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SPUTUM CONVERSION RATES (SCRs) AMONG SMEAR POSITIVE PULMONARY TUBERCULOSIS PATIENTS ON ANTI-TB DRUG: ASSESSING THE NNAMDI AZIKIWE UNIVERSITY TEACHING HOSPITAL, NNEWI, NIGERIA.

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ABSTRACT

Tuberculosis (TB) remains a major public health issue in Nigeria, which accounts for 5.6% of the overall global TB burden. Early case detection and effective treatment using the Directly Observed Treatment Short Course (DOTS) strategy are the adopted control programs. An operational indicator for the DOTS strategy is the sputum conversion rate (SCR) at the end of two months of intensive treatment. This study determined the association between treatment and SCR among patients attending the DOTS clinic of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria. A total of 215 sputum smear positive pulmonary TB patients enrolled for treatment at the TB DOTS clinic between January, 2012 and February, 2014 were recruited for this study. Of these, 180 patients who completed their intensive phase of treatment were reviewed by follow up sputum smear microscopy. Two consecutive early morning sputum samples were collected from each patient and examined microscopically to determine sputum conversion rate. The relationship between SCR and initial sputum grading between genders of patients were determined. The study recorded a sputum conversion ratio of 76.7% and SCR was seen to have a significant association with initial sputum grading. The lower sputum grading (scanty and 1+) had higher SCR (92.95% and 83.7% respectively) compared with the higher sputum grading (2+ and 3+) which had 71.4% and 72.1% SCRs respectively. The different age groups showed comparable SCR. The females had a higher SCR (78.6%) than the males (73.6%). It may be necessary to consider the relationship between SCR and initial sputum grading in determining the dosage and duration of therapy in the DOTS program.

KEYWORDS: Tuberculosis, DOTS, SCR, Treatment.

1. INTRODUCTION

Tuberculosis (TB), as old as more than 130 years, remains a major public health issue, despite being a preventable and curable disease. Annually, it kills between 1 and 2 million people, mainly people of productive age, and people living with HIV/AIDS. An estimated 95% of TB cases and 98% of TB deaths occur in developing countries, including Nigeria.[1] TB is an air borne infection that occurs in more than 70% of cases as pulmonary tuberculosis (PTB), affecting primarily the lungs. PTB patients who are usually sputum smear positive (SSP) are the most significant source of TB transmission in the communities.[2] TB infection is through inhalation of infectious droplet nuclei forcefully released when a SSP-PTB patient coughs sneezes or spits and it is estimated that one such patient can infect between 10 and 15 other persons annually.[3] Detecting and treating smear positive PTB cases are the most effective means of eliminating TB from the population. Control programs aim to achieve this using DOTS (Directly Observed Treatment Short course), is WHO (World Health Organization) recommended strategy for detection, cure and control of TB. The DOTS strategy has five major components, one of which is quality assured laboratory diagnosis of TB using sputum smear microscopy method.[4]

Out of the available techniques for sputum smear microscopy, the Ziehl Neelsen staining method is recommended for use in the National Tuberculosis Program (NTP) in Nigeria.[5] The method is quite attractive for public health programs being fast and

inexpensive, requiring simple equipment. It is also specific enough that no confirmatory testing is needed.[6] It provides not only visual evidence of tuberculosis but also of the bacterial burden[7] as its smear positivity correlates well with the severity of pulmonary TB, the infectiousness and risk of death of the patients in untreated cases. Microscopy result is based on the number of acid-fast bacilli per oil immersion field and the different grading indicates different levels of bacillary load.[8] According to the NTP guidelines, the treatment regimen for new SSP/PTB patients consists of a 2-month intensive phase using the first line drugs, rifampicin, isoniazid, ethambutol and pyrazianimide, followed by a 4-month continuation phase of daily rifampicin and isoniazid.[5] Upon treatment, it is expected there would be a multifold decrease in bacillary load of the sputum such that patients who adhere to treatment regimen become smear negative after two months of treatment at a conversion rate of 80-90%.[9] At the end of the 2-month intensive phase of treatment, patients are sent for follow up smear microscopy using two consecutive early morning sputum samples to determine smear conversion. Smear conversion is defined as new sputum smear positive pulmonary TB case who becomes smear negative at the end of the 2-month intensive phase of anti - TB treatment and is therefore no longer infectious as confirmed by at least two consecutive negative sputum acid fast bacilli[5]. The smear conversion rate (SCR) is an operational indicator for the DOTS strategy.[10] WHO recommends the use of SCR as vital indicator for monitoring the TB program and as a trigger for assessment of the patients.[11] Several factors, including high initial sputum smear AFB grading, may delay SCR in the treatment of tuberculosis. Delay in sputum conversion at 2-3 months is one of the predictors of treatment failure and relapse.[12] Several studies elsewhere had shown that SCR is associated with initial sputum grading. It was therefore the aim of this study to determine the SCR and its association with initial sputum AFB grading age and gender in patients attending the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria.

