

An Investigation into Five Notified Cases of Q Fever in Changhua Region

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Antecedent

Q fever is a zoonotic disease caused by *Coxiella burnetii*, a species of bacteria that is distributed globally. However, its incident patterns and clinical symptoms vary in different regions. The Q fever infection suffered by animals is called “coxiellosis,” and it is transmitted among arthropods, birds, and mammals. Most human Q fever infections originate from species of livestock or

domesticated pets [1]. Once people have been infected, the usual manifestations are either acute forms of pneumonia, flu like illness and hepatitis, or chronic form of endocarditis. Humans may get infected through inhaling contaminated aerosol droplets, and those droplets come from tissues or body fluids of infected animals. Because Q fever is not listed as a notifiable disease in Taiwan and the law does not require reporting, its actual occurrence rate and geographic distribution are not clearly known by us.

In the period between April 20 and 28, 2004, Changhua Christian Hospital, China Medical University Hospital, and Chung Shang Medical University Hospital in the central part of Taiwan reported five cases of Q fever infection. These five cases were all residents of Changhua area. Two of them were living in Erlin Township of Changhua County, while the other three cases were from Pitou Hsiang of Changhua County, Fusing Hsiang of Changhua County, and Anhsi Li of Changhua City respectively. In such a rather short 8-day period, so many cases of Q fever showed up in a rather small neighborhood, we thought it was necessary to investigate and find out if there was a major local cluster outbreak of human Q fever infections behind those spotted and confirmed cases, or even a much overlooked and widespread epidemic of the same. Field Epidemiology Training Program (FETP) of Taiwan CDC immediately went ahead to assemble an ad hoc epidemiological outbreak investigation team to undertake the task. This special taskforce consisted of two instructors plus two current trainees of the Program. One of the latter happened to be a regular staff of Changhua County Health Bureau taking the training at the moment. In other words, the investigation was deemed as part of a field training assignment in the curriculum of FETP. Besides, there were two other CDC officials specializing in disease control and prevention, one from the then Quarantine and Prevention Division (now called the Second Division instead), and the other one from the Central Region Branch (also renamed the Third Branch not long ago), which was located in Taichung City and rather close to the Changhua area where the Q fever infection cases were

reported. The investigation kicked off on April 29, and the major objectives of the investigation were: to find out whether the five Q fever cases were epidemiologically related, or if they actually belonged to a single cluster outbreak; what infection source caused each of the five Q fever cases; whether family members living in the same household of each of the five Q fever cases were also infected with the bacterium; and what else had happened during the diagnostic process in the first place. The following is a report of our findings from the investigation.

Materials and Methods

Subjects of the investigation: The five Q fever cases, the family members living with them under the same roof, and their neighbors and other kin.

Tools of the investigation: Using a self-designed semi-structured questionnaire. Its content includes basic personal information, clinic symptoms, the date of illness onset, circumstances of seeking medical help, relevant exposure factors, and the case's regular routine work and recreational activities. The questionnaire was filled up while conducting a face-to-face interview with a selected subject.

Characterizing the outbreak(s): Based on the demographic data, dates of illness onset, and incident locations of the five Q fever cases, the taskforce tried to establish the epidemiological connection in terms of personal interaction, timing, and locality.

Definition of the case: Looking into the public health records of the townships and boroughs where the five Q fever cases resided, to find out if there was anybody else having prolonged fever and suffering from sclera jaundice symptom during the period from March 1 to April 30, 2004.

Household environment inspection: Visiting the residences of the Q fever cases to inspect their house surroundings and ask people living there if they keep pets or other animals. Also taking a good look at the neighborhood to see whether

there are signs of stray cats, stray dogs, rats, livestock animals, slaughterhouses, farms, and animal hospitals.

Paying visits to the physicians taking care of those cases: Looking into the cases' medical histories and discussing with the attending physicians about the treatments they prescribed for the patients and upon which rationale they first suspected and verified Q fever in the patients.

