Impact the prevalence of *Mycobacterium tuberculosis* in Erbil city

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Abstract

Background: Infection by *Mycobacterium tuberculosis* is a continuous problem in patient especially in developing country, due to its infectious nature, complex immunological response, chronic progression and the need for long-term treatment, TB has always been a major health burden; in more recent years, associated with its severe social implications, treating and preventing TB have represented a permanent challenge over the course of human history.

Objectives: Our study aimed to carry out a center-based cross sectional study on *Mycobacterium tuberculosis* isolated from January 2015 till November 2019, rate of Tuberculosis among age group, gender, site of infection and extra pulmonary sub- diagnosis.

Materials and Methods: Totally 1061 tuberculosis patients from January 2015 till November 2019. were collected from Chest and Respiratory Disease Center/Erbil-Iraq. Identified by using macroscopical, microscopical. Acid fast stain was performed, isolates were characterized by using Gene xpert. Sputum smear-positive tuberculosis (PTB) patients diagnosed were enrolled and then were cultured at Löwenstein–Jensen (LJ) medium. Statistical analysis was performed.

Results: A total of (1061) samples were collected from eight sources (abscess, peritoneal fluid, pleural effusion, spinal cord, sputum, tissue biopsy, urine), the number of cases increased from 2015 to 2019 distributed as 198(18.7%) positive cases in 2015, 196(18.5%) in 2016, 208(19.6%) in 2017, in 2018 238(22.4%) and 221(20.8%) in
2019. From 2015 to 2019 the percentage of males infected with *M.tuberculosis* were more than the females being 520/1061(49.0%) and males being 541/1061(50.9%,there was highly significant correlation ($p < 0.0009$) between bacteria and genders, infections by TB increased among age groups (25-34) being 207/1061(19.53%) and elderly patients(above 65) being 222/1061 (20.94%), there was significant correlation between bacteria and age group, ($p<0.009$) Cases of extra pulmonary tuberculosis 595(56.1%) were more than pulmonary tuberculosis infection 466(43.9%). Lymph nodes was major site of extra pulmonary tuberculosis infection being 189/595(31.8%) among all five years.

Conclusions: The study findings showed a significant distribution of tuberculosis which may increase the burden of healthcare-associated infections. Although is essential for the appropriate treatment of TB patients and the prevention of spread of drug-resistant strains. Moreover. New molecular tools are now used in many countries as part of a standard laboratory diagnosis. Nevertheless, there is still a lot to be done, especially in our country where fast identification and early treatment are needed.

Keywords: Mycobacterium tuberculosis, especially, Erbil

Introduction

M.tuberculosis is a non- spore forming, non-motile, obligate-aerobic, facultative, catalase-negative, intracellular bacteria. The organism is neither gram-positive nor gram-negative because of a very poor reaction with the Gram stain. Weakly positive cells can sometimes be demonstrated on Gram stain, a phenomenon known as "ghost cells." The organism has several unique features compared to other bacteria such as the presence of several lipids in the cell wall including mycolic acid, cord factor, and WaxD. The high lipid content of the cell wall is thought to contribute to the properties of *M.tuberculosis* infection, Resistance to several antibiotics and difficulty staining with Gram stain and several other stains. Ability to survive under extreme conditions such as extreme acidity or alkalinity, low oxygen situation, and intracellular survival (within the macrophage).

