Smear positive pulmonary tuberculosis in Bida, North Central Nigeria

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Citation

Abstract
Tuberculosis is a major cause of morbidity and mortality and Nigeria ranks among the 22 high-burden countries for tuberculosis (TB). Objective: To measure the burden of pulmonary tuberculosis (PTB) in Bida, Nigeria. Methodology: A retrospective study was conducted from January 2011 to December 2012. Ziehl-Neelsen staining method was employed and examined microscopically. Result: A total of 1375 data of TB suspects were evaluated and 124(14.0%) were found to be sputum positive for acid-fast bacilli (AFB). Higher prevalence was found in male 17.2% (124 out of 721) than in female 10.6% (69 out of 654). 79.3% of smear positive PTB (153 out of 193) cases were in the age group between 20-49 years. Statistical significant association was observed between age and gender with pulmonary tuberculosis (P< 0.05). Conclusion: The prevalence of smear positive pulmonary tuberculosis is high in Bida. This study showed that tuberculosis is affecting every one regardless of age and the magnitude is higher in the economically productive age groups. Therefore, to reduce the spread of the disease, intensification of health education on TB is recommended.

1. Introduction
Tuberculosis (TB) is a global burden disease and has remained a major health problem world over. Although it occurs predominantly in resource-limited countries, it also occurs in the developed world. Despite implementation of effective control programs, it has remained a major cause of morbidity and mortality in all age groups of human populations around the world. According to the World Health Organization (WHO) global tuberculosis report released in June 2013, an estimated 8.6 million people developed TB in the year 2012 and 1.3 million died from the disease. The number of TB deaths is unacceptably large given that most are preventable [1].

Tuberculosis mostly affects young adults, in their most productive years. However, all
age groups are at risk. Indoor air pollution has been shown to be a risk factor. In developing countries, the percentage usage of solid fuels for cooking is more than 80% [2]. Firewood or biomass smoke has been previously recognized as an independent risk factor for TB disease in case control studies conducted in India and Brazil [3-6]. Alcohol has also been recognized as a strong risk factor for TB disease. Studies concluded that the risk of active tuberculosis is substantially elevated among people who drink more than 40 g alcohol per day and/or have an alcohol use disorder [7].

The association between smoking and TB has been studied in several systematic reviews. Bates and colleagues, in their studies on the effects of smoking on TB, showed that the relative risk of TB disease was high among smokers in comparison to nonsmokers and that there was clear evidence that smoking remained a risk factor for TB infection and disease, with additional risk of death in persons with active TB [8]. This was also supported by the studies of Lin et al [9].

Rapid urbanization witnessed in developing countries and socioeconomic status of individuals has also been shown to have influence on a person’s susceptibility to infection [10, 11]. The TB burden follows a strong socioeconomic gradient between and within countries with the poorest having the highest risk [12, 13]. Diabetes has also been shown to increase the risk of active TB disease [14, 15]. A systematic review examining the association between diabetes and TB found that diabetic patients had about a threefold increased risk of developing TB when compared to those without diabetes [16]. Studies have also shown that malnutrition increases the risk of TB because of an impaired immune response [17-20]. TB disease can itself lead to malnourishment because of decreasing appetite and changes in metabolic processes [21].

Immunosuppressive conditions are also of paramount importance. HIV co-infection is the most potent immunosuppressive risk factor for developing active TB disease [22]. HIV co-infection greatly increases the chances of reactivation of latent infection of TB [23] and increases the rapid TB progression following primary infection or reinfection with TB [24-26]. Studies conducted in both high-[27] and low-burden TB countries [28] have attributed increasing TB incidence to HIV infection. HIV co-infection exacerbates the severity of TB disease while additionally TB co-infection accelerates HIV replication in affected organs including lungs and pleura [29]. TB also accelerates HIV progression through increased systemic immune activation [30]. Therefore, co-infection leads to increases in the rate of disease progression and mortality [31, 32] among patients.

Individuals with immune-mediated inflammatory disorders (IMID) are also known to be at increased risk of developing active TB, particularly after the use of tumour necrosis factor (TNF)—alpha inhibitors to treat a variety of autoimmune disease [33,34].

Bacillary load is also a risk factor for TB infection and disease. Studies have shown that smear positive cases are more infectious than the others and an untreated sputum positive patient can infect approximately 10 individuals per year, and each smear positive case can lead to two new cases of TB [35]. A study conducted by Espinal and colleagues showed that the concentration of bacilli in the sputum from a TB case is positively correlated with the infectivity of the TB patient [36].