Results

Individual case reports

Case #1: A 54-year-old male, unemployed, who lives in Anhsi Borough, Changhual City. His residence is an old-fashioned courtyard house. The house is built on the slope of a hillside with no other houses situated near by. Part of the house is used for storing various kinds of farming equipment. In the courtyard and behind the kitchen, there are stray cats passing through sometimes. The case's family keeps dogs, pigs, chicken, and ducks at home. The patient doesn't normally wear shoes when staying inside his house or going out to work. As to his recent medical history, he noticed that his four limbs started to swell on March 15, and simultaneously he wasn't feeling well at all and experienced a sudden onset of symptoms including chills, fever and profuse night sweats. He went to a near by clinic called Mouyuan Clinic that day to see a doctor and was duly examined and given some medicines to bring home. However, during the next week the symptoms did not diminish at all and kept returning after temporary abatements. So he visited Changhua Christian Hospital's outpatient department on March 22 asking for medical help. Another week passed afterwards and his sickness remained the same, and he was finally admitted on March 30 to Changhua Christian Hospital. His illness lasted for more than a month. At the time we wrote up this report, he was still having

symptoms of chills, a persistent fever, sclera jaundice, body aches, and fatigue.

Case #2: A 40-year-old male owner of a hardware factory, he lives in Pitou Township, Changhua County. There are two separate storied buildings on his property, with one housing his family and the other his factory. Both houses are surrounded by farmland, where rats are evidently roaming around. His family keeps no animal pets, poultry birds, or livestock animals. Whether at work or doing nothing, he seldom wears shoes on the premises. The case had a sudden onset of symptoms including fever, chills, and headache on March 21. He felt so sick that he was hurried once to the emergency room of Hochi Hospital in Beidou Township where he was examined by a physician and given some medicines to take but to little avail. Therefore, he went to China Medical University Hospital on March 26 seeking second opinion, and was hospitalized until April 2 when he felt somewhat better. However, soon after he returned home, the same symptoms came back to him once more and he had to be readmitted to the China Medical University Hospital to receive further treatments. Altogether he fell sick for a period of over one month. Besides, this patient is a type B hepatitis carrier. When we interviewed him, he still had sclera jaundice and appeared very frail and tired. He told us that he had visited a friend regularly and that in the vicinity of her home, he saw stray cats and dogs coming and going all the time. He remembered that shortly before he got the disease, some flea at her house bit him and caused an unusually strong reaction. Only three hours after the bite, his skin around the bite site started to blister, and before long the blisters broke and festered. He then showed us the awful dark-colored eschar on his left ankle.

Case #3: A 49-year-old male, this patient is a school employee and a farmer.

He lives in Erlin Township of Changhua County and his dwelling is an independent single-family house facing a large piece of cropland where you occasionally see rat tracks. Next to his house, someone has a chicken ranch and the environment looks quite messy. He is used to not wearing shoes when working in the field. He began to show symptoms on March 26, including chills, night sweats and a total depletion of strength. So he went to the emergency department at the Erlin Branch of Changhua Christian Hospital to seek help. He was examined by a physician and brought some medicine home to take, but it did not seem to be helpful. Then he checked into Chung Shang Medical University Hospital as an inpatient to receive therapy. His illness lasted for about twelve days, and when we saw him, he still had sclera jaundice and tiredness.

Case #4: A 76-year-old male farmer and a resident of Fusing Township, Changhua County, he also lives in an independent single-family house next to a farmland where field rats are spotted sometimes. The patient's family keeps a dog, three cats, a monkey, and a flock of geese and ducks (kept behind the house). He does not wear shoes regularly at home or when working in the field. The case had a medical history of high blood pressure but had not followed the doctor's advice to take medicine for it regularly. On March 26, he started to find that he could not raise his arms and felt as if he had lost all his strength. He was rushed to the emergency room of Changhua Christian Hospital and hospitalized for treatments. He was released on April 1, but no sooner than arriving at home he started to have symptoms again, such as fever, vomiting, total body fatigue and a rash. So he was readmitted to Changhua Christian Hospital in no time at all, and his condition was up and down like a roller coaster ride during this second stay at the hospital. He looked and felt much better when he was released again on April 5. His

illness lasted for two-dozen days. As we interviewed him, he still had a bit of sclera jaundice, and he claimed to have lost strength in his arms and feel tiredness all over his body.

