Epidemiol. Infect. (1997), **119**, 357–362. Printed in the United Kingdom

An outbreak of *Trichinella spiralis* infection in southern Lebanon

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(*Accepted 4 May 1997*)

SUMMARY

An outbreak of trichinosis occurred during January 1995 in a south Lebanese village with a population of 800–1000 persons. The estimated number of persons treated for a *Trichinella*-like illness was 200. Sixty-three persons sought medical attention at a local infirmary: 44 of them were diagnosed as having trichinosis or suspected trichinosis according to their clinical symptoms, signs and laboratory tests. An environmental investigation indicated that the source of infection was pork obtained from a single butcher in the village and consumed uncooked, as an ingredient of 'kubeniye' (a local dish), during Christmas and New Year's meals. Sera of patients, suspected patients, and asymptomatic controls were tested for the presence of anti-*Trichinella* antibodies. Eight (89%) of the 9 tested patients were positive, 1 (11%) was negative. Among the 7 suspected patients, 2 (28·5%) were positive, 3 (42·9%) had equivocal results, and 2 (28·5%) were negative. Among the 20 asymptomatic persons, 3 (15%) were positive, 12 (60%) negative and 5 (25%) had equivocal results. Specimens from the implicated pork meat were examined by microscopy and were found to contain encysted larvae of *Trichinella spiralis*. This outbreak of trichinosis is one of the largest reported. Previous outbreaks in Lebanon occurred under very similar circumstances, indicating a need to control and prevent the trading of pork meat that is not under veterinary control, and to increase the awareness of the population for this problem.

INTRODUCTION

Human infection with *T. spiralis* has been reported from many countries including: Lebanon [1–5], Mexico [6], USA [7–10], Thailand [11], Hong-Kong [12], Canada [13, 14] and Kenya [15]. Most reported cases have been associated with the consumption of raw or undercooked pork or home-made meat-based products [3–6, 8, 10–12]. Infection can also be associated with the consumption of infected wild boar [1, 2, 15], walrus [9, 14], and bear [13]. Infection usually occurs within families [8, 2, 15] or in larger outbreaks – in villages or communities, after the consumption of infected meat from a common source [1–5, 9–11, 13, 14].

Trichinosis in Lebanon has been reported previously [1–5]. Recent outbreaks were associated with consumption of uncooked pork and involved large numbers of people [3–5]. We describe an outbreak of trichinosis in a rural southern Lebanese region composed mainly of a Muslim population and a Christian minority living in separate villages. The

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outbreak took place in a village with an exclusively Christian population. We became aware of the epidemic when several physicians from the affected village informed us of an outbreak. Concomitantly several persons sought medical care at our local infirmary.

METHODS

The first patients were identified and presumptively diagnosed as trichinosis by local medical authorities based on typical clinical symptomatology. According to doctors in the village approximately 200 of its inhabitants were assessed and treated for a *Trichinella*-like illness. We investigated 63 persons who sought medical care at our local infirmary located near the affected village. This infirmary is a small clinic that provides outpatient clinic services (e.g. medicine, pediatrics, surgery, obstetrics and gynecology) to the residents of the nearby villages.

Clinical investigation

Each person with a *Trichinella*-like illness was interviewed and examined by a physician: each was asked about recent consumption of raw meat and symptoms and signs were recorded, including the presence or absence of fever (> 38 °C), myalgia, periorbital oedema, abdominal pain, vomiting, diarrhoea and conjunctivitis. Routine laboratory examinations included complete and differential white blood cells counts.

Four primary criteria were used for the clinical diagnosis of trichinosis: fever (> 38 °C), myalgia, periorbital oedema and eosinophilia, which was defined by an eosinophil count greater than 10%. Four minor diagnostic criteria were also delineated: diarrhoea, vomiting, abdominal pain and conjunctivitis.

A case was defined as a person with a history of eating the purportedly infected meat in the 3-week period preceding an illness that included at least three of the primary clinical diagnostic criteria. A suspected case was defined in a person who ate the purportedly infected meat and had at least two primary and one minor criteria.

Environmental investigation

After the presumptive diagnosis of *Trichinella spiralis* infection was made, the patients were asked about recent consumption of food items made of uncooked meat and about the source of that meat.

After learning that all the families in the village bought their holiday meat from a single butcher, the butcher was asked about the source of the implicated pork. The butcher provided samples from leftover implicated meat for laboratory investigation.

