J Clin Tuberc Other Mycobact Dis 9 (2017) 30–35

Contents lists available at ScienceDirect

J Clin Tuberc Other Mycobact Dis

journal homepage: www.elsevier.com/locate/jctube

A study on zoonotic tuberculosis in selected rural areas of Bagalkot and Belgaum districts of Karnataka state

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ARTICLE INFO

Keywords:
Tuberculosis
Zoonotic transmission
Tuberculin antigen
Animal positive

ABSTRACT

The close association of cattle/buffaloes to farmers and their family members is a well-known phenomenon in rural India. Cattle are major contributors to the income for the sustenance of families, and for many landless farmers, often the only source of livelihood. The animals are sheltered under the same roof where the family members sleep, cook and eat. This close proximity of humans to cattle/buffaloes exposes farmers and family members to tuberculosis (TB), especially if they are vulnerable (e.g. malnourished children along with adults, diabetics, people with HIV/AIDS, people with addiction to alcohol, or smokers) . Several studies have examined the risk factors that are associated with TB, such as crowding (slum dwellers), poor living conditions, alcohol, and tobacco . Other studies have found a significant proportion of diabetic patients with coexistent TB. This study examines the spread of TB from animals to humans and its public health significance. To achieve this, selected numbers of cattle/buffaloes were tested for TB and the association with humans and animals was examined.

Introduction

Tuberculosis in humans is a public health problem; India has the highest burden of TB in the world. The World Health Organization (WHO) TB statistics for India for 2015 mentions an estimated incidence of 2.2 million cases out of a global incidence of 9.6 million. The estimated TB prevalence in 2015 was 2.5 million. It is estimated that about 40% of the Indian population is infected with TB; the vast majority of whom have latent TB rather than active TB disease [1]. Antimicrobial drug resistance along with HIV/AIDS have added further challenges to this public health problem. In 1997, the Government of India initiated the Revised National Tuberculosis Control Programme (RNTPC), which focuses mainly on early detection and initiation of treatment [2] with an objective of controlling the spread rather than eradication.

In 2015, there were an estimated 149,000 new human cases of zoonotic (bovine) TB globally, with 13,400 deaths due to zoonotic TB. Africa carries the heaviest burden of disease and death due to zoonotic TB, followed by South-East Asia. The true burden of zoonotic TB is likely to be underestimated due to a lack of routine surveillance data from most countries [3]. Many countries lack effective data collection and reporting mechanisms; this is an urgent need to address the problem of zoonotic TB and needs to be put in place with information technology methods.

Bovine TB is not as major a public health problem in the United States and western European countries, where historically (around the year 1950) a different strategy has been adopted that includes mass tuberculin testing on animals and isolation or culling of the herd if an animal is found positive. This approach has been largely neglected in Asian and African countries, which may explain why bovine TB still continues to be a major cause of morbidity and mortality.

This fieldbased cross-sectional study examines the spread of TB to humans from cattle/buffaloes (herein after referred to as 'cattle'). The study was planned and implemented by a team of veterinarians, medical doctors and a statistician.

World Bank and local state government facts and figures

In 2015, the incidence of human TB in India was 217 per 100,000 people [4]. The incidence of human TB in Belgaum District (Karnataka state) was 78 per 100,000 people in the year 2016 [5]. The prevalence

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http://dx.doi.org/10.1016/j.jctube.2017.10.002
Received 16 April 2017; Received in revised form 22 August 2017; Accepted 24 October 2017

Table A
Animal tested and positive tuberculin according to villages in the study area.

Sl No	Name of village	Number of animals tested	Number of positive (+ve) animals for Tuberculin testing
1	Budhihal SH	Total = 44, Buffalo = 14, Others = 30.	**1 buffalo +ve.** (The farmer has 2 buffalos, 1 cow tested & 1 buffalo is +ve)
2	Avaradi	Total = 41, Buffalo = 19, Others = 22	**2 buffalos +ve.** (The first farmer has 3 buffalos tested & 1 buffalo is +ve) (The second farmer has 1 buffalo, 1 calf tested & 1 buffalo is +ve).
3	Kendur	Total = 48, Buffalo = 19, Others = 29.	**3 buffalos +ve.** (The first farmer has 3 buffalos tested & 1buffalo is +ve) (The second farmer has 2 buffalos tested & 1 buffalo is +ve) (The third farmer has 2 cows & 1 buffalo tested & 1 buffalo is +ve)
4	Baragi	Total = 43 , Buffalo = 26 others = 17.	**3 buffalos +ve** (The first farmer has 4 buffalos, 3 cows tested & 2 buffalos are +ve). (The second farmer has 2 buffalos tested & 1 buffalo is +ve)
5	Katharaki	Total = 27, Buffalo = 21, Others = 6.	**3 buffalos +ve.** (The first farmer has 3 buffalos tested and 1 buffalo is +ve). (The second farmer has 2 buffalos tested & 1 buffalo is +ve) (The third farmer has 1 buffalo & is +ve)
	TOTAL	203	12