Case #5: A 49-year-old male, he is a precinct chief (elected borough master) in the neighborhood and a farmer by trade. He lives with his family in Erlin Township, Changhua County, and his residence is in a duplex building. His family keeps no pets and animals, and his house and the surrounding area appear to be quite neat and in good order. He does not wear shoes habitually when working in the field. He became quite ill on April 6 when he started to experience chills, fever, profuse night sweats, and discomfort all over his body. He was hurried to the emergency room at the Erlin Branch of Changhua Christian Hospital, where he was examined and sent home with medicine to take. However, the medicine did not seem to help, so he went to seek more medical care at Chung Shang Medical University Hospital and he was hospitalized there. At the time we interviewed him, he still had the signs of sclera jaundice and body fatigue.

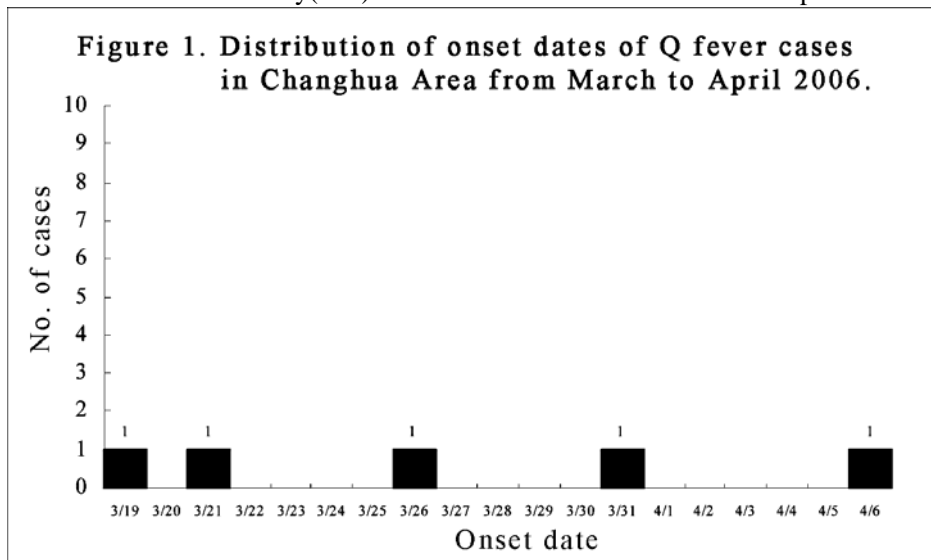
Put the five cases together and we saw a general pattern in them. They all had fever, sclera jaundice, and fatigue as symptoms. Most symptoms came and went, repeated themselves several rounds but fever always lasted more than ten days. They are all male, living on or in the vicinity of farmland. Among them three are farmers by trade, two kept pets at home, three had poultry birds roaming on their premises, and one had livestock animals around his house. They all lived in independent housings with surrounding yards frequent with tracks of stray cats, stray dogs, and field rats. What they don't have are leather goods factories, slaughterhouses and sheep farms. They all lead a similar simple, casual life and none of them like to wear shoes. Another common fact for them is that none of them had traveled to other countries in the one month before illness onset.

An epidemiological description

Although both Case #3 and Case #5 live in Yuandou Borough of Erlin Township, their houses are quite far apart from each other. However, Case #3 would go to Case #5's home everyday to have tea together. The other three patients each lives in a different township or borough (Pitou Township, Fusing Township, and Anhsi Borough), and they didn't know one another. The record shows that from March 19 to April 30, 2006, Changhua County had five confirmed Q fever cases. The distribution of their onset dates are shown in Figure 1.

Test results

Serum specimens collected from the five cases were all examined with indirect fluorescence assay(IFA)and confirmed to be *Coxiella burnetii* positive.