2. MATERIALS AND METHODS

This was a retrospective study conducted at the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria. This study was approved by the Research and Ethics Committee of the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi. The study population comprised of 215 sputum smear positive pulmonary TB patients enrolled for treatment at the TB DOTS clinic between January, 2012 and February, 2014. Their initial sputum smear microscopy using the hot Ziehl Neelsen method demonstrated acid fast bacilli (AFB) with grading and reporting done according to the World Health Organization/International Union Against Tuberculosis and Lung Diseases (WHO/IUATLD) guidelines as adopted by the National Tuberculosis Program (NTP).[5] Overall, out of the 215 patients, 14 died before the end of the 2-month intensive phase, 11 were transferred to other facilities while 10 defaulted and were lost during follow up. The remaining 180 who successfully completed their intensive phase of treatment were reviewed and referred back to the TB DOTS laboratory for follow up sputum smear microscopy.

Two consecutive early morning sputum samples were collected from each of the 180 SSP /PTB patients using leak-proof wide mouthed transparent sputum cups. Smears measuring 1x2 cm in diameters were made from each specimen received, stained by hot ZN staining method and examined microscopically to determine sputum conversion. The initial sputum grading, gender and ages were compiled from the TB register and analyzed in relation to sputum conversion rate.

3. RESULTS

Out of the 180 subjects that presented for follow up microscopy, 138/180(76.7%) converted at the end of the intensive phase of treatment. Table 2 shows the pretreatment sputum grading and their various sputum conversion rates (SCRs) at the end of the 2-month intensive phase. The lower sputum grading (scanty and 1+) had higher SCR (92.95% and 83.7% respectively) compared with the higher sputum grading (2+ and 3+) which had 71.4% and 72.1% respectively. Table 3 shows the sputum conversion rate with respect to gender. A total of 81 of 110 (73.6%) males and 55 of 70 (78.6%) females converted at the end of the 2-month intensive phase of treatment. Table 4 shows sputum conversion rate in relation to age. Conversion rate at the end of intensive phase of treatment was not related to age groups. The various age grouping showed similar sputum conversion rates.

Table: 1 Interpretations of ZN results according to the NTP guidelines.

Number of AFB found	Records	Report as
No AFB in at least 100 fields	0	Negative
1-9 AFB in 100 fields	Actual AFB counts/100	Actual AFB counts /100
10-99 AFB in 100 fields	1+	1+
1-10 AFB per field in at least 50 fields	2+	2+
>10 AFB per field in at least 20 fields	3+	3+

Key: AFB = Acid-fast bacilli

Table 2: Pre-treatment sputum smears grading and smears conversion rates.

Initial Grading	Number of patients	Number Converted	Number not converted
Scanty	14	13 (92.9%)	1 (7.1%)
1+	49	41 (83.7%)	8 (16.3)
2+	56	40 (71.4%)	16 (28.6%)
3+	61	44 (72.1%)	17 (27.9%)
Total	**180**	**138(76.7 %)**	**42 (23.3%)**

Table: 3 Sputum smear conversion according to the sex distribution of patients.

Sex	No. examined	No. converted	No. not converted
Male	110	82 (73.6%)	28 (26.4%)
Female	70	56 (78.6%)	14 (21.4%)
Total	**180**	**138 (76.7%)**	**42 (23.3%)**

Table: 4 Sputum smear conversion according to the age distributions of patients.

