

LEPTOSPIROSIS AMONG ABATTOIR WORKERS — A SEROLOGICAL SURVEY

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SYNOPSIS

The degree of leptospirosis risk was studied in two abattoirs processing pigs. A total of 150 abattoir workers, comprising 75 freelance and 46 registered butchers and 29 abattoir attendants, was investigated. They were interviewed and their serum samples were examined for the presence of leptospiral antibodies by the sensitised erythrocyte lysis (SEL) test. Serum samples of another 150 control subjects matched by sex, age and abattoir workers were over 10 times those of the controls for SEL titres of 1:100 and over seven times higher for titres of 1:25. The of $\geq 1:100$ and over seven times higher for titres of $\geq 1:25$. The highest seroprevalence was demonstrated in the butchers doing entrail cleaning. The abattoir attendants involved in bleeding and pancreas collection had the lowest seropositive rates. These findings were consistent with the degree of direct handling. No significant correlation was evident between the prevalence of positive titres and symptom prevalence or hospitalisation.

INTRODUCTION

Leptospirosis is an important zoonosis caused by species of spirochaetes belonging to the genus *Leptospira*. It has long been a recognised occupational disease among persons in contact with infected animals, contaminated water and soil, including veterinarians, slaughter-house workers and farmers handling infected livestock (1).

In Singapore there have been a few reports on leptospirosis since 1950 (2,3). However no serological surveys on specific occupational groups have been published.

Ng (4), in a descriptive case review of clinical leptospirosis, estimated that about 42% of his cases were directly related to occupational exposure, with the highest risks among public health cleaners, abattoir workers and timber and sawmill workers.

The object of this study was to determine the degree of leptospirosis exposure risk among local abattoir workers, including butchers.

METHODS

The study covered 150 abattoir workers comprising 75 freelance and 46 registered butchers, as well as 29 abattoir attendants from two abattoirs processing pigs. A total of over 2,000 pigs were slaughtered a day at the two abattoirs, which had been operating for 9 and 17 years respectively.

The study subjects were randomly selected from universe populations of 199 freelance butchers, 298 registered butchers and 45 abattoir attendants respectively. The butchers were all males while seven of the attendants were females. All the abattoir workers were Chinese except for five Indian attendants.

The freelance butchers were mainly doing entrail cleaning and handling live pigs, while the registered butchers were mainly selling pork in the wet markets. The abattoir attendants were mainly involved in evisceration or removing internal organs. Among the three groups of abattoir workers, the freelance butchers were considered to be at highest risk to leptospirosis. The abattoir attendants were thought to be at lowest risk as their work was largely mechanised.

The duration of employment of the freelance and registered butchers studied ranged from one to 40 years and six to 35 years respectively, while that for the attendants ranged from two to 17 years.

All the abattoir attendants and butchers were interviewed. Relevant medical and occupational history (particularly concerning the nature of work) were noted, as well as history of other sources of contact (eg domestic and military). Their sera were tested for leptospiral antibodies by the sensitised erythrocyte lysis (SEL) test.

Another 150 subjects, matched by sex, ethnic group, age (using 10 year age groupings) were tested for SEL antibody titre. These controls were drawn mainly from healthy blood donors and factory workers.

The test used for detecting leptospiral antibody was a microvolume adaptation of the method described by Cox (5). Initially 0.1 ml of heat-inactivated serum was diluted 1:15 by adding 1.4 ml of Veronal buffer and 0.1 ml of packed sheep erythrocytes. The serum was absorbed for 20 minutes. After centrifuging, the supernatant was used.

Into different test tubes were added 0.075 ml of different dilutions of the absorbed serum, 0.025 ml of guinea pig serum (diluted 1:25), and 0.025 ml of antigen sensitised sheep erythrocytes, prepared according to the method of Cox (5). The tubes were incubated for one hour at 37°C, and the highest dilution showing complete haemolysis was read.