Laboratory investigation

After identifying the possible source of the outbreak, a sample of the implicated pork meat was examined in our laboratory for the presence of *Trichinella* larvae. Blood samples of 9 patients, 20 asymptomatic persons, and 7 suspected patients whose symptoms and blood counts were not available were drawn approximately 4–5 weeks after the onset of symptoms for serologic confirmation of clinical diagnosis. The controls (asymptomatic persons) were relatives of patients or other persons from the affected village, who were free of symptoms, and denied any *Trichinella*-like illness during that period.

The blood samples were tested by the Reference Immunodiagnostic Laboratory, Division of Parasitic Diseases, Centers for Disease Control, Atlanta, Georgia, USA for antibodies to *T. spiralis*. All specimens were tested in the *Trichinella spiralis* Microwell ELISA kit, lot #5049 (LMD Laboratories, Carlsbad, California, USA) according to the kit insert. The test's specificity is greater than 95%, while sensitivity is in the range 32–100% and is dependent upon number of larvae ingested, and the time interval that the serum specimen is drawn relative to onset of symptoms (Wilson M, Centres for Disease Control and Prevention, unpublished data).

Statistics

Statistical differences in proportions between patients and controls were assessed using Fisher's exact test. A two-tailed p value is reported.

RESULTS

Clinical study

The estimated number of ill with a trichinosis-like illness was approximately 200 (as estimated by local physicians in the village) from the total village population of 800–1000. The estimated proportion of

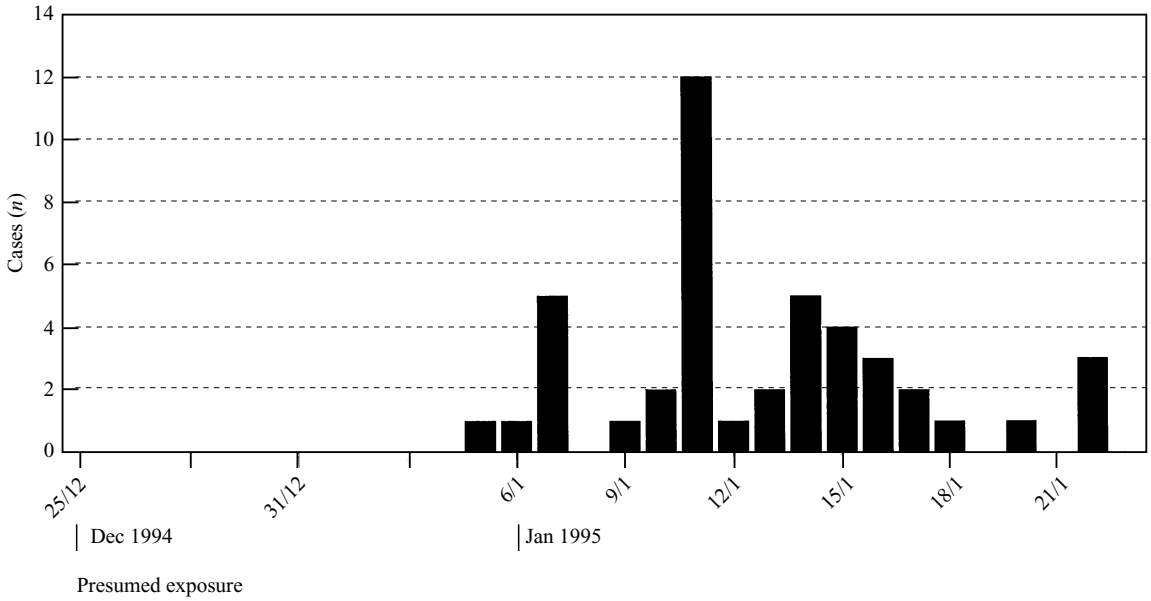

Fig. 1. Epidemic curve of cases with trichinosis. Southern Lebanon, January 1995.