(Terracciano *et al*., 2020) [25], Infection occurs when a person inhales droplet nuclei containing tubercle bacilli that reach the alveoli of the lungs. These tubercle bacilli are ingested by alveolar macrophages; the majority of these bacilli are destroyed or inhibited. A small number may multiply intracellularly and are released when the macrophages die. If alive, these bacilli may spread by way of lymphatic channels or through the bloodstream to more distant tissues and organs, the organ system most commonly affected includes the respiratory system, the gastrointestinal system, the lymphoreticular system, the skin, the central nervous system, the musculoskeletal system, the reproductive system, and the liver (Mathiasen *et al*., 2020) [17]. The clinical features of pulmonary TB includes chronic cough, sputum production, appetite loss, weight loss, fever, night sweats, and hemoptysis. Someone presenting with any of these symptoms should be suspected of having TB. If they are or were known to be in contact with infectious TB, they are even more likely to be suffering from TB (Escombe *et al*., 2010) [8]. Most cases show constitutive symptoms such as fever, weight loss, night sweats, or malaise with specific systemic symptoms based on the organ affected, affects the brain, eye, mouth, tongue, lymph nodes of neck, spine, bones, muscles, skin, pleura, pericardium, gastrointestinal, peritoneum, and the genitourinary system as primary and/or disseminated disease (Gopalaswamy *et al*., 2021) [9]. In some people, the tubercle bacilli overcome the immune system and multiply, resulting in progression from LTBI to TB disease. Persons who have TB disease are usually infectious and may spread the bacteria to other people. The progression from LTBI to TB disease may occur at any time, from soon to many years later. Persons with LTBI have *M.tuberculosis* in their bodies, but do not have TB disease and cannot spread the infection to other people. A person with LTBI is not regarded as having a case of TB. The process of LTBI begins when extracellular bacilli are ingested by macrophages and presented to other white blood cells. This triggers the immune response in which white blood cells kill or encapsulate most of the bacilli, leading to the formation of a granuloma. At this point, LTBI has been established. It can take 2 to 8 weeks after the initial TB infection for the body's immune system to be able to react to tuberculin, within weeks after infection, the immune system is usually able to halt the multiplication of the tubercle bacilli, preventing further progression (Long *et al*., 2022) [16]. Monodrug-resistant tuberculosis is defined as tuberculosis caused by organisms resistant to one first-line antituberculosis drug. MDR-TB is defined as tuberculosis caused by organisms resistant to both isoniazid and rifampin. Polydrug-resistant TB is defined as tuberculosis caused by organisms resistant to more than one first-line antituberculosis drug (except isoniazid and rifampin, resistance to both of which is characterized as multidrug resistance). Extensively drug-resistant tuberculosis is defined as tuberculosis caused by organisms resistant to rifampin, isoniazid, a fluoroquinolone, and at least one of three injectable second-line drugs (amikacin, kanamycin, or capreomycin). Rifampin-resistant tuberculosis is defined as tuberculosis caused by organisms identified as having resistance to rifampin by rapid molecular testing for tuberculosis drug resistance (World Health Organization, 2013; Brasil, 2016**)** [27].

Methods

A center-based cross sectional research study was conducted among 1061 tuberculosis patients from January 2015 till November 2019.

Data were collected from Chest and Respiratory Disease Center/Erbil-Iraq. The data were systematically reviewed for prevalence and rate of Tuberculosis among age group, gender, site of infection and extra pulmonary sub-diagnosis.

Identification of bacteria

Microscopic identification

The most basic technique used for detection bacteria is based on bacterium's shape and cell arrangement after staining. The ordinary shape of bacteria include rod cellular arrangement occurs singularly (Mohamad *et al*., 2014) [18].

Acid fast staining

The cell wall consists of a thick, lipid-rich outer layer composed primarily of mycolic acids. This lipid layer lies on top of a layer of peptidoglycan and the polysaccharide arabinogalactan, which, in turn, are anchored to the inner lipid membrane common to all bacteria (Pawełczyk and Kremer, 2014) [21].

The overall thick waxy coat renders acid-fast mycobacteria resistant to gram staining when stained with alternative dyes, the cell wall is resistant to decolorization with acid alcohol, thus giving these bacteria their sobriquet "acid-fast." This unique AF property remains the cornerstone for the diagnosis of tuberculosis (TB) the waxy mycolic acid containing cell wall of mycobacteria are relatively impermeable to ordinary staining techniques. They can be stained by aniline dyes using drastic measures such as application of heat and phenol. Heat softens the wax in the cell wall and allows the stain (basic fuchsin) to enter. The fuchsin dye is more soluble in phenol than in water or alcohol. Phenol in turn is more soluble in lipids or waxes, thus the dyephenol mixture enters the cell. Once stained, it resists decolorization by weak mineral acid (20% H2SO4). This is due to the fact that phenol-dye mixture is more soluble in waxes of the mycobacteria than the acid or alcohol. This way phenol acts as a mordant. While the mycobacteria retain the primary stain (pink), the background material gets decolorized and takes up the counterstain (methylene blue).