RESULTS

The abattoir workers had significantly higher prevalence of positive SEL titres than the controls (see Table 1). This was the case for titres of $\geq 1:25$ ($p < 0.001$) as well as for titres of $\geq 1:100$ ($0.01 > p > 0.001$). The prevalence rates were 28.7% and 7.3% respectively among the abattoir workers as against 4.0% and 0.7% respectively among the controls.

TABLE 1: PREVALENCE OF POSITIVE SEL ANTIBODY TITRES AMONG ABATTOIR WORKERS AND CONTROLS

Subjects	n	No. with +ve SEL titres	
		$\geq 1:25$	$\geq 1:100$
Controls:	150 (100%)	6 (4.0%)	1 (0.7%)
Abattoir Workers:	150 (100%)	43 (28.7%)	11 (7.3%)
a) Freelance butchers	75 (100%)	25 (33.3%)	8 (10.7%)
b) Registered butchers	46 (100%)	11 (23.9%)	2 (4.3%)
c) Abattoir attendants	29 (100%)	7 (24.1%)	1 (3.4%)

Of the exposed subjects, the freelance butchers had the highest prevalence of positive SEL titres, although the differences were not statistically significant.

When the nature of work was considered, butchers who were involved in entrail cleaning were found to have the highest prevalence of positive SEL titres (see Table 2). This was true for titres of $\geq 1:25$ (41.5% prevalence rate) as well as $\geq 1:100$ (15.1% prevalence rate) — both $0.025 > p > 0.01$.

TABLE 2: PREVALENCE OF POSITIVE SEL ANTIBODY TITRES AMONG ABATTOIR WORKERS BY NATURE OF WORK

Nature of Work (Main Activity)	n	No. with +ve SEL titres	
		$\geq 1:25$	$\geq 1:100$
a) Entrail cleaning	53 (100%)	22 (41.5%)	8 (15.1%)
b) Evisceration	18 (100%)	6 (33.3%)	1 (5.6%)
c) Selling pork	43 (100%)	10 (23.3%)	1 (2.3%)
d) Transport and handling live pigs, carcasses and viscera	23 (100%)	4 (17.4%)	1 (4.3%)
e) Bleeding	8 (100%)	1 (12.5%)	0 (0%)
f) Pancreas Collection	5 (100%)	0 (0%)	0 (0%)

The prevalence of positive SEL titres was also high among those doing evisceration and selling pork, as well as those transporting and handling live pigs, carcasses and viscera. Workers involved in bleeding and pancreas collection (all abattoir attendants) had the lowest prevalence rates.

No significant correlation was evident between the prevalence of positive titres and symptom prevalence or hospitalisation among the abattoir workers (see Table 3). Only five of the 20 abattoir workers who had symptoms required hospitalisation.

abattoir workers for SEL titres of $\geq 1:25$ seems to be in agreement with the approach by Blackmore and Schollum. However unlike the MAT, the SEL test determines relatively recent leptospirosis infection (8). Thus our findings indicate that there is constant exposure

TABLE 3: RELATIONSHIP BETWEEN PREVALENCE OF POSITIVE SEL ANTIBODY TITRES AND SYMPTOM PREVALENCE AND HOSPITALISATION AMONG ABATTOIR WORKERS

SEL titre	n	Symptom Prevalence			Hospitalisation ^b
		Fever ^a	Abdominal Symptoms ^b (nausea/ vomiting/ or pain)	Conjunctivitis ^b	
- ve	107 (100%)	15 (14.0%)	3 (2.8%)	1 (0.9%)	3 (2.8%)
+ ve $\geq 1:25$	43 (100%)	5 (11.6%)	3 (7.0%)	1 (2.3%)	2 (4.7%)
+ ve $\geq 1:100$	11 (100%)	4 (36.4%)	2 (18.2%)	0 (0%)	1 (9.1%)

a: + ve history if not accompanied by upper respiratory tract symptoms and especially if associated with chills and rigors.

b: + ve history if associated with fever

The complaints were of fever, chills and rigors, abdominal symptoms and conjunctivitis. None of the workers had jaundice or renal symptoms such as colic and dark coloured urine.

