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A Cluster Diarrhea Outbreak Caused by Norovirus Infection at the Psychiatric Ward of a Certain Hospital in Taichung County

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Foreword

Norovirus group outbreak has become a significant problem for nosocomial infection control in recent years. Statistically, somewhere between 35% and 63% of diarrhea group outbreaks in the hospital turn out to be caused by this kind of virus. It has been reported that hospital units most prone to norovirus cluster infections are psychiatric wards, pediatric wards, plastic surgery wards, geriatric wards, and geriatric rehabilitation centers. Although diarrheic cases caused by norovirus infection are usually self-limited and bear a rather short disease course, this virus is extremely contagious and can make a person sick rapidly with the invasion of as few as 1-10 virus particles. Therefore, when a hospital or an institution is hit by a

group infection of this virus, it is very likely to have a tremendous impact on the patient care routine and financial situation of the institution [1, 2].

On August 31, 2006, somebody working at Third Branch of Taiwan CDC received a phone notification from Taichung County Health Bureau, reporting that in a local psychiatric ward located on the eighth and ninth floors of a certain hospital branch in Shalu Township, Taichung County, there had been several diarrhea cases taking place sequentially among both the inpatients and the healthcare personnel. A physician from the infectious disease division at the same hospital suspected that a group diarrhea situation was at hand. Right after receiving the notification, the Third Branch took the initiative to assemble a small investigation team consisted of experts from the Branch itself as well as the local Health Bureau and sent the team to the outbreak site to carry out an epidemiological investigation on the incident. The objectives of this investigation were to determine the true scale of the outbreak, the pathogen(s) involved, the transmission route, and the etiologic factors of the disease. Also, the team made an assessment on the efficiency and effectiveness of the hospital's existing control measures against nosocomial infections. These findings will be used as a reference for better response measures to similar group infection events in the future.

Background information on the psychiatric ward at the Shalu Branch of the said hospital

This particular psychiatric ward occupied two separate floors of the same building. The facility located on the eighth floor was mainly used to house hospitalized acute psychiatric patients. At the time of this investigation, 26 inpatients lived there and were cared for by 12 nurses. There were three

single-patient rooms, four double-occupancy rooms, and another five rooms each accommodating three patients. The facility located on the ninth floor was primarily for subacute patients of psychiatric disorders. There were 22 patients living on that floor when the investigation was conducted, and 5 nurses were looking after them. There were six big bedrooms on that floor and each could accommodate a maximum of four or six patients. Each room in the ward (on both floors) featured a separate bathroom of its own. Daily meals for all inpatients and nurses in the ward were uniformly prepared by the hospital central kitchen, and the cooked food was delivered and served in individual boxes. Drinking water was supplied by an automatic drinking water dispenser to all individuals living and working in this ward through the use of their own mugs.

None of the patients living on the eighth or the ninth floor were suffering from chronic psychiatric illnesses, so the hospital did not offer any job training or rehabilitation programs for the patients. Under the circumstances, there were normally few opportunities for the residents to engage in close contact with one another. Even the nurses working in this particular ward were each assigned to a floor without ever swapping duties with nurses on the other floor. However, 25 individuals, including the attending physicians and their assistants, the head nurse, several nurse guards and a number of cleaning workers, did set foot on both floors to carry out their work and activities on a daily basis.

Scale of the outbreak

During the on-site investigation by the health authorities, the residents were not capable of describing their diarrheic conditions accurately and in greater details due to their psychiatric illnesses, so the investigators could only refer to the number of

diarrheic runs the patient went through as recorded by the nurses looking after them. In order to make sense of the records, we defined a diarrhea case as anyone having at least 3 times of diarrheic runs or watery stool within a 24-hour period. Up to September 1, on both the eighth and ninth floors, there had been a total of 21 inpatients and 2 nurses displaying symptoms of diarrhea and fever at one time or another. Therefore, the overall attack rate of this outbreak among the ward's inpatients and nurses was 35.4% (23/65). Among the diarrheic residents of the ward, 8 sick people were living on the eighth floor and 13 on the ninth, but the two diarrheic nurses were both working on the eighth floor. So, the attack rate of the ¡§fixed¡¨ population (live-in patients plus nurses) on the eighth floor was 26.3% (10/38), while that of the ninth floor was 48.1% (13/27) (see Figure 1). Among those patients having fallen sick with diarrhea, 73.9% (17/23) of them were male and 26.1% (6/23) were female. The age distribution of all people fallen sick in this outbreak was between 24-61. All sick people showed a definite symptom of diarrhea, but 2 of them got a fever as well.

