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Prevalence of Smear Positive Tuberculosis among Patient Attending, National Hospital Abuja, Federal Capital Territory, Nigeria

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Abstract

Objective: *This study was planned to determine the prevalence of smear positive pulmonary TB among patients receiving care at a tertiary reference Hospital - National Hospital Abuja, Federal Capital Territory (FCT), Nigeria.*

Background: *With an estimated 9.4 million new cases globally, tuberculosis (TB) continues to be a major public health concern[1]. Eighty percent of all cases worldwide occur in 22 high-burdens, mainly resource-poor settings. This devastating impact of tuberculosis on vulnerable populations is also driven by its deadly synergy with HIV. Therefore, building capacity and enhancing universal access to rapid and accurate laboratory diagnostics are necessary to control TB and HIV-TB co-infections in resource-limited countries[2]. In low income countries (Nigeria inclusive), Ziehl-Neelsen sputum smear microscopy is the only cost-effective tool for diagnosis and monitoring of patients on treatment[3].*

There is dearth of data on the prevalence of pulmonary tuberculosis (PTB) among patient attendees from individual Institutions and Health Care Facilities performing sputum smear microscopy in Nigeria. This retrospective study will analyze sputum smear microscopy results among pulmonary TB suspected patients presenting to National Hospital Abuja, Federal Capital Territory (FCT), Nigeria. Sputum smear microscopy for Acid Fast Bacilli (AFB) results of new suspected pulmonary TB (Diagnosis) patients and their demographic data comprising age and sex recorded from January 2010 to December 2014 were retrieved from the TB Laboratory Register of the Medical Microbiology department and analyzed.

Methods: *This hospital based retrospective study analyzed sputum smear microscopy results among pulmonary TB suspected patients presenting to the National Hospital Abuja, Federal Capital Territory, Nigeria. Sputum smear microscopy for Acid Fast Bacilli (AFB) results of new suspected pulmonary TB (Diagnosis) patients and their demographic data comprising age and sex recorded from January 2010 to December 2013 were retrieved from the TB Laboratory Register of the Medical Microbiology department and analyzed. Data processing and statistical analysis were performed using SPSS software (Windows version 16.0). The results were expressed as percentage, with significance at 5%.*

Results: *The overall prevalence of sputum smear positive cases were 17.3% (63 0f 364) and most of the positive patients were within the age range 15 – 44 years. The highest percentage of TB was seen in the age group of 15 - 24 years compared with the lowest percentages in the age group below 14 years and above 45 years. A total of 63 (17.3%) suspects were found to have at least one positive. Of these, 56 (88.9% of those with one or more positive smears and 92% of those who fulfilled the case definition) were detected from the first specimen and 7 (11.1%) were positive on the second specimen but not the first. The third specimen did not have any additional diagnostic value for the detection of AFB.*

Conclusion: *The prevalence of sputum smear positive cases of 18.3% increases with age up to the age 44 years. Our result show that examining two sputa smears was sufficient for the detection of AFB in our laboratory. Further research involving different laboratories from all of the six geo-political groups in Nigeria is needed to reassess these findings.*

Introduction

Tuberculosis (TB) still remains a major global health problem. It causes serious ill-health among millions of people each year globally and ranks as the second leading cause of death from an infectious disease worldwide, after the human immunodeficiency virus (HIV). There

were 8.6 million new TB cases as at 2012 and 1.3 million TB deaths (just under 1.0 million among HIV-negative people and 0.3 million HIV-associated TB deaths). In 2012, there were an estimated 2.9 million cases and 410 000 TB deaths among women, as well as an estimated 530 000 cases and 74 000 deaths among children[1].

At least one-third of the 35.3 million people living with HIV worldwide are infected with latent TB. Persons co-infected with TB and HIV are 29.6 times (27.1 – 32.1) more likely to develop active TB disease than persons without HIV. TB is the most common presenting illness among people living with HIV, including those who are taking antiretroviral treatment. There were an estimated 1.1 million HIV positive new TB cases globally in 2012. Around 75% of these people live in sub-Saharan Africa (Nigeria inclusive). TB is the leading cause of death among people living with HIV, accounting for one in five HIV-related deaths. In 2012, some 320,000 people died of HIV-associated TB[2]. People living with HIV are facing emerging threats of drug-resistant TB such as multi-drug resistant (MDR-TB) and extensively drug resistant TB (XDR-TB) [2].

