



Evaluation of a Rotavirus Outbreak in a Tertiary Care Children's Hospital Burn Unit

Üçüncü Basamak Bir Çocuk Hastanesi Yanık Ünitesinde Meydana Gelen Rotavirüs Salgınının İncelenmesi

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Cite this article as: Böncüoğlu E, Kıymet E, Şahinkaya Ş, Polatdemir K, Akaslan Kara A, Sorguç Y, et al. Evaluation of a rotavirus outbreak in a tertiary care children's hospital burn unit. J Pediatr Inf 2023;17(1):e36-e40.

Abstract

Objective: In this study, it was aimed to examine the rotavirus outbreak that occurred in the burn unit at our hospital, the precautions to be taken in the outbreak, and our experiences.

Material and Methods: Infection control measures carried out for patients who were found to be positive for rotavirus antigen in the stool at least 48 hours after hospitalization in the burn unit during the outbreak were retrospectively reviewed from the records of the infection control committee.

Results: Nosocomial rotavirus infection was detected in seven of the 15 patients in the burn unit between March 2 and March 24, 2021, and a total of eight patients were followed up due to contact. Median age was 14 months (minimum eight months, maximum 53 months). Rotavirus infection was detected on the 5th, 22nd, 6th, 3rd, 4th, 4th and 6th days of hospitalization, respectively. The compliance of the healthcare workers in the unit with contact precautions, especially hand hygiene, and asepsis-antisepsis rules was evaluated with daily infection control committee visits. No symptoms developed in eight patients who were followed up due to contact. The outbreak ended in 22 days.

Conclusion: The fact that the infected patients were mostly hospitalized in different rooms at the beginning suggests that fomites, inanimate surfaces, or caregivers may have contributed to the contamination. For this reason, in addition to isolation of the patients, proper cleaning of inani-

Öz

Giriş: Bu çalışmada hastanemizin yanık ünitesinde meydana gelen rotavirüs salgını ve salgında alınması gereken önlemleri ve tecrübelerini incelemeyi amaçladık.

Gereç ve Yöntemler: Yanık ünitesinde salgının görüldüğü dönemde tedavi gören ve yatıştan en az 48 saat sonra gaytada rotavirüs antijeni pozitif saptanan hastalara yönelik yürütülen enfeksiyon kontrol önlemleri enfeksiyon kontrol komitesi kayıtlarından geriye dönük olarak incelendi.

Bulgular: Yanık ünitesinde 2 Mart-24 Mart 2021 tarihleri arasında toplam 15 hastadan yedisinde nozokomiyal rotavirüs enfeksiyonu saptandı ve toplam sekiz hasta temas nedeniyle takibe alındı. Yaş ortancası 14 ay (en küçük 8 ay, en büyük 53 ay) idi. Rotavirüs enfeksiyonu, sırasıyla yatışlarının 5, 22, 6, 3, 4, 4, 6. günlerinde saptandı. Ünitadaki sağlık çalışanlarının el hijyeni başta olmak üzere temas izolasyonu önlemlerine, asepsi-antisepsi kurallarına uyumu günlük olarak enfeksiyon kontrol komitesi ziyaretleri ile değerlendirildi. Temas nedeniyle takibe alınan sekiz hastada semptom gelişmedi. Salgın 22 günde sonlandı.

Sonuç: Olguların çoğunlukla başlangıçta farklı odalarda yatan hastalar olması fomit, cansız yüzey ya da bakım veren personelin bulaşmaya katkıda bulunmuş olabileceğini düşündürmektedir. Bu nedenle hastaların izole edilmesinin yanında, cansız yüzeylerin belirli aralıklarda uygun şekilde temizlenmesi ile sağlık personelinin el hijyeni kurallarına tam

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Received: 27.11.2021

Accepted: 26.05.2022

Available Online Date: 31.03.2023

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Available online at www.cocukenfeksiyon.org

mate surfaces at certain intervals, full compliance of healthcare workers with hand hygiene rules, and strict supervision of the measures taken play a key role in ending the outbreak as soon as possible.

Keywords: Infection control measures, nosocomial infection, rotavirus, outbreak

Introduction

Rotavirus is the leading cause of severe diarrhea in children younger than five years of age worldwide, with an estimated more than 25 million outpatient admissions and more than two million hospitalizations each year. In developing countries, three-quarters of children experience the first episode of rotavirus diarrhea before the age of 12 months, while in developed countries the first attack is often delayed until the age of 2-5 years. Severe rotavirus gastroenteritis, which causes dehydration, mostly affects children aged between 6-24 months (1). A small inoculum (100 cfu/g) is sufficient for fecal-oral transmission. It can survive for weeks or even months on contaminated environmental surfaces and fomites (such as toys), which can lead to contamination (2).