Specimen collection and laboratory diagnosis

On August 31 and September 1, the investigation team collected a total of 18 specimens of bacterial rectal swabs and 12 stool samples from those diarrhea sufferers in the ward, and had them rushed to the Central Regional Laboratory (in Taichung City) and Kunyang Laboratory (in Taipei City) at Center for Research and Diagnostics of Taiwan CDC to proceed with the necessary examinations and tests for gastroenteric pathogenic microorganisms. About one week later (on September 6 and 7), the results of the screening tests came out on the 18 bacterial rectal swabs, and they turned out to be all negative, which suggested that the

incident might have nothing to do with cholera, typhoid fever, paratyphoid fever, Staphylococcus aureus, Vibrio parahemolyticus, Shigella dysenteriae and Salmonella. All of the 12 stool samples, however, did give a positive norovirus diagnosis. Besides, the hospital conducted tests of its own, i.e. they collected a specimen of bacterial rectal swab from each of three diarrheic patients on August 28 (one day before the arrival of the outside investigation team) and had those specimens tested in their own laboratory. The results came out on September 4 and were similarly negative. Based on the facts that norovirus was detected in the stool samples of 12 sufferers and the detectable rate was 100%, we believe it is reasonable to suggest that norovirus was the pathogen responsible for this group diarrhea outbreak.

Deduction of transmission route

There are two possible transmission routes for a group diarrhea infection, either through co-infection or contact infection [3, 4]. In order to determine the transmission route of this incident, we first looked into several apparent possible sources that could have led to co-infection. The number one suspect was of course the regular meals those people consumed before getting diarrhea. We found out that they all ate boxed meals uniformly prepared by the hospital's central kitchen, which could not have been the contaminated source simply because the same meal boxes were also distributed to and consumed by people staying on other floors of the same building, as well as patients and health workers in another branch of the hospital located in the nearby Wuchi Township, yet no one other than people living and working in this particular psychiatric ward was hit by the diarrhea outbreak. Therefore, we believe those meals prepared by the central kitchen should have

nothing to do with the norovirus infection. Secondly, as to the drinking water, there was an automatic drinking water dispenser for all people staying on the eighth and ninth floors, and it happened to be the one and only drinking water supply for the entire ward. However, apparently not everyone in the ward had fallen sick with diarrhea, which indicated that the drinking water source could lot be blamed either. Furthermore, we have produced an epidemiological curve for this outbreak by plotting the daily case numbers against the date of onset for the 23 diarrhea sufferers between August 24 and September 1 (see Figure 2). By looking at this curve, we discovered that it was definitely not a single peak distribution. In other words, it sufficiently ruled out co-infection as the transmission route of this outbreak.

According to many investigation reports on similar norovirus group outbreaks taking place at hospitals or rehabilitation institutions over the past few years, the highly contagious norovirus pathogen most frequently spread through contact transmission [5-7]. Therefore, after ruling out the involvement of co-infection, contact transmission became the reasonable alternative. In a closer look, we ascertained that the very first individual case was Mr. Wang living in Room 812 on the eighth floor. He became diarrheic on August 24 and was referred to as the index case by definition. Because Mr. Wang had difficulty moving around by himself, he needed the nurse's assistance whenever using the toilet. As a consequence, the two nurses - one on the day shift and the other on the evening shift - who respectively helped the index case to go to the bathroom and changed the soiled bed sheets for him on August 24, found themselves suffering from diarrhea on August 24 and 25 separately. After that, several other residents of the eighth floor were hit by the diarrheic symptom, but the hospital management failed to respond with any

quarantine program to control the infection. They even transferred a diarrheic patient, whose psychiatric illness was deemed to have improved, from the eighth floor to a subacute room on the ninth floor on August 27. After the arrival of this diarrheic person, residents on the ninth floor started experiencing diarrhea on the same day and the illness spread rapidly to 10 other residents on the ninth floor in almost no time at all. During this wave of outbreak, Room 955 was worst hit with all 6 roommates infected and falling sick. Based on the information discussed so far, we deduced that the most likely transmission route was contact transmission occurring between residents themselves and between a nurse and a resident under her care.