Of the 43 workers who were seropositive, five had symptoms. Four of them were seropositive at the 1:100 titre level. Four of the seropositive workers had symptoms within three years prior to the test, while the fifth (positive at 1:100) had symptoms four years earlier. The 15 seronegative workers who had symptoms had complaints within three years prior to the test.

There was no significant association between the prevalence of positive titres and age or duration of employment in abattoir work. It was interesting that among the freelance butchers, positive titres were found in those with two years of employment while none of the five butchers employed for one year or less had positive titres. Among the registered butchers and abattoir attendants, positive titres were obtained in those with six or more years of employment.

DISCUSSION

The occupational risk of leptospirosis in the meat industry, especially in countries with a large and intensive pig industry has been highlighted (6).

The results of our study confirm that leptospirosis is an occupational hazard among abattoir workers processing pigs. Their seropositive rates were over 10 times those of control subjects for SEL titres of $\geq 1:100$ and over seven times higher for titres of $\geq 1:25$.

In their reports on the meat industry and pig farming, Blackmore and Schollum (6,7) stressed the importance of using a minimal dilution of 1:24 of sera in cross sectional studies on occupational exposure to leptospirosis. They demonstrated the persistence of titres at this dilution using the microscopic agglutination test (MAT) in medically confirmed leptospirosis cases for up to 10 and 17 years respectively.

The significantly higher seropositive rate in our

and re-infection among the abattoir workers (9).

In a three-year followup on proven leptospirosis cases, Tan (8) demonstrated a decline in SEL antibodies after 1½ years. At titre levels of $\geq 1:80$, she obtained a 40% seropositive rate between 1½ and three years. Our findings generally concur with this. In all the abattoir workers who had symptoms and were seropositive, the period between the onset of symptoms and the SEL test was within five years, with 80% of them within three years.

The lack of correlation in our study between the clinical history and prevalence of positive titre is largely due to the difficulty in establishing a firm diagnosis of leptospirosis from medical history alone. There was a general tendency among the abattoir workers to self-medicate. None of those who were treated by general practitioners or at hospitals were clear about the cause of their symptoms or whether they were related to their work.

In addition, a number of the seropositive cases with negative clinical history may be the result of infection by serotypes which give rise to subclinical or mild forms of leptospirosis (9).

The seroprevalence in our abattoir workers was between 23.9% and 33.3% at SEL titres of $\geq 1:25$. This is generally comparable with those reported by Blackmore and Schollum (6,7). Using MAT titres of $\geq 1:24$, they obtained seropositive rates of 38.5% for meat workers processing pigs only and 31% for pig farmers.

Tan (9), using SEL titres of $\geq 1:80$, reported an overall seroprevalence of 11.6% among veterinary staff. The seroprevalence in our abattoir workers for SEL titres of $\geq 1:100$ was 7.3%.

Blackmore (6) demonstrated significant prevalence of titres to pomona and tarassovi (pig-adapted serovars) in meat workers who were in contact with pigs and involved in the slaughter and processing of fresh carcasses and viscera. Our observations also indicate significant risks among such workers. Serological surveys of pigs in Singapore (10,11) have

demonstrated that *Leptospira pomona* is present in local swine.

The high seroprevalence in the freelance butchers, particularly those involved in entrail cleaning, reflect the degree of direct handling. While most of the abattoir attendants used protective gloves and boots, the butchers did not.

The management of the abattoirs are taking further measures to minimise the risk of leptospirosis infection. Among these measures will be the automation of the entrail cleaning process.

This study underlines the importance of checking the occupational exposure in persons with fever, especially if a differential diagnosis of leptospirosis is being considered. Leptospirosis is a compensable disease under the Workmen's Compensation Act, 1975.

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