of patients with TB, it seems that age groups of 25–34 years and 15–24 years were most commonly affected for both genders [2, 4]. TB incidence, prevalence, and mortality have decreased for the last 7 years due to the application of national and international health policies in Iraq [7, 8].

Most cases of TB in children occur in TB-endemic countries, but the actual burden of childhood TB is unknown. In 2012, WHO estimated that globally there were 530 000 TB cases among children (under 15 years of age) and 74 000 TB deaths (among HIV-negative children), 6% and 8% of the global totals, respectively [9–12]. In Indonesia, it was found that the proportion of childhood TB was 8.2% [13]. Dodd, in 22 high-burden countries, found that about 7·6 million children < 15 years old became infected with Mycobacterium tuberculosis, and roughly 650 000 developed tuberculosis. They also estimated that about 15 million children younger than 15 years old in these countries were living in the same household as an adult with TB [14]. In Iran, it was found that the total prevalence of TB was about 56.6 per 100,000. Most of the patients were between 5 and 12 years old. Sixty-one percent were male. Twenty-two percent had a history of TB in their family [15]. While in Egypt, it was found that the incidence rate of TB was 12 per 100,000 people, 6% of whom were children 14 years of age and younger [16]. Iraq adopted the DOTS strategy in April 1998, and 100% coverage was assumed to have been achieved in the early 2000s, which helped to reduce its incidence. [10,11]. The population (0–18 years old) in Iraq is about 20 million, according to the Central Organization for Statistics and Information Technology (COSIT). Abu Ghraib population is about 900,000 (according to COSIT), with more than half aged (1–18 years). A TB coordinator (now called a chest and respiratory disease unit) exists in each health center. All data about TB was supervised and implanted by this unit according to the Electronic Name Registration System (ENRS), with trained staff. The aim of this study is to show the prevalence of T.B. among children in Abu-Ghraib city from January 1, 2001, to December 31, 2020. As well as the frequency of all forms of TB in children in Abu-Ghraib city and finding out the more common form of extra-pulmonary TB in children in Abu-Ghraib city.

Patients and Methods

Study design and setting

A retrospective center-based study in the Abu-Ghraib health sector CRDU (chest and respiratory disease unit) was conducted to show the distribution of T.B. in children aged 18 and younger from 2001 until the end of 2020.

Target population

All children (1–18 years old) TB patients were registered and treated in the chest and respiratory disease unit in Abu-Ghraib from January 1st, 2001, to December 31th, 2020.

Sample frame and sample size

The health system in Iraq, from the administrative point of view run by the MOH, consists of central health directorates and peripheral health directorates (one in

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each province and three in Baghdad), and each peripheral health directorate furthermore consists of some hospitals and primary health sectors in addition to some specialized centers for tertiary care. Each primary health sector consists of some primary health care centers in different numbers according to the population's size. Abu-Ghraib health sector is one of ten primary healthcare sectors in the Al-Karkh health directorate in Baghdad, and in each primary healthcare sector, there is a chest and respiratory diseases unit (CRDU), which is responsible for the detection and treatment of T.B. patients in all forms according to WHO criteria and plans. We studied all TB children patients (248; female: 152 and male: 96) who were registered and treated in the CRDU of the Abu-Ghraib primary health care sector from January 1st, 2001, to December 31th, 2020.

Definition of Variables

Age

The age of patients was classified into 3 groups (by using Sturge's formula, the width of the class interval was 6 years), approximating the preschool child age group (0–6 years), young children (7–12 years), and adolescents (13–18 years).

Pulmonary T.B. PTB

Infection of the lung by Mycobacterium tuberculosis.

Extra-pulmonary TB. (EPTB)

Any TB. infection by Mycobacterium tuberculosis outside the lung.

Sputum smear-positive TB. SS+ve

All smears were examined by direct microscopic examination of the sputum and showed T.B. bacilli.

Sputum smear-negative TB. SS-ve

All smears were examined by direct microscopic examination of the sputum and did not show TB. bacilli.

New TB cases

All cases of T.B. who were infected for the first time.

Relapse TB

All cases who were previously infected with TB. at any time or discontinued treatment for more than 15 days.