Nosocomial rotavirus, or in other words, hospital-acquired rotavirus infection, has been reported frequently in hospitalized children and is responsible for approximately 25% of all rotavirus-related hospitalizations (3-5). Rotavirus outbreaks in health institutions are important in terms of prolonging the length of hospital stay and increasing the social and economic burden of hospitalization (6,7). In this retrospective study, it was aimed to examine the rotavirus outbreak that occurred in the burn unit of our hospital, the control measures taken during the outbreak and our experiences.

Materials and Methods

Our hospital is a tertiary pediatric hospital, and an average of 300 inpatients have been treated annually in the burn unit in the last three years (2018-2020). There are five patient rooms, one dressing room and one washing room, three of which are two-bed and two of which are three-bed, in the 12-bed capacity unit.

Rotavirus infection occurring at least 48 hours after hospitalization was considered a nosocomial infection. The first case that had contact with the index case and met the definition of nosocomial infection was accepted as the starting point of the outbreak, and the detection of the last case with nosocomial rotavirus infection was accepted as the end point. Rotavirus was tested in the stool of all patients who were treated in the burn unit between March 2 and March 24, 2021 and who started to have diarrhea at least 48 hours after hospitalization using the qualitative immunochromatographic test kit (Ameritek-USA one step rapid test adenovirus/rotavirus complex

olarak uyması ve alınan önlemlerin sıkı bir şekilde denetlenmesi salgının en kısa sürede sonlanması için anahtar rol oynamaktadır.

Anahtar Kelimeler: Enfeksiyon kontrol önlemleri, nosokomiyal enfeksiyon, rotavirüs, salgın

2-panel card test) in accordance with the working procedure of the manufacturer (8).

The precautions and control measures taken during the outbreak were reviewed retrospectively from the infection control committee records.

Data were analyzed with PASW Statistics 18 statistical package program. Discrete variables were given as numbers and percentages, and continuous variables as medians.

Ethics committee approval for the study was obtained from the Clinical Research Ethics Committee of Health Sciences University İzmir Dr. Behçet Uz Pediatrics and Surgery Training and Research Hospital (Protocol no: 689, decision no: 2022/07-02).

Results

Nosocomial rotavirus infection was detected in seven out of 15 patients treated in the burn unit between March 2 and March 24, 2021 (Table 1), and a total of eight patients were followed up due to contact. Four (57.1%) of the infected patients were girls and three (42.9%) were boys. Median age was 14 months (youngest eight months, oldest 53 months). Rotavirus infection was detected in the patients on their 5th, 22nd, 6th, 3rd, 4th, 4th and 6th days of hospitalization, respectively. Due to diarrhea that developed on the 5th day of hospitalization in the index case, rotavirus antigen was found positive in the stool examined on the same day and was isolated in the room the patient was in. Since the burn treatment of two of the patients was completed, contact isolation process in terms of rotavirus was completed in the infectious diseases clinic. The other five patients were placed in contact isolation in separate rooms in the burn unit. No symptoms developed in eight patients who were followed up due to contact. The outbreak ended in a total of 22 days.

Infection Control Measures

Infection control precautions were applied in accordance with the recommendations of the Center for Disease Prevention and Control (CDC) (9). The compliance of the employees in the unit with contact isolation precautions, especially hand hygiene, and asepsis-antisepsis rules were evaluated by daily infection control committee visits. The number and availability of the hand sanitizer points were increased. Personnel caring for infected and non-infected patients were separated by cohort. Infected patients were allowed to take baths and

Table 1. Characteristics of the patients with rotavirus positivity

	Age	Clinic	Date of hospitalization	The room the patient stayed at the beginning	The room the patient was cohorted	Length of hospital stay	Rotavirus+ date of detection	Rotavirus+ hospitalization date when the virus was detected
Patient 1	14 months	2 nd degree 15% hot water burn	02.25.2021	217	217→ moved to 216 in 03.05.2021	12 days	03.02.2021	5 th day
Patient 2	9 months	2 nd degree 30% hot water burn	02.11.2021	213	216→ moved to a single-bed room in the infectious diseases service	30 days	03.05.2021	22 nd day
Patient 3	53 months	2 nd degree 15% hot water burn	02.27.2021	216	216	36 days	03.05.2021	6 th day
Patient 4	15 months	2 nd degree 10% hot water burn	03.03.2021	215	215→ moved to a single-bed room in the infectious diseases service	12 days	03.06.2021	3 rd day
Patient 5	15 months	2 nd degree 8% hot water burn	03.05.2021	217	215	11 days	03.09.2021	4 th day
Patient 6	13 months	2 nd degree 8% hot water burn	03.07.2021	217	216	11 days	03.11.2021	4 th day
Patient 7	14 months	2 nd degree 5% hot water burn	03.18.2021	218	218	7 days	03.24.2021	6 th day

change their dressings after other patients. The cleaning and disinfection of frequently touched surfaces such as the faucet head, door handle, telephone, light switches, computer, and etc. was done at least once in two hours and with 1/100 chlorine solution as they became dirty. The cleaning of surfaces such as the beds, shelves, door handles, etc. in the rooms of infected patients were carried out with 1/100 chlorine solution every eight hours (three times a day). Considering that it may pose a risk for the spread of rotavirus, disinfection of patient wash tubs and dressing stretchers was provided with 1/10 chlorine solution (100 cc bleach to 1 liter of water). In order to control cleanliness, swab samples were taken from the bed, bedside, door handle, electrical switches, cabinet doors, treatment trolley, perfuser, patient washing tubs, refrigerator interior surface, and tap heads in the treatment room on a daily basis, and the organic load on these surfaces were measured luminometrically with a luminometer device (3M™ Clean-Trace™ Ngi Luminometer LX25). The surfaces detected above the limit value of the measurement results were cleaned again until the results fell below the limit value.