Age	Total	Converted	Unconverted
≤ 20	14	11 (78.6%)	3 (21.4%)
21-30	58	44(76.3%)	14 (23.7%)
31-40	39	30(76.9%)	9 (23.1%)
41-50	35	27(75.0%)	8 (25.0%)
51-60	18	14 (77.8)	4 (22.2%)
≥60	16	12 (78.6)	4 (21.4%)
Total	**180**	**138 (76.7%)**	**42 (23.3%)**

4. DISCUSSION

Sputum conversion results at end of the intensive phase of TB treatment are used for the management of patients and for monitoring the performance of the DOTS program. It is to a great extent, an indicator of treatment outcome. Successful conversion is associated with good treatment outcomes while a delayed conversion is an important predictor of treatment failure and potential relapse and drug resistance.[13] Amongst other factors, (namely: cavitory lesions, old age, uncontrolled hyper-glycerin/diabetes mellitus, poorly supervised or incorrect antibacterial treatment regimens), initial sputum grading seems to be the most important factor that may delay or affect the time to convert. Initial sputum grading signifies different levels of bacillary load and correlates well with the degree of cavitations and infectivity and therefore a good indicator to evaluate treatment response and outcome.[9] This present study showed a sputum conversion rate (SCR) of 77.2% in new SSP/PTB at the end of 2 month intensive phase of treatment. This SCR is a little above the WHO recommended SCR of at least 75%, but lower than those found in other studies in Morocco 95%[9], Tanzania 98.8%[14], Cameroun 86.6%[15], Rwanda 82%[16], Burkina Faso 92.0%[17], China 95.0%[18], India 91%[19] and back home in Kano, northern Nigeria 91%[20] and Umuahia, eastern Nigeria 84%.[21] Though an SCR of 77.2% indicates the need for assessment and improvement, our facility DOTS program appears to be doing well in the context of the WHO recommendation. Again, even in a well functioning national TB program 25% of initially PTB positive patients may still be smear positive at the end of the intensive phase of treatment despite good adherence and supervised medication.[22] Similar SCR of 78.5% was recorded in Oman[12], Uganda (76%)[23] and in a refugee camp in Thailand (75%).[24] In this study SCR was determined using only sputum smear microscopy which could have shown dead, non-viable bacilli even as patients had responded successfully to treatment and converted. May be, culture could have shown a higher SCR but unfortunately there is no culture facility in our site. Another possible explanation for this level of SCR could be the differential compliance among patients. Patients with underlying disease conditions like HIV/AIDS or diabetes mellitus may have different risk factors for non-conversion and these were not considered in this study. The present study also showed an association of SCR with initial sputum grading. From table 2, the lower sputum grading (scanty and 1+) had higher SCR (92.95% and 83.7% respectively compared with the higher sputum grading (2+ and 3+) which had 71.4% and 73.8% respectively. The results tallied with the results of the several other studies afore mentioned[9,16,20,21] The females had a slightly higher SCR (78.6%) than the males (73.6%). In two separate studies in Morocco and Oman gender was not associated with SCR, but Balasubramanian et al in India reported that males were more likely to default in taking their drugs compared to the females who are more likely to adhere and comply with drug regimen and therefore more likely to have a better SCR.[25] Conversion rate at the end of intensive phase of treatment was not significantly related to age groups.[12] The various age grouping showed comparable sputum conversion rates.[12] This present study tallied with the report of the Oman study which also showed that SCR was not significantly associated with age.[12] However, Arora *et al*. in India observed that geriatric tuberculosis patients showed lower SCR compared with the younger patients[26] while Singla *et al*. showed that patients above

60 years had an almost six times greater risk of remaining sputum smear positive after two months of intensive treatment than patients aged 21-40 years.[27] Follow up microscopy at the end of the 2 month intensive period is very crucial and should be given more importance rather than being seen as program partners' documentation exercise. Those who failed to convert are more likely to remain infectious for a longer time and would continue to infect more people in communities. They therefore need closer watch by the DOTS clinic staff. They are required to have more stringent self precautionary measures to break the chain of infection in the community.[10] Infection control measures are recommended for them to minimize the spread of infection and they need to be subjected to further investigations for possible presence of drug resistance using the GeneXpert MTB/RIF or culture technique.

CONCLUSION

SCR is associated with initial sputum grading. The dosing of TB treatment is based on pretreatment weight of patient with no consideration of the initial sputum grading. It may be necessary to take the initial sputum grading into consideration in determining dosage and duration of therapy in the DOTS program.

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