Study on etiological origin

According to a record of patients newly admitted in the week before the index case's onset day (from August 16 to 23), we found that in addition to the index case, another fellow was also admitted to the eight floor, and the two became roommates after they both moved in. The index case and this other patient were admitted on August 19 and August 22 respectively. This roommate caught the illness on August 25, or one day after the onset day of the index case. So, this roommate should not be the one who brought in the infectious agent in the first place. Besides, given that the index case was hospitalized on August 19 but did not fall sick with diarrhea until August 24, and that the normal incubation period for norovirus infection was merely 1-2 days [8, 9], we figured that the index case did not bring in the virus either, but rather got infected after being admitted into the ward. It is to say, the chances of this wave of outbreaks having been caused by pathogens brought in by new comers were quite remote. After ruling out the possibility of new residents

being the pathogen carriers, nurses working on the eighth floor became an alternative group of suspects in bringing in the bugs. However, due to the limited capacity of available laboratory testing facilities, we were not able to check each and every nurse working on that floor as we had hoped earlier to verify whether there were any subclinical carriers among those 12 nurses. In other words, we could not identify the original spreader responsible for initiating this outbreak. Nevertheless, since the index case was physically handicapped and needed the nurse's assistance for most part of his daily activities, he obviously had more contact opportunities than other patients with the nurses, so we believe some sort of indirect transmission through more than one nurse could be a very likely cause among the possible etiological origins responsible for the disease onset of the index case.

Preventive and control measures

In order to prevent the outbreak from spreading further and in accordance with "Guidelines on infection control in psychiatric hospitals (institutions)," the health authorities sent people over to meet with physicians at the infection control division of the hospital immediately after the notification was received and asked the hospital to enact necessary infection control measures according to the regulation [10]. First there was a resident quarantine program, in which two rooms on each floor (Room 811, 812, 951, and 952) of the ward were assigned to be the quarantine areas. Any inpatient found having diarrhea symptom would be transferred to the quarantine rooms and made to stay in the room until the symptom had disappeared for 5-7 days. It was a matter-of-course practice on the part of the hospital management that once the psychiatric symptoms of a resident on the eighth

floor had improved to a certain level, the patient would be transferred to a subacute room on the ninth floor. Therefore, on August 29 and 30, the hospital did carry out this routine practice to transfer two diarrheic patients with bettered psychiatric conditions to the ninth floor. They were placed in the quarantine area first. Furthermore, as to the control measures and arrangements related to the health workers, the hospital asked the two nurses having diarrhea symptom to temporarily stop working in the ward, and also made a special arrangement to assign certain nurses to look after the diarrheic sufferers exclusively throughout the outbreak. As to disinfection of the ward and promotion of health education aiming at the involved inpatients, the hospital had all reachable surfaces in the ward wiped with disinfectant twice a day. At the same time, it also reinforced the supervision of hand-wash practices of the inpatients, especially before and after having meals, and after using the toilet. Finally, the health authorities requested the hospital to keep an eye on the health conditions of its inpatients and reminded the medical staff that if any suspected case of diarrhea showed up again, they had to report to the health authorities right away. After all aforementioned control measures were implemented, no new cases had showed up since September 2, and the health authority stopped its monitoring and tracking effort on this particular outbreak on September 14. In other words, it was case closed.

