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How accurate are self-reported smoking habits in patients with tuberculosis?

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ABSTRACT

Background

Smoking or chewing tobacco is a global public health problem that is becoming increasingly prevalent in developing countries. These same countries often also have high rates of tuberculosis disease and infection. As smoking can adversely affect tuberculosis severity, response to treatment and relapse, it is therefore important that clinicians have an accurate picture of patients' smoking habits. Self-reported smoking habits may be unreliable and objective measurements of tobacco exposure more accurate.

Objective

To determine the reliability of self-reported smoking habits in patients with tuberculosis by measurement of urinary cotinine levels, an objective measure of tobacco exposure.

Methods

Self-reported tobacco use was recorded in 100 patients receiving treatment for active or latent tuberculosis using an interviewer administered 'questionnaire. Urinary cotinine levels were measured by the SmokeScreen test 24hours after the end of treatment.

Findings

Of 81 reported non-smokers, 10 had a positive test for cotinine, six of whom gave a result indicative of heavy (11-15 cigarettes/day) or very heavy (>16/day) smoking. Of the 17 self-confessed smokers and two chewers of tobacco, nine gave a result consistent with very heavy smoking although none had reported this degree of tobacco use.

Conclusions

Important discrepancies exist between subjective and objective smoking habits. Reliance on patient history may adversely affect response to tuberculosis treatment, and some patients will be denied appropriate intervention for smoking cessation.

Keywords: Smoking, Tuberculosis, Cotinine, Self-Reporting

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INTRODUCTION

Smoking is an independent risk factor for tuberculosis (TB) infection, disease and mortality,[1-3] most probably due to previously demonstrated impairment of host defence.[4] It is therefore important that clinicians can accurately identify TB patients who are actively smoking in order to offer

appropriate smoking cessation intervention. The reliability of self-reported smoking habits is often questioned and has led to the development of objective methods for assessing smoking status.[5] Exhaled carbon monoxide measurements provides a simple and rapid test but is not specific to tobacco smoke and only has a half-life of 3-5 hours, whereas plasma, urinary or salivary levels of cotinine, a metabolite of nicotine are specific to tobacco and have a half-life of 16-18 hours. A meta-analysis of the validity of self-reported smoking yielded an average unweighted sensitivity of 87% and specificity of 89% but pointed out the high degree of variability among studies,[6] with interviewer administered questionnaires giving a higher specificity and sensitivity than self-administered questionnaires. A more recent systematic review reported lower average unweighted sensitivities of 86%, 76% and 75% when compared with cotinine-based assessments of saliva, blood and urine respectively, citing declining social desirability of smoking over the intervening 14 years as a likely source of the reduced accuracy of self-reported smoking habit.[7] Both reviews noted that under-reporting was greater in studies of patients with smoking-related diseases or where smoking cessation is encouraged. This may reduce the reliability of smoking histories obtained from patients with TB, with the possibility that outcome of TB treatment may be adversely affected. In this study we assessed the accuracy of self-reported smoking habits with the results of an assay detecting urinary nicotine metabolites in a population of patients with TB.

MATERIAL AND METHODS

Patients receiving treatment for either active TB (aTB) or latent TB infection (LTBI) were recruited from two London TB clinics. Demographic data, ethnicity, alcohol use and smoking habit were recorded using an interviewer administered questionnaire. Patients provided a urine sample 24 hours after ingestion of the final dose of isoniazid which was tested for cotinine and other metabolites of nicotine, using the SmokeScreen test (GFC Diagnostics, Oxfordshire, UK). This is based on the König reaction, whereby the pyridine ring of nicotine and its metabolites (including cotinine) are labelled to form a coloured (pink) derivative as previously described.[5] 2mls of urine were injected onto the dried chemicals enclosed in the SafeTube testing device and shaken. A pink colour of varying degrees from light to deep pink at five minutes denotes a positive test. The colour was read against a standardised colour chart to semi-quantify smoking habit into none, light (equivalent to 1-5 cigarettes/day), moderate (6-10), heavy (11-15) and very heavy ($\geq$16). Patients completed informed written consent and the study was approved by Bexley and Greenwich (SE London, UK) REC (Corec#07/H0809/45).

RESULTS

One hundred patients completed the study; their demographic data and factors that theoretically could have influenced the results are shown in Table 1.

Table 1 Patients Demographics (n=100) including Kidney and Liver Function, Alcohol and Drug Use plus HIV Status

Variables	Value
Sex	
Male	56%
Female	44%
Age	
Mean ± SD	35.6+12.1
Median (range)	33 (17-74)
Place of Origin	
U.K	11%
Africa	27%
Indian Subcontinent	52%

South East Asia	4%
Caribbean	4%
Year of Entry to U.K	
Before 2000	18%
After 2000	72%
Weight	
Mean ± SD	65.8+10.6 kg
Median (range)	65 (38-94)
Creatinine	
Mean ± SD	65.3±15 mol/L
Median (range)	63 (35-103)
Estimated Glomerular Filtration Rate	
>60mls/min	100%
<60mls/min	0%
Liver Function	
Normal	96%
Abnormal	4%
Alcohol Consumption	
No Alcohol	89%
Regular Alcohol	11%
Recreation Drug Use	
Yes	2%
No	98%
HIV Status	
Positive	1%
Negative	99%

Self-reported smoking habits and SmokeScreen results are shown in Table 2. All 19 self-reported tobacco users had either smoked or chewed tobacco the day before testing, the quantity of which was representative of a standard day's consumption. Duration of smoking ranged from 3 to 40 years with a mean of 13.4±10.5 and a median of 10.0. Eight further patients recorded stopping smoking between a few days and 6 years prior to testing, with a mean cessation period of 2.0±2.1 years. Two of these had later started chewing tobacco.