Gene expert

Mutations in the rpoB gene, encoding the β subunit of RNA polymerase, have been shown to be strongly associated with RIF-resistant phenotypes in multiple study populations. rpoB mutations are more likely segregated in an 81-bp region called the RIF resistance-determining region (RRDR). Detection of rpoB gene mutations is considered a surrogative marker for MDR-TB detection and can be used as a tool in MDR-TB diagnostics (Ogwang *et al*., 2009) [20]. The Xpert MTB/RIF test for use with the Cepheid GeneXpert® System is a semiquantitative nested real-time PCR in vitro diagnostic test for: The detection of *M.tuberculosis* complex (MTB complex) DNA in sputum samples or concentrated sediments prepared from induced or expectorated sputa that are either acid-fast bacilli smear positive or negative. The detection of rifampicin resistance associated mutations of the rpoB gene in samples from patients at risk for rifampin resistance (Cepheid, 2020) [3].

Culture

The current gold standard for the diagnosis of viable *M.tuberculosis* bacteria is culture. In biological specimens,

sputum has invariably been used for that purpose, the introduction of prokaryotic cell culture techniques has enabled both clinical and research laboratories to identify the *Mycobacterium spp*. and its susceptibility to antibiotics, leading to more efficacious treatment for patients with TB (Campelo *et al*., 2021).

Löwenstein–Jensen (LJ) medium is the most widely used in clinical practice. This is an egg–glycerol-based medium to which malachite green dye is added to inhibit the growth of some contaminating bacteria and to provide a contrasting colour against which colonies of mycobacteria are easily seen (Greenwood *et al*., 2012).The composition of the LJ medium prevents the growth of other organisms that may mask MTB or NTM, to improve selectivity, some antibiotics may be added to the medium (Kassaza *et al*., 2014; Tille, 2017).Although LJ medium recovers *M.tuberculosis* well, it is not reliable for the recovery of other species of mycobacteria. (Sharp *et al*., 2000).Cultures are more sensitive and significantly increase the number of notified cases. LJ medium is the most commonly used medium for the culture of *M.tuberculosis*. Growth of *M.tuberculosis* is slow, appear in two to six weeks and negative culture report cannot be given before eight weeks (Asmar and Drancourt, 2015).

They are time-consuming when compared to molecular techniques and sputum smear microscopy. Additionally, cultures provide the necessary isolates for conventional drug susceptibility testing (DST) to provide a definitive diagnosis, therefore, molecular techniques and sputum smear microscopy are not replacing the culture of *M.tuberculosis* (Chihota *et al*., 2010).

Collection of sputum

One of the most important parameters affecting the performance of a microbiological diagnostic test is the quality of the specimen. Fasting, early morning specimens are recommended in order to obtain sputum swallowed during sleep. Samples of 5 to 10 ml are collected on 3 consecutive days, and if not processed within 4 hours of collection, they should be adjusted to neutral pH with sodium carbonate since long- term exposure to acid can be detrimental to mycobacteria (Clinical and Laboratory Standards Institute, 2008).

Statistical analysis

Data entry was made using Excel v.14.0 and statistically analyzed by SPSS v.26, Excel v.14.0 and GraphPad Prism v.9.5.1 software. Logistic regression models were used to determine prevalence. A p-value less than 0.01 was taken as a cut point.

Results

Prevalence of *Mycobacterium tuberculosis*

The results in Table (1) showed that we had 1061 tuberculosis cases between 2015 and 2019. Results showed that we had 198(18.7%) cases in 2015, 196(18.5%) cases in 2016, 208(19.6%) cases in 2017, in 2018 we had 238(22.4%) cases and 221(20.8%) cases in 2019.

Table 1: Prevalence of *Mycobacterium tuberculosis*

Year	Patient(No.)	%
2015	198	18.7
2016	196	18.5
2017	208	19.6
2018	238	22.4
2019	221	20.8
Total	1061	100

No.=number of patients, %=percentage

Relation between *Mycobacterium tuberculosis* and Gender

In 2015 out of 198 isolates the female rate was 95(47.9%) cases and for the males we had 103(52.0%) cases. In 2016 out of 196 isolates we had 120(61.2%) male cases *M.tuberculosis* infected, 76(38.7%) females were infected with *M.tuberculosis*. In 2017 we had 208 isolates and in 2018 we had 238 isolates and in 2019, 221 isolates, for 2017 female's rate was 105(50.4%) isolates and the male's cases were 103(49.5%), and in 2018 for females we had 130(54.6%) cases while for males we had 108(45.3%) isolates, as for 2019 we had 114(51.5%) female isolates while 107(48.4%) males isolated. Statistical analysis showed that significant correlation between *M.tuberculosis* and gender (P= 0.0001) as in Table (2).