Tuberculosis bacteriology is one of the fundamental aspects of a national tuberculosis control programme and a key component of the DOTS strategy, yet the tuberculosis laboratory service is often the most neglected component of these programmes[5]. Despite recent advances in mycobacteriology, most developing countries still rely on the sputum examination in making a diagnosis of pulmonary TB and in monitoring of patients' progress under anti-TB treatment[7].

The use of smear microscopy in patients suspected of tuberculosis presenting to health services is of great value in case detection and in reducing the spread of the infection throughout the population by treatment of such cases. Sputum smear positive patients with active respiratory disease transmit the bacilli to other persons via droplets[6]. Left undetected and untreated, each person with active TB disease will infect on average between 10 and 15 people every year[2]. Early detection and treatment in other to reduce the transmission within communities are therefore essential for an effective control of the disease[7].

Nigeria ranks 13th among the 22 high-burden TB countries in the world[2]. WHO estimates that 90,305 new cases of all forms of TB occurred in Nigeria as at 2012. There were an estimated 161,000 prevalent cases of TB in 2012. 97,853 TB cases were notified in 2012 with 52,901 (59%) cases as new smear positives, and a case detection rate of 51%. Also, there is estimated range of 1800-3400 MDR-TB cases among notified pulmonary TB cases in Nigeria as at the end of 2012. The main goal of Nigeria's TB program is to halve the TB prevalence and death rates by 2015[4].

Therefore, the aim of this study was to evaluate the prevalence of smear positive pulmonary TB among patients at the National Hospital Abuja, a tertiary health facility located in Federal Capital Territory (FCT), Nigeria. In addition, some aspects of the performance of the pulmonary TB diagnosis are equally discussed.

Moreover there is limited independent data from institutions and health care facilities enumerating TB case detection performance of such institutions to support the data from the National TB Program (NTP). This study was therefore aimed at assessing and evaluating the prevalence of new smear-positive pulmonary tuberculosis diagnosed among suspected persons presenting at the National Hospital Abuja from January 2010 to December 2013.

Methodology

Study design and site

This hospital-based retrospective study was conducted at the National Hospital Abuja (NHA) and comprised of review of available data from January 2010 to December 2013. NHA is a 280-bed tertiary hospital, located in the Central Business District of the Federal Capital Territory, with state-of-the-art facilities for both clinical and Laboratory components. It used to serve as the final tertiary health care referral centre for the entire country and other neighbouring countries in the West African sub-region until recently when some selected teaching hospitals within and outside Nigeria was upgraded to its level in terms of equipment

and manpower support. The Medical Microbiology and Parasitology department of the NHA received average of 25 sets of sputum samples per week from individual client, both from inpatients and outpatients departments.

Data extraction

Demographic data comprising age, sex and results for Ziehl-Neelsen stained sputum smear microscopy for Acid Fast Bacilli (AFB) of all (1011) recorded cases from January 2010 to December 2013 were retrieved from the TB Laboratory Register of the National Hospital Abuja, Medical Microbiology Laboratory. From the recorded data information about patients for whom diagnosis has been requested for the first time were retrieved /recorded (using a standardized data collection form) and these were classified as new suspected TB. Repeat cases and patients requesting follow-up test were excluded from the analysis.

Case definition

In this retrospective study, a case of pulmonary TB was classified as positive (confirmed case of PTB) if at least one out of the two/three smears from the two/three sputum specimen received was AFB positive and quantified as being scanty, 1+, 2+ and 3+ AFB present. New patients for the purposes of this study were defined as patients who were not on TB treatment.

In this study, all patients having symptoms suggestive of pulmonary tuberculosis (cough for >3 weeks, chest pain, low-grade fever, night sweats) are routinely instructed to submit three early morning sputum samples for the detection of acid-fast bacilli (AFB) and Ziehl-Neelsen or Kinyoun technique was performed on each specimen in compliance with standard bacteriological procedure according to WHO guidelines. Laboratory personnel process three sputum samples for all suspects irrespective of the number of positive smears, as only the physician is allowed to make the decision to start treatment. Patients are considered smear positive if they have at least two smear-positive specimens. Laboratory personnel keep all smear positive slides and an equal number of smear negatives for quality control.