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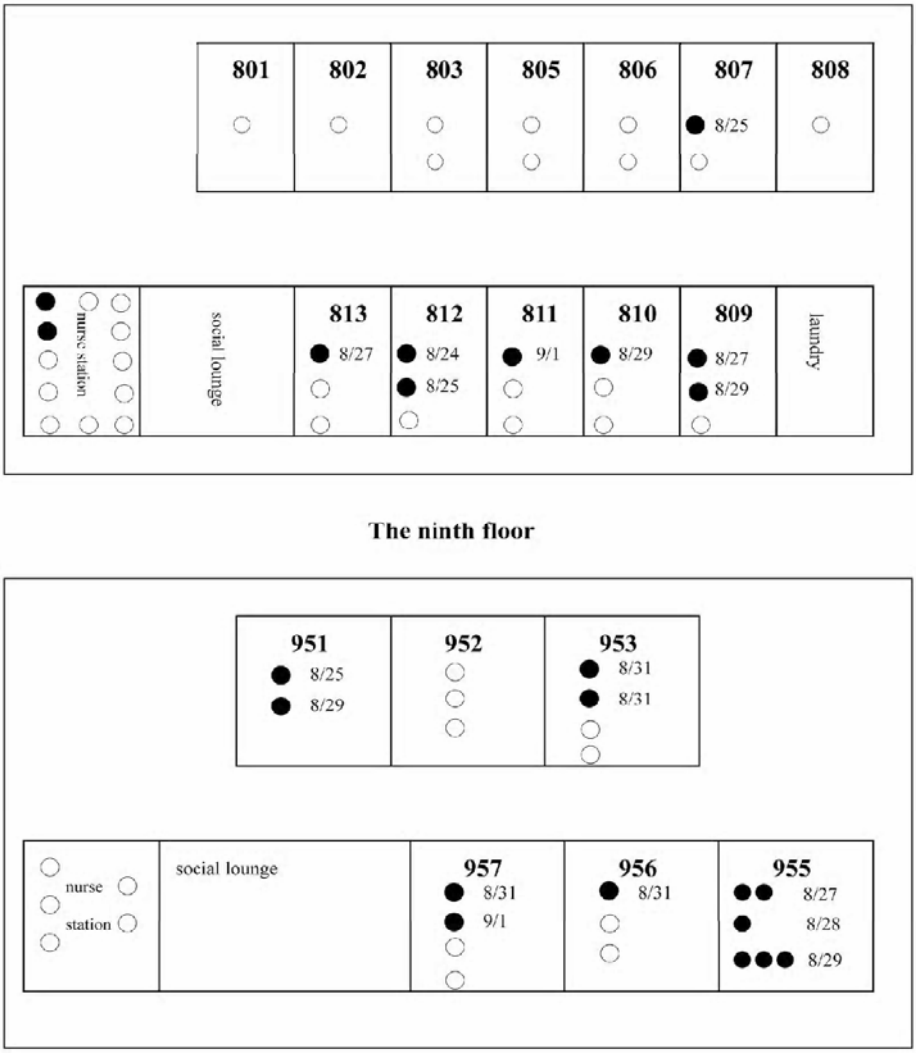
The eighth floor



Note : ● diarrheic ○ non-diarrheic

Figure 1. Case distribution of a diarrhea outbreak on the eighth and ninth floors within a psychiatric ward of certain hospital in Taichung County

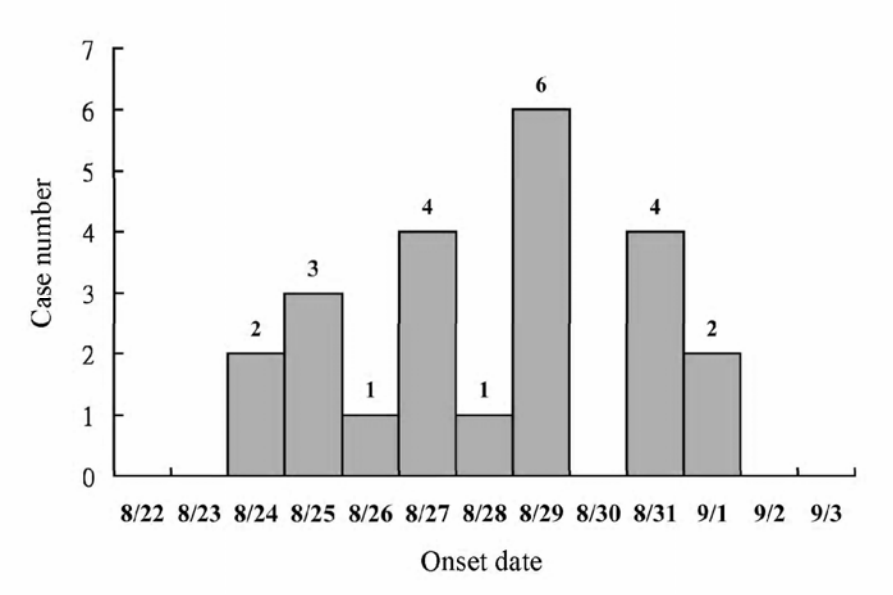


Figure 2. Epidemiological curve of a recent group diarrhea outbreak in a psychiatric ward of certain hospital in Taichung County.