Table 1. *Baseline characteristics, clinical and laboratory data of 44 definitive and suspected cases with* Trichinella spiralis *infection. Southern Lebanon, January 1995*

Characteristic	*n* (%)
Demographic characteristics	
Male	24 (55)
Mean age	33 years
Clinical data	
Incubation period (mean)	18·1 days
Myalgia	42 (95)
Fever	41 (93)
Periorbital oedema	40 (91)
Conjunctivitis	25 (57)
Abdominal pain	19 (43)
Vomiting	8 (18)
Diarrhoea	3 (7)
Laboratory data	
Eosinophilia	29 (66)
Positive *Trichinella* antibodies ($n = 9$)	8 (89)

affected people was 20–25%. Sixty-three patients were examined at our local infirmary. Of them, 44 patients matched our clinical criteria for definitive (36 patients) or suspected (8 patients) trichinosis. These 44 patients became ill between 5 January and 22 January with a mean incubation period of 18 days (range 12–21 days) (Fig. 1).

Of these 44 patients, 24 (55%) were males and 20 (45%) females. Patients were 10–70 years of age, with a mean age of 33 (Table 1). Thirty-six (82%) patients were from the affected village. Seven (16%) were from a second village and one (2·3%) from a third village, all of whom were guests in the affected village during the Christmas and New Year period. The most common symptom was myalgia (95%) followed by fever (> 38 °C) (93%), and periorbital oedema (91%) (Table 1). Other common symptoms were conjunctivitis (57%) and abdominal pain (43%). Vomiting (18%) and diarrhoea (7%) were less common. An eosinophil count higher than 10% was seen in 29 (66%) patients.

Eleven (25%) patients were hospitalized for an average of 3·8 days (range 2–8). The only significant clinical differences noted between hospitalized and non-hospitalized patients, were a shorter incubation period and a lower proportion with eosinophilia among the hospitalized patients.

Environmental investigation

The environmental investigation indicated that most of the patients seeking care from us for the *Trichinella*-like illness consumed 'Kubeniye'-during Christmas and New Year meals. This traditional dish, which is usually consumed during holidays, is prepared from minimally cooked pork meat, and eaten after minimal heating. A formal case-control study was impossible to perform, since adequate controls for investigation were not interviewed during the acute phase of the illness. Serum samples were collected from asympto-

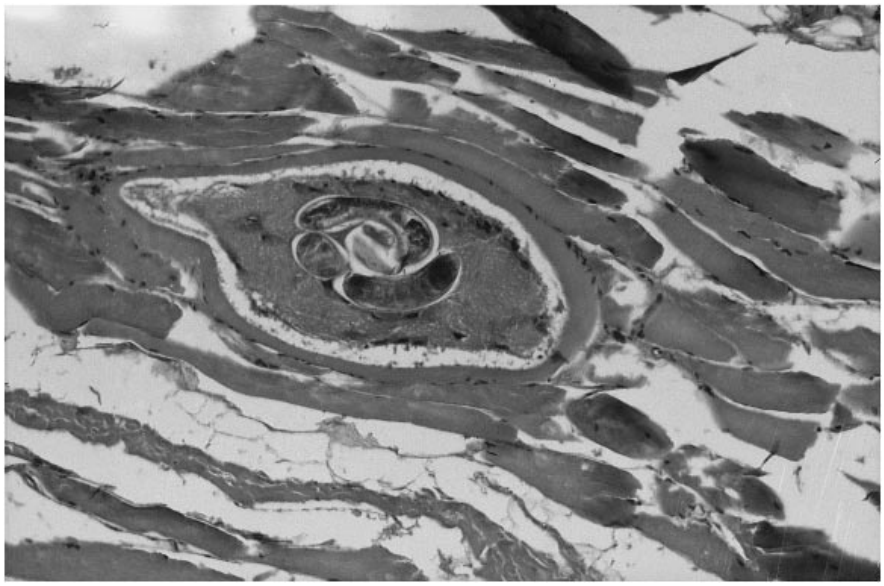

Fig. 2. *T. spiralis* larva in a sample of the implicated pork meat (light microscopy, × 100).

matic controls 4–5 weeks after the onset of the epidemic. By that time information as to their possible consumption of various food items served during Christmas and New Year meals were not considered reliable since most of the controls did not remember the food items consumed by them more than one month prior to the interview.

Almost all the families of the patients in the village bought their meat from a single butcher in the village. This butcher purchased a shipment of live pigs just before Christmas from traders in northern Lebanon but he could not provide any information as to whether these pigs were raised under proper veterinary supervision. The butcher provided leftover meat samples from this shipment for laboratory investigation.