Cured: A pulmonary TB patient with bacteriologically confirmed TB at the beginning of treatment who was smear negative or culture negative in the last month of treatment and on at least one previous occasion .

Treatment completed: TB patient who completed treatment without evidence of failure but with no record to show that sputum smear or culture results in the last month of treatment and on at least one previous occasion were negative, either because tests were not done or because results are unavailable.

Lost to follow-up: TB patient who did not start treatment or whose treatment was interrupted for 2 consecutive months or more.

Statistical Analysis

Data was collected from ENRS of the chest and respiratory diseases unit in the Abu-Ghraib health sector from January 1, 2001, until December 31, 2020. The data were analyzed using "Epi-Info version 9" and Excel 2013. Appropriate tables were used for the presentation of the data. An ANOVA test was used for the assessment of the statistical significance between means. A P value<0.05 was considered significant.

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Results

A total sample of 248 patients, which represents 15.1% (according to WHO children, TB represents 11% in 2020) of all TB patients in Abu-Ghraib (1642) from January 1, 2001, until December 31, 2020, Female (152; 61.2%) and male (96; 38.8%). The age of children aged 13–18 represents 71.7% of the total. The incidence of all forms of T.B. in Abu-Ghraib was 3.4/100,000, and 152 (61.2%) were female, as shown in Table (1).

Table (1): Shows the age-sex distribution of 248 patients registered in CRDU in Abu-Ghraib during the period of the study

Age in years	Female	Male	Total
1-6	16	18	34 1.7+/-0.4
7-12	16	20	36 1.8+/-0.4
13-18	120	58	178 (71.7%) 8.9±2.8 *P-value 0.001*
Total	152 (61.2%) 6.7±1.5 *P-value 0.001*	96 (38.8%) 4.8+/-0.9	248

Around 31.8% of patients had SS+ve PTB, 20% had SS-ve PTB, and 48.2% had EPTB, as shown in Table (2).

About 84.4% of PTBs are aged 13–18 years. 61.2% were PTB+ve, and 71.3% of PTB were female, as shown in Table (3).

Table (2): shows the distribution of all forms of T.B. according to sex and site of infection in Abu-Ghraib (2001–2020)

Forms of TB	Female	Male	Total
SS+ve	59	20	79 (31.8%) 3.9+/-0.8
SS-ve	33	17	50 (20%) 2.5+/-0.7
EPTB	60	59	119 (48.2%) 5.9±1.6 P-value 0.001
Total	152	96	248

Table (3): The distribution of PTB according to age and sex in TB children in Abu-Ghraib City (2001–2020)

Age in years		PTB SS +ve	PTB SS -ve	Total
1-6	Female	0	2	5 0.25±0.09
	Male	0	3	
7-12	Female	4	6	15 0.75±0.3
	Male	2	3	
13-18	Female	55	25	109 (84.4%) 5.4±1.4 *P-value 0.001*
	Male	18	11	
Total		79 (61.2%) 3.9±0.9 *P-value 0.000*	50 2.5±0.7	129

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Regarding EPTB, 50.4% were female, 44.5% had TB lymphadenitis, and 21% had pleural TB, as shown in Table (4).

Concerning treatment in females, 56.5% completed treatment, 36.1% cured, and 7.2% lost follow-up, while in males, 75% completed treatment, 19.7% of them cured, and 5.3% lost follow-up, as shown in Tables (5) and (6).

Regarding the onset of TB, about 91.9% of TB cases were new, while 8.1% were considered relapsed, as shown in Table (7).