Data analysis

Individual patients who contributed fewer than three sputum AFB specimens were excluded from the analysis. One hundred and forty seven files did not satisfy entry criteria due to incomplete information. Data processing and statistical analysis were performed using SPSS software (Windows version 16.0). The results were expressed as percentage, with significance at 5%.

Results

A retrospective study of 864 suspects fulfilling all the set inclusion criteria were studied over the 4-years period for AFB smear microscopy analyses; the analysis made up of 506 (58.6%) male and 358 (41.4%) females. the age ranges was 5 - 79 years with a mean of 33.6 years (Table 1).

Table 1: Age and sex distribution of study patients

Age group (years)	Male (%)	Female (%)	Total (%)
0 -15	70 (8.1)	41 (4.7)	111 (12.8)
16 - 25	102 (11.8)	98 (11.4)	200 (23.2)
26 - 35	117 (13.5)	61 (7.1)	178 (20.6)
36 - 45	83 (9.6)	55 (6.4)	138 (16.0)
46 - 55	51 (5.9)	48 (5.5)	99 (11.4)
56 - 65	35 (4.1)	36 (4.2)	71 (8.3)
>=66	48 (5.6)	18 (2.1)	66 (7.7)
Total	506 (58.6)	358 (41.4)	864 (100)

The overall prevalence of sputum smear positive cases were 18.3% (157 of 864) and most of the positive patients were within the age range 16 – 45 years (12.9%). The highest percentage of TB was seen in the age group of 16 - 25 years (5.6%) compared with the lowest percentages in the age group below 15 years and above 46 years (Table 2).

Table 2: Age distribution of sputum smear results

Age Group (Year)	Number tested	Sputum Positive (%)	Sputum Negative (%)
0 -15	111 (12.8)	11 (1.3)	100 (11.5)
16 - 25	200 (23.2)	48 (5.6)	152 (17.6)
26 - 35	178 (20.6)	35 (4.1)	143 (16.5)
36 - 45	138 (16.0)	28 (3.2)	111 (12.8)
46 - 55	99 (11.4)	18 (2.1)	81 (9.3)
56 - 65	71 (8.3)	12 (1.4)	59 (6.9)
>=66	66 (7.7)	5 (0.6)	61 (7.1)
Total	864 (100)	157 (18.3)	707 (81.7)

The prevalence rates of smear-positive pulmonary TB for 2010, 2011, 2012 and 2013 were 19.8% and 18.5%, 18.4% and 16.0% respectively (Table 3). A total of 157 (18.3%) suspects were found to have at least one positive smear and 154 (18%) fulfilled the case definition (at least two positive smears). Of these, 131 (83.4 of those with one or more positive smears and 85.1% of those who fulfilled the case definition) were detected from the first specimen and 26 (16.6) were positive on the second specimen but not the first.

The third specimen did not have any additional diagnostic value for the detection of AFB as shown in Table 3.

Table 3: Sputum smear results by timing of sample

Year	At least two positive, N (%)	At least one positive N (%)	PXX N (%)	NPX N (%)	NNP N (%)	Total with three results
2010	44 (19.4)	45 (19.8)	37 (82.2)	8 (17.8)	-	227
2011	40 (18.0)	41 (18.5)	34 (82.9)	7 (17.1)	-	222
2012	36 (18.4)	36 (18.4)	30 (83.3)	6 (16.7)	-	196
2013	34 (15.5)	35 (16.0)	30 (85.7)	5 (14.3)	-	219
Total (All)	154 (18)	157 (18.3)	131(83.4)	26 (16.6)	-	864

Discussion

TB is a global issue and is a great concern in Nigeria. The main requirement for TB control is the rapid and accurate identification of infected individuals[8]. For the detection of TB, microscopy examination of sputum still remains the first step and is an insensitive tool in providing quick information to the clinician in this setting[9]; [10].

There have been few reports of the prevalence of sputum smear-positive pulmonary TB in Nigeria. The present study, which employed a retrospective laboratory-based study, provided unique information on the prevalence of TB in suspect patients in the developing community.

The study observed improvement in reported case activity among suspected individual patients in a year-on-year basis with steady declines in positivity rates. The impact of initiated treatment plans and support packages afforded to patients burdened with TB could have led to the effective management of cases and improvements in living and social conditions of the people thereby leading to a reduction in prevalence rates and declines in risk of transmission from infected individuals. Over time, the social and living conditions of indigenes have improved tremendously with improvement in diet and environmental hygiene. The resultant decrease in overcrowding in homes as a result of social development could have impacted

greatly on the degree of exposure, reduction in the risk of transmission and susceptibility to infection in exposed persons[11].