Table 2: Relation between *Mycobacterium tuberculosis* and Gender

Years		Gender			Total	P.value
	Male		**Female**			
	No.	%	No.	%		
2015	103	52.0%	95	47.9%	198	
2016	120	61.2%	76	38.7%	196	
2017	103	49.5%	105	50.4%	208	
2018	108	45.3%	130	54.6%	238	
2019	107	48.4%	114	51.5%	221	
Total	541	50.9%	520	49.0%	1061	0.0001

No= Number, %= Percentage

Prevalence of tuberculosis among age groups

The prevalence of TB in 2015 was seen mostly among (25-34) age group being 39/198(19.7%), meanwhile elderly patients (above 65 years old) and (15-24) age group being 38/198 (19.2%), also in 2016 it was mostly seen in (15-24) age group having 46/196(23.5%), while in 2017 it was seen mostly among people older than 65 years 49/208(23.6%), in 2018 it was seen mostly between the ages (25-34) providing 49/238 (20.6%) and lastly in 2019 the majority whom were infected were above 65 years old having 57/221 (25.8%), statistical analysis showed that there is significant correlation between the infections and age groups ($p<0.009$) as in Table (3).

Table 3: Prevalence of tuberculosis among age groups

Year	(0-4)	(5-14)	(15-24)	(25-34)	(35-44)	(45-54)	(55-64)	(+65)	Total
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	
2015	6(3.0)	5(2.5)	38(19.2)	39(19.7)	22(11.1)	25(12.6)	25(12.6)	38(19.2)	198(100.0)
2016	2(1.0)	6(3.1)	46(23.5)	41(20.9)	20(10.2)	24(12.2)	23(11.7)	34(17.3)	196(100.0)
2017	3(1.4)	10(4.8)	37(17.8)	39(18.8)	31(14.9)	20(9.6)	19(9.1)	49(23.6)	208(100.0)
2018	5(2.1)	9(3.8)	39(16.4)	49(20.6)	22(9.2)	27(11.3)	42(17.6)	45(18.9)	238(100.0)
2019	5(2.3)	8(3.6)	34(15.4)	39(17.6)	20(9.0)	23(10.4)	35(15.8)	57(25.8)	221(100.0)
Total	21(2)	38(3.6)	194(18.3)	207(19.5)	115(10.8)	119(11.2)	144(13.6)	223(21.0)	1061
P.value									P< 0.001

No.= Number of patients, %= Percentage

Site of tuberculosis distribution among patients

In 2015 most *M.tuberculosis* infection site was extra pulmonary infection being 107/198(54.0%), and pulmonary tuberculosis was 91/198(46.0%). For 2016 out of 196 patients 118 had extra pulmonary tuberculosis which means (60.2%) and was higher than pulmonary tuberculosis which was 78/196(39.8%). In 2017 most tuberculosis infected patients had an extra pulmonary site of infection too which were 123 patients out of 208 means (59.1%) and pulmonary tuberculosis patients were 85/208 cases that equals 40.9%. Both 2018 and 2019 most infections were from an extra pulmonary site 125 out of 238(52.5%) for 2018 and 122 out of 221(55.2%) for 2019, and pulmonary tuberculosis infected patients were 113 cases out of 238(47.5%) for 2018 and for 2019 number of patients were 99 out of 221(44.8%). Statistical analysis showed high significant correlation between pulmonary and extra pulmonary tuberculosis was ($p<0.0001$) as seen in Table (4).

