Research that Begins with a Patient in Front of You: *Legionella* Bacteria in Puddles on Roads

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ABSTRACT
In this article, I would like to describe researches that begin with a patient transferred to an emergency department of a local hospital in a rainy season. A patient transported after a car accident turned out to have Legionnaires' disease (LD). Although the causal relationship is unknown, Legionella genes were detected in the evaporator of the car driven by the patient. In the process of searching for the source of the infection, it was found that *Legionella pneumophila* prevalently exists in puddles on the road. *Legionella* bacteria can be detected in the water from rain, well, river, tap, puddle in Indonesia too. It should be recognized that *Legionella pneumophila* can be frequently exposed to in the daily living environment. The frequency of LD should be monitored in various regions, especially among patients with severe community-acquired pneumonia at the core hospitals.

Keywords: *Legionnaires' disease, Legionella pneumophila, traffic accident, evaporator, puddle, global warming.*

1. INTRODUCTION

In this article, author would like to describe researches that begin with a patient transferred to an emergency department of a local hospital in a rainy season. In reality, it is quite difficult to take time out in the busy medical field, but author believe that a new horizon will open up by considering the background of a patient's illness based on the place in life.

2. CASE PRESENTATION

During the rainy season, while author was working in the emergency department, author received an emergency call. The ambulance crew wanted to transport a 54-year-old man who had been involved in a car accident. His vital signs showed that his pulse rate was high at 148 beats per minute. Author waited for the ambulance to arrive, thinking that he had lost a lot of blood somewhere due to the trauma. The man was lying on the stretcher, his eyes were open but he did not respond to questions with words. There was no major trauma to his body, he was incontinent and his temperature was 39.6°C. The ambulance crews said that he had watery diarrhea and had been diagnosed with acute gastroenteritis a few days earlier by a local doctor [1].

There was a rale in the right chest on auscultation, so a portable radiograph was taken, which showed a shadow in the right lower lung field. A CT scan showed an infiltrative shadow in the right lower lobe, suggestive of pneumonia. The blood data also showed low sodium and liver dysfunction. Author considered the possibility of Legionnaires' disease (LD). As the most hospitals in Japan could not immediately make a definitive diagnosis at that time, author sent the specimen to an outside company and started treatment for suspected Legionnaires' disease. Later, the test results came back and the patient was found to have LD. With treatment the patient recovered [1].

3. DISCUSSION

The LD is a category 4 infectious disease in Japan and all cases must be reported immediately after diagnosis, but at that time there were only two to three hundred cases a year in Japan, and many doctors regarded it as a rare disease. This raised a question in author mind. Is LD overlooked? Why did the patient cause the car accident? Where was the source and route of infection? For this question, many researches have already shown that it is not a rare disease if it were tested properly. It's just that we don't test for it. In particular, author found out that it is one of the three most important causative agents of severe community-acquired pneumonia [2]. Since then, the number of reports has been increasing, but the majority of cases are still missed in all over the world including Japan.

A next question was raised in author mind. Why did this patient have a road traffic accident? In 2004, an interesting study was reported from the United States that shows a transient lesion in the splenium of corpus callosum, the part of the brain that connects the right and left hemispheres on MRI [3]. As general knowledge, the symptoms of the corpus callosum are very interesting. For example, if physician show a patient a picture or a string of letters and they can draw it with their left hand, but if physician ask them to draw it with their right hand, they cannot draw the left part of the visual field properly [4]. Symptoms associated with spatial neglect have also been reported, especially for lesions in the splenium [5,6].

Information about the left visual field goes into the right hemisphere of the brain and information about the right visual field goes into the left hemisphere. In addition, the left hemisphere controls the movement of the right hand and the right hemisphere controls the movement of the left hand, but in a person with an injury to the corpus callosum, the information about the left visual field, which enters the right hemisphere, does not properly go to the left hemisphere, which is why the patient cannot command the right hand properly. These are only a matter of speculation, but there is a possibility that the patient could not properly use his right hand and right foot to control the steering wheel and brake based on the information from his left visual field because of splenial dysfunction. In fact, when author spoke to the ambulance service, they said that the patient had failed to go round a right-hand bend and had hit left shoulder of the road.

Where did the patient catch *Legionella* from? While author was thinking about it, a paper came out from the Netherlands. It said that there may be about three times as many professional drivers. The paper was a result of an analysis of the Dutch national database, and said little about the possible reasons for this [7]. After author submitted a Freedom of Information request to the Ministry of Health, Labor and Welfare, author analyzed the Japanese data, it was suggested that there may be a higher risk in Japan for people working in the transport industry [8]. In this report, the patient was a truck driver. So, author thought that if I could find out the source of this patient's infection, it might help me to understand why. In the course literature search, author came across a paper in which *Acanthamoeba* was found in the evaporator of a car air-conditioner [9]. This is it! Because *Legionella* can multiply in it, author thought that the *Legionella* could be in the evaporator of the air conditioner of the patient's car.

Author called the health center in charge, told them about the articles and asked them to check the patient's car. However, the health center refused. Not wanting to give up, author told the patient what had happened and asked if I could check the car he was using. He told me that the truck did belong not to him but to the company. Author spoke to the wife of the owner of the company who had come to visit him. The company was a small business run by a couple. Author thought she might say no, but she said, "I was saved from cancer by the hospital. I believe that the health of our employees comes first. I don't want to cover up the stink. Please look into it." Author was very excited. So, author went to the car repair shop, took out the evaporator and sampled it. First of all, the samples were submitted to a laboratory to be cultured for bacteria. However, the results were all negative. But author could not give up. Author decided to send the samples for genetic testing as a last hope. Then the result was positive. This is the first time to our knowledge that *Legionella* has been detected in the evaporator part of the vehicle [8].

Where did it get into the evaporator? Author was crossing the bridge near my house on a rainy day. At that time, author was thinking about this all the time. A car drove past me at great speed, splashing me with water. Author thought that this puddle of water might contain *Legionella*. So, author collected water from the puddle with a syringe and went to study in Japan at Faculty of Medicine, Toho University, which is the mecca of LD research in Japan, to learn how to culture it. And found that *Legionella* bacteria exists in the puddles on road. It was published in the journal of the

CDC that *Legionella pneumophila* serogroup 1, the most common cause of pneumonia among *Legionella* bacteria, was found to be particularly prevalent on warm days [10].

In connection with this, author wrote an article which pointed out that LD should now be added to list of Intergovernmental Panel on Climate Change of important climate-sensitive health issues [11]. Although various diseases, such as malaria and dengue fever, are feared to increase due to global warming, LD is overlooked. It was published in the official journal of the World Health Organization. Legionella bacteria were detected in the water from rain, well, river, tap, puddle in Papua, Indonesia too (Data not published). It is frequently detected in the water we use in our daily lives. *Legionella* bacteria can be isolated even at altitudes as high as 3,930 meters [12]. *Legionella* bacteria can be frequently detected in Bhutan too [13]. The frequency of LD should be monitored in various regions, especially among patients with severe community-acquired pneumonia at the core hospitals. Author believe that LD had a significant influence on the U.S. presidential election in 1976.

4. CONCLUSION

An interesting case could come in front of you, and it could promote the research that may have a high impact in the world.

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