Table (4): The distribution of sites of EPTB according to age and sex in TB children in Abu-Ghraib City (2001–2020)

Sites of EPTB	**Age in years**						**Total**	
	1-6		7-12		13-18			
	Female	Male	Female	Male	Female	Male	Female	Male
Lymph nodes 2.5+/-1.2 p-value 0.0000	6	6	4	5	22	10	32	21
							Total 53	44.5%
Pleura 1.25+/-0.7	1	0	0	5	5	14	6	19
							Total 25	21%
Skeleton	1	3	1	2	1	2	3	7
Gastrointestinal	1	0	0	0	8	0	9	0
Meninges	0	2	1	1	2	1	3	4
BCG	3	3	0	0	0	0	3	3
Others	2	1	0	2	2	2	4	5
Total	14	15	6	15	40	29	60 (50.4%)3±1.6 *P-value 0.7*	59 2.9±1.5

Table (5): The distribution of outcomes of TB treatment in female children in Abu-Ghraib City (2001–2020)

		Ages in years			**Total**
		1-6	7-12	13-18	
Cure 2.75+/-1.4	SS+ve	0	3	52	55 36.1%
	SS-ve	0	0	0	0
	EPTB	0	0	0	0
Complete 4.3+/2.1 p-value 0.001	SS+ve	0	0	0	0
	SS-ve	2	5	22	29
	EPTB	14	6	37	57
					86 56.5%
Loss to follow up 0.55+/-0.3	SS+ve	0	1	3	4
	SS-ve	0	1	3	4
	EPTB	0	0	3	3
					11 7.2%
Total		16	16	120	152

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Table (6): The distribution of outcomes of treatment for TB in male children in Abu-Ghraib City (2001–2020)

		Ages in years			Total
		1-6	7-12	13-18	
Cure 0.95+/-0.6	SS+ve	0	2	17	19 19.7%
	SS-ve	0	0	0	0
	EPTB	0	0	0	0
Complete 3.6+/-1.8 p-value 0.000	SS+ve	0	0	0	0
	SS-ve	2	3	10	15
	EPTB	15	15	27	57
					72 75%
Loss to follow up 0.25+/-0.09	SS+ve	0	0	1	1
	SS-ve	1	0	1	2
	EPTB	0	0	2	2
					5 5.2%
Total		18	20	58	96

Table (7): The distribution of TB onset in children in Abu-Ghraib City (2001–2020)

-Gender		Ages in years			Total
		1-6	7-12	13-18	
Female	New 6.85±3.2 p-value 0.001	13	15	109	137
	Relapse 0.75±0.4	3	1	11	15
Male	New 4.55±2.6 P-value 0.001	17	19	55	91
	Relapse 0.25+/-0.09	1	1	3	5
Total New cases of TB 228 91.9% Relapse cases 20 8.06%		34	36	178	248

Discussion

In this study, we found that the incidence of all forms of T.B. in Abu-Ghraib (from 2001-2020) for children was (3.4/100000) females more than males, and this disagrees with a retrospective review in Zambia in 2012 by Kapata et al., which found that male children were more than females, but the opposite was the case in smear-positive childhood TB, with more female than male smear-positive childhood TB cases, which agree with our study [17]. In our study, we found that TB is more common in older children than younger ones, and this is in agreement with a retrospective study in China in 2015 by Yang et al., which found that more than two-thirds of cases were 10 years and older [18]. We found that EPTB is more common than PTB, and this disagrees with a retrospective study in Ethiopia in 2019 by Ramos et al., which found that PTB is more common than EPTB [19]. We found that TB lymphadenitis is the most common type of EPTB, and this agrees with an overview done

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in 2005 in the United States by Marjorie P. Golden et al., which found that lymphadenitis is the most commonly occurring form of EPTB [20].

In our study, we found that favorable (cure and completed) outcomes are the most common in all patients treated with anti-TB drugs, and this agrees with a retrospective cohort study in the Netherlands (1993–2018) by Gafar, which found that highly successful treatment outcomes were demonstrated in children routinely treated for TB [21]. We found that new cases of TB are more common (about 91%) than relapsed ones and this agrees with a center-based study done in North Sudan in 2017 by Elmadhooun et al., which found that about 90% of cases were new [22]. In this study, we notice a significant difference in TB distribution regarding female children more than male children, and this can be explained by the absence of a dependent census since 1997, so we can know which sex is more predominant than the other.

Also, we found that EPTB is more common than PTB, but as we know, PTB is more common. This can be explained by difficulties in sputum collection, especially in younger children. For that reason, we see that in the adolescent age group (13–18 years), PTB is increasing versus EPTB.