Laboratory results

When examined by microscopy for evidence of infection, remaining samples of the implicated pork contained encysted larvae of *Trichinella spiralis* (Fig. 2). Serum specimens from 9 of 44 patients were tested by ELISA for *Trichinella* antibodies: 8 (89%) were strongly positive while 1 (11%) was negative (Table 1). Of the 7 suspected patients without clinical data 2 (29%) were positive, 3 (43%) had equivocal results and 2 (29%) were negative. Of the 20 asymptomatic persons, 3 (15%) were positive, 12 (60%) negative and 5 (25%) had equivocal results ($p < 0{\cdot}01$ by Fisher's exact test for comparison of the proportions of patients with a positive anti-*Trichinella* antibodies, by ELISA, in the group of patients versus the group of asymptomatic controls).

DISCUSSION

Outbreaks of human infection with *Trichinella spiralis* have been reported from many different areas of the world and from virtually every continent [1–15]. Most reported outbreaks were caused by consumption of undercooked pork or meat-based home-made products [3–6, 8, 10–12]. This outbreak of trichinosis affected the residents of one village in southern Lebanon where only a few outbreaks have previously been reported [1–5]. The outbreak took place in a Christian village, while there were no reported cases among the residents of the nearby Muslim villages in that area. The absence of cases among the Muslim population can be explained by the fact that this population is religious and pork consumption is forbidden according to Islam. The infected meat was consumed during Christian holidays and only by the Christian population. The estimated number of persons seeking care for a *Trichinella*-like illness (based on the estimations of local medical authorities and the number of patients treated by us) was approximately 200. The outbreak took place during January 1995 with patients presenting between 5 January through 22 January. The investigation raised the suspicion that the aetiologic agent might be a food item called 'kubeniye' made of raw pork meat and

consumed by all the patients during Christmas and New Year's meals. This suspicion was confirmed when *T. spiralis* larvae were identified by histologic examination in meat from which the 'kubeniye' was prepared.

It is interesting to note that the two last outbreaks of trichinosis reported from Lebanon (1979 and 1982) took place under similar circumstances [3–5]. In the 1982 outbreak, involving >1000 patients in four villages in southern Lebanon (including the village involved in the current outbreak), the implicated food item was also 'kubeniye' consumed during Christmas and New Year's meals. In the 1979 outbreak which involved four provinces in Lebanon, the source of the outbreak was also apparently 'kubeniye' (5). The mean incubation period (between consumption of the meat and appearance of symptoms) was 18 days, which is in agreement with other published data [8, 9]. The estimated proportion of the village population that was affected in our study was 20–25% as compared with the 46% attack rate reported by Olaison and colleagues [4]. This difference may be explained by the fact that the reported proportion of affected population in our study is an approximation based on reports of the local village physicians, while Olaison and colleagues based their estimation on an interview of patients some time after the acute illness. In addition, among the 20 asymptomatic patients whose sera were tested, 3 had positive results and 5 had equivocal results. The positive and equivocal serological results found in 8 of 20 asymptomatic persons reflect either early infection, light infection, previous infection, or could possibly be false positive reactions. This latter observation suggests that there were other asymptomatic or only mildly symptomatic patients not seeking medical care, thus the true proportion of affected people might have been higher than we estimated in the present study. In addition, it is not unlikely that the cases investigated and reported by us in the present study represent more severely ill patients, who sought our care, while most of the other patients (presumably milder cases) were treated in the village. Thirty-six (82%) of the patients examined by us were considered definite cases according to the clinical presentation and 8 (18%) were considered to be suspected cases. The clinical picture reported was quite typical of trichinosis [3, 4, 8, 10]. No trichinosis-related mortality was noted during the outbreak, and all the patients recovered without complications. This agrees with the low mortality rate reported by others [3, 4, 8]. *T. spiralis* antibodies were found in 8 of the 9 patients (89%) and 3 of the 20 asymptomatic persons (15%). These results confirmed our clinical suspicion of an outbreak of *T. spiralis* infection.

The similarity of circumstances between the trichinosis epidemic reported and previous outbreaks reported from this area [3–5] indicate a great need for public health measures to be instituted to avoid similar events in the future. These epidemics occur in the Christian population of regular pork eaters and are specifically associated with the consumption of 'kubeniye' prepared especially for Christmas and New Year's meals and made of uncooked meat. Measures should be taken by health and other state authorities to control and prevent the trading of pork meat that is not under veterinary control. Educational efforts should be aimed at the Christian population to explain the risks of consuming raw meat and that freezing the meat at -15 °C or cooking it (to 77 °C) are both effective ways of killing *T. spiralis* larvae [9].

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