Discussion

The diagnosis of Q fever infection case is by no means easy. All five cases mentioned above had suffered from persistent fever for more than three

weeks before being eventually diagnosed Q with fever infections. For instance, Case #2 had an enduring fever but without much of any apparent infection symptoms, so the attending physician had the case discussed with several colleagues of his before he suspected that the patient was infected with Q fever. Case #1 and Case #4 also puzzled their doctors first with the persistent fever that would not relent nor reveal the cause. Finally, the physician had to resort to Q fever tests before getting to the conclusions. Look at their symptoms, one would realize that they matched the characteristics of Q fever quite well [2], especially the symptoms of fever, sclera jaundice, and exhaustedness. The results of their liver function tests disclosed abnormalities [3]. Another clue lied in the sclera jaundice they all shared. According to Kovacova and Kazar's point of view, the onset of their symptoms indicated that the infections were displayed in the acute mode [1]. A study by Alarcon, et al. shows that 90% of Q fever infected people would have a prolonged fever often lasting for any length between 1~4 weeks [3]. In our investigation, all five cases suffered from persistent fever.

In spite of the fact that the disease onset of the five cases occurred within the typical 2~3-week incubation period of Q fever [4], there are no apparent connection between any of the individual cases with another involving any personal and geographic relationships. Therefore, we assume that in view of their occurrence characteristics, they were all sporadic individual cases. In other words, there were no cluster outbreaks whatsoever. An important fact that seems to support our assumption is that none of the cases' family, next of kin, or neighbors showed similar symptoms. On the contrast, all those five cases shared a common habit of wearing no shoes. Three of them were in fact farmers who grew things in the field and lived on farmland. The surroundings of their residences or their community environments were playgrounds for stray cats and dogs. Kovacova and Kazar indicated that the most frequently seen infection sources of human Q fever cases are livestock animals and house pets

[1]. Another report [5] told us that among the veterinary personnel working at veterinary hospitals, 62.3% have been bitten by fleas, 16.0% have been scratched by cats, and some have had Q fever infections because of these incidents. Komiya, et al. reported that in the 310 Japanese house cats surveyed by them, 14.2% had been infected with Q fever, while among the 116 Korean house cats in the survey, the rate turned out to be 8.6%. Besides, almost half (41.7%) of the 36 Japanese stray cats had Q fever before. They concluded that different areas have different Q fever infection rates. Alarcon, et al. also illustrated that among 231 human Q fever cases, 39.0% had contact with animals before the onset of illness [3]. Buhariwalla, et al. described in yet another report that three members of the same family played with a Q fever infected house dog and developed Q fever symptoms 8~12 days afterwards [7]. Cases of Q fever transmission from dog to human were also mentioned in another paper by Komiya, et al. [8]. Yadav, et al. indicated that rodents are a group of animal possibly passing on Q fever to humans [9]. In our investigation, we saw Case #4 had house cats of his own, and he and the others all had stray cats and dogs frequently roaming around their residences (if you can see stray cats in daylight, it indicates that the number of stray cats is quite large, or they are not afraid of humans). Therefore, we do suspect, although not certain, that cats were likely the infection sources of those five patients.

From a review of literature, we find that sheep and goats (especially goats) and cattle are easy preys of Q fever[10-12]. That is why slaughterhouse workers are sometimes singled out as candidates prone to Q fever infections [13]. However, we find that none of the five cases were living close to any veterinary hospitals, livestock farms, or slaughterhouses. Therefore, the odds they got infected through those special localities are quite small. There is another possible infection route, i.e. by drinking *Coxiella burnetii*-contaminated goat milk [14]. But we find that the five patients did not drink any fresh goat milk, so goat milk should not be the cause either.

Recommendations

The five confirmed Q fever cases were all living in Changhua Area. Their living environments are rather similar to one another, including their closeness to farmland, livestock and poultry. During the questionnaire interview sessions, we learnt that they shared the common factor of having many stray cats, stray dogs, and rats frequently passing by the empty yards around their residences. A bad habit they seem to share is none of them care to wear shoes at work. Based on these findings, we propose the following recommendations to improve the situation:

1. Strengthen health education on how farmers can better protect their feet while working.
2. Keep up the campaign to promote cleaning and sterilizing work in and around the house;
3. Develop strategies to minimize or eradicate stray cats, stray dogs, and rats in the neighborhood.
4. Upgrade Q fever surveillance and keep on tracking individuals who are either *Coxiella burnetii* (positive) or with apparent Q fever symptoms.

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