Since 1995, many people have been successfully treated through use of Directly Observed Treatment Short course (DOTS) and the Stop TB Strategy recommended by WHO. With an efficient case detection program and the DOTS strategy, it is feasible to bring about a substantial reduction in the burden of TB in the community [37]. However, extensively drug-resistant (XDR) tuberculosis (TB) is a global public health emergency. Worldwide emergence of extensively drug-resistant tuberculosis (XDR-TB) has raised global public health concern, given the limited therapy options and high mortality. XDR TB had been defined as TB with resistance to isoniazid, rifampin, a fluoroquinolone, and at least 1 of 3 injectable second-line drugs, amikacin, kanamycin, or capreomycin [38]. Pre-XDR TB was defined as TB with resistance to isoniazid and rifampin and either a fluoroquinolone or second-line injectable agent but not both [39].

Based on WHO, Global Tuberculosis Report; 2013, Nigeria is one of the 22 High Burden Countries (HBCs) occupying the eleventh position in the world and the third position in Africa [40]. This study therefore is a retrospective study aimed at ascertaining the prevalence of smear positive pulmonary tuberculosis amongst patients attending the DOTS Clinic at the Federal Medical centre, Bida, Niger State, Nigeria.

2. Materials and Methods

2.1. Patients

Laboratory records for a period of two years from January 2011 to December 2012 of Pulmonary Tuberculosis (PTB) suspects seen at the Directly Observed Therapy Short-course (DOTS) clinic of the Federal Medical Centre, Bida, Niger state, Nigeria were retrospectively reviewed. The institution where this study was carried out is a tertiary medical institution which is also a reference centre in the state. In Nigeria, a patient to be recognized as a TB suspect needs to report to a health facility with cough for 2 or more weeks with or without accompanying symptoms. Suspects were asked to submit three sputum specimens for direct microscopy over two days. The first and the third spot specimens taken at the centre, and second one an early morning specimen according to the National Tuberculosis and Leprosy Control program (NTBLCP).

Specimens were prepared, stained and examined using standard Ziehl-Neilsen microscopy method according to the WHO/IUATLD guidelines. Positive and negative control slides were included. At least 100 microscopic fields were examined to declare a slide negative. In case of positive slides, the numbers of organisms present were classified using WHO/IUATLD guidelines. 1 to 9 AFB per 100 fields,
exact figure recorded; 10 to 99 AFB per 100 fields recorded as 1+; 1 to 10 AFB per field after examining at least 50 fields recorded as 2+; and more than 10 AFB per field after examining at least 20 fields recorded as 3+.

2.2. Statistical Analysis

A total of 1375 Data were extracted and analyzed using SPSS 16. Influence of age and gender on pulmonary tuberculosis infection was computed using descriptive analyses such as sum and percent distribution. Comparisons between frequency variables were assessed through the chi-square test. Statistical significance was set at two-tailed $p < 0.05$.

3. Results

A total of 1375 TB suspects were enrolled in this study, of the study participants ranging from 10–70 years, 721(52.4%) were males and 654(47.6%) were females. Mycobacterium tuberculosis was detected in 193 out of the 1375 suspects (124 males and 69 females). Therefore, the overall prevalence of smear positive PTB was 14.0% in the study population with a prevalence of 9.0% (124 out of 1375) amongst male subjects and 5.0% (69 out of 1375) amongst female subjects (Table 1).

Table 2 described smear positivity in relation to gender and age. Age group 20 – 29years was recorded to have the highest percent distribution of 35.8% (69 out of 193) while the lowest 4.2% (8 out of 193) was observed in age group 10 – 19years.

Gender differences in the prevalence of smear positive Pulmonary Tuberculosis was also determined and higher prevalence was found in male 17.2% (124 out of 721) than in female 10.6% (69 out of 654) (Table1).

Figure 1 and 2 graphically show prevalence of PTB amongst gender subjects and age groups respectively within the two years (January, 2011 – December, 2012). There was statistical significance between age group with PTB positivity ($X^2=2.755$ at $p=0.00$ and $X^2=564.481$ at $p=0.00$).