Eighty-one patients denied taking any form of tobacco but only 71 (88%) of these produced a negative urine sample. A further four patients produced a negative result despite admitting to smoking the previous day; two had smoked one cigarette each, another smoked seven cigarettes and the fourth patient reported smoking 8 cigarettes.

Twenty-five urine samples were positive. Four gave a colour associated with light smoking, including one from a patient who had recorded passive smoking and one non-smoker; two moderate smoking (both had recorded not smoking); nine heavy, of whom five denied smoking, three smoked and one chewed tobacco; and ten very heavy including one who denied smoking and another who reported chewing tobacco.

Although 19 patients reported either smoking or chewing tobacco, positive results were obtained with the SmokeScreen in a further six, i.e. 24% of tobacco users failed to report its use. Furthermore, nine patients produced the colour change indicating heavy smoking (11-15/day) and ten patients produced a colour indicating very heavy smoking (≥16/day), although only two reported smoking 11-15 cigarettes the previous day and a further two must have chewed an equivalent amount of tobacco. This corresponds

to 79% of heavy to very heavy smokers under-reporting their tobacco use.

Table 2 Self Reported Tobacco Use Against the Urinary Cotinine Levels as Determined by the SmokeScreen Test

Smoking History (n=100)		SmokeScreen (n=100)				
		Negative	Light	Moderate	Heavy	Very heavy
No tobacco	81	71	2	2	5	1
Total Smokers	17	4	2	0	3	8
1-5 Cigarettes / day	9	2	2	0	2	3
6-10 Cigarettes / day	6	2	0	0	1	3
11-15 Cigarettes / day	2	0	0	0	0	2
Chew tobacco	2	0	0	0	1	1

DISCUSSION

This study demonstrates important discrepancies between subjective and objective measures of tobacco use in patients with aTB and LTBI, with significant failures to report both use and quantity of tobacco exposure. Smoking habits were obtained by an interviewer administered questionnaire rather than a self-administered questionnaire because the former has been suggested to yield a more accurate smoking history,[6] thus suggesting that reliance on self-reporting could be expected to give even greater discrepancies.

In previous studies, the sensitivity of the SmokeScreen to detect cotinine in urine was 98% and specificity 100% [8] and 92% and 96% respectively in saliva[9] in patients not taking isoniazid. The method also compared favourably with quantitative urinary cotinine levels.[5,8] In one study, isoniazid treatment was significantly associated with both false-positive and false-negative SmokeScreen results, but with wide Cis (Confidence Limits).[10] The authors hypothesized that this effect was due to the molecular similarities between isoniazid and nicotine, suggesting isoniazid could interfere with the chemicals used in the SmokeScreen. In our study, patients were only tested for cotinine at least 24 hours after taking a final dose of TB medication which included isoniazid so this drug should not have interfered with the test results as its half-life varies between 0.5 and 5 hours, depending on acetylator status.[11] Similarly, rifampicin should not have affected colour change.[12]

Cotinine will detect tobacco use from sources other than combustible cigarettes, but is specific for nicotine. Bidis which have a high nicotine and tar content, are a cheap and popular form of nicotine consumption on the Indian Sub-Continent, from where the majority of patients in this study came. Bidi use was possibly not reported. It is also possible that the number of cigarettes is a poor surrogate marker of consumption because of wide variations in number of puffs taken/cigarette, depth of each inhalation and variety of tobacco used. However, under-reporting is well recognised, both in terms of smoking status and level of smoking in admitted smokers.[8]

Smoking is important in the management of TB, because of both increased susceptibility to infection and poorer outcome of disease.[4] In a recent study of 16,345 patients with aTB in Hong Kong, smoking was found to adversely affect disease severity, bacterial response, and treatment outcome and relapse.[13] It is also associated with risk-taking behaviour and the theory that smokers may be less compliant with treatment regimens.[14] A recent study found a positive dose response relationship between salivary cotinine and both Quantiferon®-TB (QFT) Gold positivity and INF-γ, suggesting that smoking intensity is important.[15] It also reported a relatively low agreement between salivary cotinine levels and self-reported smoking, salivary cotinine levels being a much stronger predictor of QFT positivity. Smoking intensity also reflects nicotine addiction which in turn

impacts upon the difficulty of smoking cessation.[16] Together, this highlights the need to obtain an accurate picture of an individual's smoking habit in order to provide optimum patient care.

Discrepancies exist between objective and subjective assessments of smoking habits amongst patients with TB which may be attributable to an under-reporting of tobacco use, raising concerns that the response to TB treatment may be adversely affected. Further research is needed to examine whether accurate assessment of smoking habit and cessation interventions introduced at the start of TB therapy improve outcome.

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