Table 4: Site of tuberculosis distribution among patients

Year	EPTB	PTB	Total	P.Value
	No.(%)	No.(%)	No.(%)	
2015	107(54.0)	91(46.0)	198(100)	
2016	118(60.2)	78(39.8)	196(100)	
2017	123(59.1)	85(40.9)	208(100)	
2018	125 (52.5)	113(47.5)	238(100)	
2019	122(55.2)	99(44.8)	221(100)	
Total	595(56.1)	466(43.9)	1061(100.0)	P<0.0001

No.= number, %= percentage
EPTB= Extra pulmonary tuberculosis, PTB= Pulmonary tuberculosis

Distribution of site of extra pulmonary tuberculosis

In 2015 *M.tuberculosis* was present mostly among extra pulmonary infected patients in lymph nodes being 41/107(38.3%), Meningitis and pleura being second 17/107(15.8%), and bones and joints were 15/107(14.0%), The infection in Gastrointestinal tract, Pericardium and genitourinary tract being 3/107(2.8%) for each. While skin and throat tuberculosis was only 1/107(0.9%) for each, also we had 6/107(5.6%) for other uncommon sites of extra pulmonary tuberculosis infection and no miliary tuberculosis have been recorded in 2015. In 2016 lymph node's tuberculosis rate remain first degree being 50/119(42.0%) and pleural tuberculosis being 17/119(14.3%), meningitis tuberculosis was being 21/119(17.6%), bone and joints case number stayed 15 cases out of 119(12.6%), and for each miliary and skin tuberculosis were 1/119(0.8%), and other extra pulmonary infections were 5/119(4.2%). For 2017 lymph nodes tuberculosis were most of cases being 35/123(38.5%), and second was meningitis tuberculosis which was 29/123(23.6%) and third was pleural tuberculosis being 21/123(17.1%), bone and joints tuberculosis were 20/123(16.3%), and 3/123(24%) for gastrointestinal tuberculosis and no record of Military, Pericardium, Throat and Genitourinary tract tuberculosis, but 14 out of 123 cases (11.4%) for other sites of extra pulmonary infection. In 2018 major site of extra pulmonary was 28/124(22.6%) for lymph nodes and meninges comes after it being 26/124(21.0%) while third common site was bone and joints together and skin being least 1/124(0.8%), no patient have been infected tuberculosis in pericardium, throat and genitourinary tract in 2018. Finally in 2019 lymph nodes tuberculosis again were most of all 35/122(287%) and 27 out of 122(22.1%) for meningitis tuberculosis which becomes second and 15/122(12.3%) for bone and joints, 7/122(5.7%) pleural tuberculosis, skin tuberculosis being 2/122(1.6%) and 1/122(0.8%) gastrointestinal tract tuberculosis and highest rate of other site of tuberculosis being 35/122(287%) and no case record of miliary, pericardium, throat and genitourinary tract tuberculosis available. Statistical analysis showed that significant correlation between extra pulmonary sites of infection and *M.tuberculosis* ($p<0.09$) as in Table (5).

Table 5: Distribution of site of extra pulmonary tuberculosis

Year	GIT	LN	Meningitis	Miliary	Pericardium	Pleura	Skin	Throat	GUT	B&J	Others	Total
	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)	No.(%)
2015	3(2.8)	41(38.3)	17(15.9)	-	3(2.8)	17(15.8)	1(0.9)	1(0.9)	3(2.8)	15(14.0)	6(5.6)	107(100.0)
2016	2(1.7)	50(42.0)	21(17.6)	1(0.8)	4(3.4)	17(14.3)	1(0.8)	-	3(2.5)	15(12.6)	5(4.2)	119(100.0)
2017	3(2.4)	35(28.5)	29(23.6)	-	-	21(17.1)	1(0.8)	-	-	20(16.3)	14(11.4)	123(100.0)
2018	7(5.6)	28(22.6)	26(21.0)	3(2.4)	-	22(17.7)	1(0.8)	-	-	25(20.2)	12(9.7)	124(100.0)
2019	1(0.8)	35(28.7)	27(22.1)	-	-	7(5.7)	2(1.6)	-	-	15(12.3)	35(28.7)	122(100.0)
Total P. value	16(2.7)	189(31.8)	120(20.2)	4(0.7)	7(1.2)	84(14.1)	6(1.0)	1(0.2)	6(1.0)	90(15.1)	72(12.1)	595(100.0)
	P<0.09											

GIT= Gastrointestinal tract, LN= Lymph nodes, GUT= Genitourinary tract B&J= Bone and Joints, No.= Number of patients, %= Percentage

Discussion

The prevalence of infection caused by MT had increased in recent years. A total of (1061) samples were collected from eight sources (abscess, peritoneal fluid, pleural effusion,

spinal cord, sputum, tissue biopsy, urine) of patients who had been hospitalized and those who had not been hospitalized according data in Chest and Respiratory Disease Center in Erbil city from January 2015 till November 2019. After collection all bacterial isolates were subjected to a series of confirming tests. The results in Table (3.1) showed that we had 1061 tuberculosis cases between 2015 and 2019.Results showed that we had 198(18.7%) positive cases in 2015 and 196(18.5%) positive cases in 2016 and 208(19.6%) positive cases in 2017 and in 2018 we had 238(22.4%) positive cases and 221(20.8%) positive cases in 2019. This shows that the number of cases increased from 2015 to 2019.