In the present study, our finding with the overall prevalence of sputum smear-positive of 18.3% is in agreement with some studies that showed different rates ranging from 12 to 20% [12]; [13]. However, higher rates of sputum smear-positive cases have been reported in some studies carried out in developing countries.

In studies from Ibandan, Nigeria, [14], [15] found high percentage of positive smear cases in 30 and 57% respectively. High rates of positive smear cases have been also reported by other many authors in their studies carried out in African regions [16]; [17]. These variations in the rate could be related to systematic differences in the various population samples. One of the reasons could be the advent of HIV/AIDS which has been shown to be associated with the increase of the prevalence of pulmonary tuberculosis in some countries with high incidence of HIV infection.

This study shows that, there was a high rate of smear positive cases in the 16 to 45-year-old group. Previous studies have also reported the highest rate of smear positive tuberculosis cases in this age group [18]. This might be as a result of the fact that individuals of this age in their life tend to be more active and are more likely to interact with other people than the elderly and the very young.

In the present study, we tried to assess the contribution of each sputum specimen collected for the detection of AFB by microscopy in our laboratory. *M. tuberculosis* was detected from the first smear specimen with relatively high rate as shown in **Table 3**, with a small proportion being detected from the second specimen. It is obvious that for the overwhelming majorities (100%) of patients from whom three smear specimen were assessed, the first and the second specimen were proved to be diagnostic.

The third specimen was of no significant for microscopic examination in smear-negative patients. The analysis of the data generated for this study shows that under routine conditions, evaluating TB suspects with two sputum smears was as effective as with three sputum smears and is followed with less laboratory work and thus, reductions in the cost related to the TB diagnosis processes. Furthermore, this strategy could leave more time for the examination of each slide.

Many recently published reports have shown results similar to the observation in the present study [19]; [9]. In a 4-year retrospective study in Turkey, it was found out that the collection of two sputum specimens was almost always adequate to make a diagnosis (100%), irrespective of the quality of the specimen obtained [20].

In another 5-year retrospective study in New Jersey, it was found that the majority of patients whose AFB smears were negative and for whom TB isolation was discontinued were identified with the first sputum AFB smear [21]. Another author reviewed 4 years' worth of data at the University of North Carolina and concluded that "modifying the smear policy formulation from three to two negative smears would have resulted in no increased risk of spreading TB and would decrease the number of days patients are unnecessarily placed under airborne precautions" in their institution [22]. The findings from this study and those mentioned above raise the question of whether three sputum AFB smears are necessary before discontinuing TB isolation. Again, given limited resource in our setting, it is mandatory to investigate strategies to maximise the detection of cases further pointing the impracticality of the current recommendations in routine clinical practice.

Conclusion and recommendation

The findings from this study shows an indication of remarkable improvement in the case detection efforts in the hospital which could possibly have resulted in the steady decline of positivity rates. Such gains made can further be enhanced by creating effective help-seeking environments within the communities and the hospital, improving diagnostic and health systems efficiency.

The overall prevalence of sputum smear positive cases of 18.3% with the most vulnerable amongst the age ranges 16 - 45. Although the contribution of each sputum specimen for the detection of AFB was not evaluated in this study directly, the result here show that examining two sputa smears was sufficient for the detection of AFB in our laboratory. Further research involving different laboratories from across the six geo-political zones of Nigeria is needed to reassess these findings.

Furthermore, to minimize delays in initiating effective chemotherapy, intensified case-finding activities should be directed towards high-risk communities and age-specific groups so as to increase awareness of typical symptoms of TB disease.

References

[1]. Borgdorff M.W., Floyd K. and Broekmans J.F. (2002) Interventions to reduce tuberculosis mortality and transmission in low- and middle-income countries. *Bull World Health Organ* 80, 217-227.

[2]. Burchfield J, Aderaye G, Palme IB, Bjorvatn B, Britton S, Feleke Y, Kallenius G, Lindquist L (2002). Evaluation of outpatients with suspected pulmonary tuberculosis in a high HIV prevalence setting in Ethiopia: clinical, diagnostic and epidemiological characteristics. Scand. J. Infect. Dis. 34: 331-7.