Conclusions

The incidence of all forms of T.B. in Abu-Ghraib (from 2001–2020) for children was 3.4/100000.Females are affected by TB more than males, with a mean of 6.7±.5 (*P-value* 0.001).Adoluscent (13–18 years) is affected by TB more than other age groups, with a mean of 8.9±2.8 (P-value 0.001).

EPTB is more common than PTB, with a mean of 5.9±1.6 (P-value 0.001).SS+ve PTB is more common than SS-ve PTB, with a mean of 3.9±0.8 (0.001).

Regarding the outcome of treatment with anti-TB, complete treatment e was highly significant for both females and males, with a mean of 4.3±2.1 and 3.6±1.8, respectively, and a P-value of 0.001 for both.

Recommendations

Enforcing the CRDUs in health sectors with highly sophisticated techniques like GeneXpert for diagnosing PTB.

As TB lymphadenitis is the most common type of EPTB, supporting the CDRUs with a trained person for fine needle aspiration is necessary to decrease the loss of follow-up patients.

As PTB is more common, especially in the adolescent age group, we recommend doing a direct sputum examination for high-risk groups of students (female, living in slum areas, suffering from chronic diseases, malnourished) before college entrance.

Financial support, especially from nongovernmental organizations, to increase awareness about TB in children.

Limitations

The study type is center-based, which has some limitations:

1. The sample includes patients who were registered and treated in the Chest and Respiratory Diseases Unit (CRDU) in the Abu-Ghraib health sector only, although there may be some patients who were treated in private health sectors or other health institutes outside Abu-Ghraib.
2. There is no facility in the CRDU of Abu-Ghraib to diagnose extra pulmonary TB, so suspected cases referred for diagnosis in

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other places (private or public) may lead to the loss of patients and decrease the CDR case detection rate.

Source of funding: The current study was funded by our charges with no any other funding sources elsewhere.

Ethical clearance: No personal information was taken for the patients nor for contacts, only numbers, so no verbal consent was taken, but permission was obtained from the administrations of the studied health centers to collect data. All data, including patient identification, was kept confidential.

Conflict of interest: Nil

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انتشار مرض السل لدى الأطفال

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الملخص

خلفية الدراسة: هناك نسبة صغيرة نسبياً (٥-١٠٪) من حوالي ٢ مليار شخص مصابين بعصيات السل في جميع أنحاء العالم سوف يصابون بالسل.
اهداف الدراسة: لإظهار مدى انتشار مرض السل بين أطفال مدينة أبو غريب .
المرضى والطرائق : أجريت دراسة وصفية استرجاعية مركزية في قطاع صحة أبو غريب (وحدة الأمراض الصدرية والجهاز التنفسي) لإظهار توزيع مرض السل لدى الأطفال ≤ ١٨ سنة من ١ كانون الثاني (يناير) ٢٠٠١ حتى ٣١ كانون الأول (ديسمبر) ٢٠٢٠.
النتائج: عينة إجمالية مكونة من ٢٤٨ مريضاً وهو ما يمثل ١٥,١٪ من جميع مرضى السل في أبو غريب (١٦٤٢) من ١ كانون الثاني ٢٠٠١ حتى ٣١ كانون الأول ٢٠٢٠. الإناث (١٥٢; ٦١,٢٪) والذكور (٩٦; ٣٨,٨٪). وكانت الفئة العمرية الأكثر إصابة هي ١٣-١٨ سنة، وهو ما يمثل ٧١,٧٪ من المرضى. وبلغت نسبة انتشار مرض السل في أبي غريب خلال فترة الدراسة للأطفال (١٠٠٠٠٠/٣,٤).
الاستنتاجات: بلغ معدل انتشار مرض السل بكافة أشكاله في منطقة أبي غريب خلال فترة الدراسة (١٠٠٠٠٠/٣,٤). تأثرت الإناث أكثر من الذكور بمتوسط ٦,٧ ±١,٥. وقد وجد أن السل خارج الرئة أكثر شيوعا من السل الرئوي.
الكلمات المفتاحية: السل، الأطفال، علم الأوبئة، العراق
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[٥] كلية الطب - جامعة الملك عبد العزيز - جده – المملكة العربية السعودية