of human TB in Belgaum District was 90 per 100,000 people in the year 2016 [6]. According to the 2011 census of the Karnataka government, the total human population in the five villages where this study was conducted was 13,085; the total cattle population per the 2016 census was 5301 [7].

Methods

This study was done in selected five villages that were selected based on the information gathered through a questionnaire. Animals were selected from households having any one or more the following: history of TB, diabetes, raw-milk consumption, and chronic respiratory diseases. The primary information about the history of TB illness and other respiratory illnesses was collected from the local government health workers. Based on this information, 27 to 48 animals in each village were screened for TB by injecting tuberculin antigen (Tables A and B).

While doing Tuberculin testing on animals, it was found that this was not a routine procedure and so the study team faced hurdles while testing in the field. This reflects at least in the Indian context the neglect of detecting TB in animals by using Tuberculin testing and so a brief outline of the experiences is shared below.

Tuberculin antigen (Picture-1) was procured from IVRI, Izzatanagar [8]; training was given to the local veterinary technicians by qualified and trained veterinarian team members before initiating testing. Tuberculin testing was performed on animals after shaving the area on the right side of the neck, throughout to keep uniformity (Picture-2). A digital Vernier Caliper (Picture-3) was used to measure the thickness of the skin before injecting the 0.1 ml of the tuberculin antigen intradermally with a Tuberculin syringe (Picture-4). During the procedure, animals were restrained by being held forcibly by the cattle owner or at times tied down (Picture-5). The reading of the skin test was done 72 hours after injecting the antigen; increase in the thickness of skin of more than 5 mm measured by using Vernier Caliper or induration or eryhthematous or tenderness changes by palpating was evaluated (Picture 6 and video). Informed consent was sought from the owners of the cattles before the procedure was undertaken.

Table B
Number of human population examined in each village from families where the animal was +ve along with detected human +ve.

Sl No	Name of the village	Number of subjects clinically examined	Clinically detected TB
1	Budhihal HS	5	Nil
2	Avaradi	25	2
3	Kendur	18	Nil
4	Baragi	15	2
5	Katharki	14	1
	TOTAL	**77**	**5**

Household members of the Tuberculin positive cattle that tested tuberculin-positive and an equal number of household members with cattle that tested tuberculin-negative cattle were examined by two senior medical doctors with clinical experience of more than three decades for evidence of pulmonary and extra pulmonary tuberculosis. A proper ethical committee was set up and consent was taken from the head of the family in a form (in regional language) after duly explaining its contents and the need for clinical examination. Every effort was made to educate the family regarding the public health issues of TB. Towards this, a one page write up in the regional language was done and was distributed to each family and the public.

Chi square test was used to compare the qualitative variables in this study. The differences with p-values less than 0.05 were considered significant. A Z-test was used to evaluate the relationship between tuberculin status in the tested cattle and TB in the households associated with them [9,10].

Results

Two-hundred-three animals were tested; 12 were positive (Tables A and B). These 12 tuberculin-positive animals were associated with households consisting of 77 individuals. Evaluation of these 77 individuals resulted in identification of 5 TB cases (Table C), 2 of which had been treated and cured, one individual was on treatment for active TB, and 2 were fresh cases.

Chi - Square test result did not indicate a significant association between the villages and the prevalence of TB. However, there was a significant association between tuberculin status of the tested cattle and human TB in the households associated with these cattle (calculated 'Z – value' was 142.076) (Table D).

An equal number of individuals (77) in households with animals that were tuberculin negative were also clinically examined for evidence of TB. In this group, 1 case of treated pulmonary TB was identified.