Table 1. Percent distribution of smear positive Pulmonary Tuberculosis prevalence rate by gender and age at the Federal Medical Centre, Bida from January 2011 – December, 2012

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total examined/ Percent</th>
<th>Smear positive/Percent</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>721</td>
<td>52.4%</td>
<td>124</td>
</tr>
<tr>
<td>Female</td>
<td>654</td>
<td>47.6%</td>
<td>69</td>
</tr>
<tr>
<td>Total</td>
<td>1375</td>
<td>100%</td>
<td>193</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 – 19</td>
<td>101</td>
<td>7.3%</td>
<td>8</td>
</tr>
<tr>
<td>20 – 29</td>
<td>394</td>
<td>28.7%</td>
<td>69</td>
</tr>
<tr>
<td>30 – 39</td>
<td>307</td>
<td>22.3%</td>
<td>43</td>
</tr>
<tr>
<td>40 – 49</td>
<td>268</td>
<td>19.5%</td>
<td>41</td>
</tr>
<tr>
<td>50 – 59</td>
<td>142</td>
<td>10.3%</td>
<td>15</td>
</tr>
<tr>
<td>60+</td>
<td>163</td>
<td>11.9%</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>1375</td>
<td>100%</td>
<td>193</td>
</tr>
</tbody>
</table>

Table 2. Gender and Age wise occurrence of smear positive Pulmonary Tuberculosis at Federal Medical Centre, Bida from January 2011 – December, 2012

<table>
<thead>
<tr>
<th>Age group</th>
<th>Smear Positive/Percent</th>
<th>Male/Percent</th>
<th>Female/Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – 19</td>
<td>8</td>
<td>4.2%</td>
<td>0</td>
</tr>
<tr>
<td>20 – 29</td>
<td>69</td>
<td>35.8%</td>
<td>45</td>
</tr>
<tr>
<td>30 – 39</td>
<td>43</td>
<td>22.3%</td>
<td>31</td>
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<tr>
<td>40 – 49</td>
<td>41</td>
<td>21.2%</td>
<td>24</td>
</tr>
<tr>
<td>50 – 59</td>
<td>15</td>
<td>7.8%</td>
<td>12</td>
</tr>
<tr>
<td>60+</td>
<td>17</td>
<td>8.8%</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>193</td>
<td>100%</td>
<td>124</td>
</tr>
</tbody>
</table>

Figure 1. Bar chart showing percent distribution of smear positive pulmonary TB prevalence rate by gender.

Figure 2. Bar chart showing percent distribution of smear positive pulmonary TB prevalence rate by age group.
4. Discussion

In this study, the overall prevalence of smear positive PTB among patients attending Federal Medical Centre, Bida between January, 2011 to December, 2012 who had coughed for two weeks or more was found to be 14.0%, which indicates that the disease is of major clinical significance in the study area and also in Nigeria. The prevalence rate in this study is similar to the finding of Imam and Oyeyi who reported a prevalence of 14.7% in Kano, North- west Nigeria [41] and Yohannes et al who reported a prevalence of 14.2% in eastern Ethiopia [42]. However it is low, when compared with a study from Pakistan which found a prevalence rate of 35% [43]. This could be as a result of differences in TB burden in the two countries as contained in the 2013 W.H.O. publication of the 22 High–Burden Countries [40].

The global data on tuberculosis prevalence have shown that the prevalence of PTB is similar in males and females until adolescence; but after that, it appears higher in males [44]. We observed a Male to Female smear positive PTB ratio of 1.8: 1 (Tables 1 and 2). This is consistent with results from other researchers. Many studies of gender differences in TB have also reported higher Male to Female prevalence ratio. A 2:1 Male: Female ratio was reported in Pakistan [45, 46]. Bangladesh Bureau of Statistics (1994 – 1995) gave a Male: Female ratio of 2.1:1 [47] and Zaman et al in Dhaka, Bangladesh reported a Male: Female ratio of 3:1 [48]. Access to health facilities, social stigma associated with PTB and dedication to household responsibilities have been identified as problems militating against case finding in women [49, 50]. The foregoing is validating the assumption that female TB cases in this part of the world are under detected.

Our study revealed a statistically strong association between smear positivity and age of the patient (p value=0.000). Similar to the findings from various studies, the finding in this study showed that tuberculosis is affecting every one regardless of age, but 153 out of 193(79.3%) of smear positive PTB cases were in the age group between 20-49 years (Table 1). This might be due to the fact that individuals of this age in their life tend to be more active and more interactive with other people than the elderly and the very young.

In Figure 1 and 2, the prevalence of smear positive PTB were graphically analyzed. This examination revealed that as age increases, prevalence of smear positive tuberculosis decreases.

5. Conclusion

Female TB cases in developing countries like ours are under detected and may serve as potential source of latent infection; we hereby advocate improvement in healthcare services accessibility and awareness campaign strengthening. We also suggest a downward review of NTLP guideline for TB suspect especially among the 22 High-Burden Countries to be patient coughing for one or more weeks as this will accelerate early TB case detection and treatment.

References