[3]. Craft DW, Jones MC, Blanchet, CN, Hopfer RL (2000). Value of examining three acid-fast bacillus sputum smears for removal of patients suspected of having tuberculosis from the "airborne precautions" category. J. Clin. Microbiol. 38: 4285-7.

[4]. Garg SK, Tiwari RP, Tiwari D, Singh R, Malhotra D, Ramnani VK, Prasad GB, Chandra R, Fraziano M, Colizzi V, Bisen PS (2003). Diagnosis of tuberculosis: available technologies, limitations, and possibilities. J. Clin. Lab. Anal. 17: 155-63.

[5]. Gopi PG, Subramani R, Selvakumar N, Santha T, Eusuff SI, Narayanan PR (2004). Smear examination of two specimens for diagnosis of pulmonary tuberculosis in Tiruvallur District, south India. Int. J. Tuberc. Lung Dis. 8: 824-8.

[6]. Harries AD, Mphasa NB, Mundy C, Banerjee A, Kwanjana JH, Salaniponi FM (2000). Screening tuberculosis suspects using two sputum smears. Int. J. Tuberc. Lung Dis. 4: 36-40.

[7]. Habeenzu C, Mitarai S, Lubasi D, Mudenda V, Kantenga T, Mwansa J, Maslow JN (2007). Tuberculosis and multidrug resistance in Zambian prisons, 2000-2001. Int. J. Tuberc. Lung Dis. 11: 1216-20.

[8]. Holmes CB, Hausler H, Nunn P (1998). A review of sex differences in the epidemiology of tuberculosis. Int. J. Tuberc. Lung Dis. 2: 96-104.

[9]. Katamba A, Laticevschi D, Rieder HL (2007). Efficiency of a third serial sputum smear examination in the diagnosis of tuberculosis in Moldova and Uganda. Int. J. Tuberc. Lung Dis. 11: 659-64.

[10]. Kolawole TM, Onadeko EO, Sofowora EO, Esan GF (1975). Radiological patterns of pulmonary tuberculosis in Nigeria. Trop. Geogr. Med. 27: 339-50.

[11]. Leonard MK, Osterholt D, Kourbatova EV, Del Rio C, Wang W, Blumberg HM (2005). How many sputum specimens are necessary to diagnose pulmonary tuberculosis? Am. J. Infect. Control. 33: 58-61.

[12]. Lonnroth K., Jaramillo E., Williams B.G., Dye C. and Raviglione M. (2009) Drivers of tuberculosis epidemics: the role of risk factors and social determinants. *Soc Sci Med* 68, 2240-2246.

[13]. Mathew P, Kuo YH, Vazirani B, Eng RH, Weinstein MP (2002). Are three sputum acid-fast bacillus smears necessary for discontinuing tuberculosis isolation? J. Clin. Microbiol. 40: 3482-4.

[14]. Onadeko BO, Dickinson R, Sofowora EO (1975). Military tuberculosis of the lung in Nigerian adults. East Afr. Med. J. 52: 390-5.

[15]. Ozkutuk A, Terek G, Coban H, Esen N (2007). Is it valuable to examine more than one sputum smear per patient for the diagnosis of pulmonary tuberculosis? Jpn. J. Infect. Dis. 60: 73-5.

[16]. Van Deun A, Salim AH, Cooreman E, Hossain MA, Rema A, Chambugonj N, Hye MA, Kawria A, Declercq E (2002). Optimal tuberculosis case detection by direct sputum smear microscopy: how much better is more? Int. J. Tuberc. Lung Dis. 6: 222-30.

[17]. WHO 2013; Tuberculosis Diagnostics: www.who.int/tb
[18]. WHO, (2009) Global TB Report *World Health Organization: Geneva, Switzerland*.
[19]. WHO (2010) Fact Sheet: Infection and transmission. *World Health Organization: Geneva, Switzerland*.
[20]. WHO (2006b) The Stop TB Strategy – building on and enhancing DOTS to meet the TB related Millennium Development Goals. *WHO/ HTM/TB2006.368. Geneva: World Health Organization*.
[21]. World Health Organization (1998). Laboratory services in tuberculosis control. Part I: organization and management. Geneva: WHO.
[22]. WHO (2003) *Toman's Tuberculosis. Case Detection, Treatment and Monitoring.*, 2nd ed: WHO, Geneva.

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