However, the number of TB cases in Iran between 2008 and 2018 shows that the TB cases per 100,000 people has decreased in recent years, in 2014-2015 they had (10,044) cases, while in 2015-2016 the number of cases decreased to (9917) then to (9118)cases in 2016-2017, the number of patients in 2017-2018 was (8819). (Kiani *et al*., 2021). Increasing number of cases in our region due to many factors one of them we presume is due to the rise of population in Erbil after 2015 because of refugees coming from different places as well as HIV/AIDS pandemic, the emergence of drug-resistant TB strains, and weakened public health system.Statistical analysis showed that highly significant correlation (p= 0.0001) between bacteria and genders. From 2015 to 2019 the percentage of males infected with *M.tuberculosis* were more than the females being 520/1061(49.0%) and males being 541/1061(50.9%). Our results agreed with (Humayun *et al*., 2022) that showed that the prevalence of TB in male more than the female and males at higher risk of TB than females this study show Characteristics of TB Diagnosed in Harare, Zimbabwe During 2011–2017, among 24 277 cases the male percentage was 14,206 (58.5%) and females was 10 ,071(41.5%).Statistical analysis showed that there is significant correlation between bacteria and age group, (p<0.001,from january 2015 till november 2019, there were a total of 1060 TB cases reported in chest and respiratory disease center in Erbi city, this showed that infections by TB increased among age groups (25-34) being 207/1060(19.53%) and elderly patients(above 65) being 222/1060 (20.94%), this agree with results recorded by (Dong *et al*, 2022) that reported rate of groups over 60 years was much higher than that of young people (2–3 times) in total of 14.82 million patients in china from 2006_2020, and disagree with results recorded by (Ibrahim,2005) which affected younger ages 85 in total 100 cases(85%) from january 1996 December 2002, Qatar.

We found that the risk was significantly lower under 15 years, possibly due to positive control effects of the neonatal BCG vaccination program. On the other hand, the rate of missed diagnosis among children was also high, The risk was higher in all groups over 15 years old than the overall average, possibly due to cumulative exposure to *M.tuberculosis* infection, air pollution, smoking, and other determinants with age. The high risk of young people might be mainly due to continued transmission within the community, such as clustering in schools and frequent social activities, which increase the risk of exposure. The high risk of the elderly in years 2017 and 2019 mainly due to the weakened immunity of the body, diabetes comorbidity, and other factors, which might cause the onset through the recent infection, or the reactivation of latent infection.

Tuberculosis is clinically categorized as either pulmonary TB (PTB) or extra pulmonary tuberculosis (EPTB). PTB is the most common clinical presentation of TB disease. EPTB refers to TB disease involving organs other than the lungs (e.g., pleura, lymph nodes, abdomen, genitourinary tract, GIT, throat, pericardium, skin, bones and joints or meninges) (Loddenkemper *et al*., 2016) [15].

From 2015 to 2019 the percentage of EPTB was more than the percentage of PTB this is due to patient's life-style and demographic factors that shown in this study (Sreeramareddy *et al*., 2008) [24]. EPTB refers to TB disease involving organs other than the lungs (e.g., pleura, lymph nodes, abdomen, genitourinary tract, skin, joints and bones, or meninges) (Shivakumar *et al*., 2022) [23]. In our study, the lymph nodes were the most common site of EPTB. Earlier studies have suggested that localization of EPTB may be variable. In Hong Kong (Noertjojo *et al*., 2002). The genitourinary system and the skin were the common sites, whereas in the USA (Yang *et al*., 2004) [28].

Bones and/or joints were the most common sites. Results of our study are comparable to two studies from Turkey which reported that lymph nodes accounted for nearly half the cases of EPTB which is agrees with our reports (Musellim *et al*., 2005) [19].

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