Discussion

Rotavirus gastroenteritis is the most common cause of viral nosocomial infections and outbreaks in pediatric services and child care centers (10,11). In a meta-analysis, the highest incidence of rotavirus has been found among hospitalized patients under the age of two years (12). Infection can be severe at the first encounter with rotavirus, especially in this age

group. It can cause dehydration and severe electrolyte disturbances, even death. It is important to bring the outbreak under control as soon as possible, especially in a situation such as a burn, where maintaining hydration and electrolyte balance is vital. For this reason, infection control measures were strictly implemented, and the outbreak was brought under control in 22 days.

Rotavirus is a highly contagious pathogen. It can be transmitted through contaminated surfaces, hands, fomites, water and food. It has been found that it can stay on dry surfaces for 10 days and up to four hours on hands (9). Very few viral particles are sufficient to infect the host. The spread of the virus begins before the onset of diarrhea and continues for up to 10 days after the symptoms begin (13,14). In the studies performed, rotavirus spread in the stool has been detected until 57 days after the onset of diarrhea with the polymerase chain reaction method (15). Virus spread has also been demonstrated in the stools of asymptomatic patients (16). In cases where hand hygiene and disinfection rules are not followed adequately, it can be difficult to control outbreaks in the pediatric units of hospitals. Since it is a non-enveloped virus, it is resistant to some disinfectants. Ninety-five percent ethanol, 70% isopropanol, 2% glutaraldehyde, 0.35% paracetic acid and 2000 ppm (parts per million) sodium hypochlorite solution have been shown to be effective (17,18). In a study investigating the risk factors for nosocomial transmission of rotavirus, it has been shown that although sharing the same room

and caregiver staff with a rotavirus-infected patient did not significantly increase the risk of spread when the cases were sporadic, it is recommended that symptomatic patients be immediately isolated in single rooms and contact precautions should be followed for at least 48 hours after the symptoms have subsided (3,19). If single rooms are not available, patients with similar symptoms should be cohort (19). Since the first diagnosis of the infection in a patient in the burn unit of our hospital, all patients were taken to different rooms from other inpatients, and their treatment continued. Patients whose burn treatment was completed but hospitalization indication for gastroenteritis continued were transferred to single rooms in the infectious diseases service.

The fact that the patients were mostly hospitalized in different rooms at the beginning suggests that fomite, inanimate surface or caregivers may have contributed to the contamination. Pillet and colleagues have reported that the mobile phones of healthcare personnel can act as a tool, especially in carrying the rotavirus, and that hand hygiene should be provided before and after touching their mobile phones (20). In a burn unit, the cleaning of the dressing room and the tubs where wound cleaning is done, which are common areas for the patients, gain importance. The cleaning of these common areas and other frequently touched surfaces (such as telephones, computers, door handles, tap heads, nurse desks) should be done with a chlorine solution prepared at a concentration of 10.000 ppm as recommended by current guidelines and should be repeated during the day (19). Following cleaning and in terms of evaluating the effectiveness of cleaning, it may be useful to evaluate the organic load on the surface through the light emitted by the adenosine triphosphate (ATP) found in microorganisms, by means of an enzyme reaction that occurs naturally in the tail of fireflies (luciferase-firefly reagent), called the luminometer device, and to repeat the cleaning when necessary (21).

One of the most important factors in preventing the spread of infection is the compliance of health personnel with hand hygiene rules (22). Inadequate staff and high patient burden are among the reasons why compliance with hand hygiene rules is low, especially in developing countries (23). The use of gloves, which is seen as another reason, does not replace washing hands or using hand antiseptics, and hands must be cleaned with soap and water or hand antiseptics after using gloves (19,23). Incorrect or deficient attitudes and behaviors related to hand hygiene can be minimized with regular training.

Our study has some limitations. First, the route of the spread of the virus within the unit is not certain. Asymptomatic patients have not been tested. Therefore, possible asymptomatic

virus spreaders have not been identified. Another limitation is the lack of molecular typing.

Nosocomial outbreaks are an important health problem in our country as well as all over the world and can be seen despite the measures taken. In order to end an outbreak as soon as possible, compliance and monitoring of compliance with infection control measures play a key role in the control of the outbreak.

Ethics Committee Approval: Ethics committee approval for the study was obtained from the Clinical Research Ethics Committee of Health Sciences University İzmir Dr. Behçet Uz Pediatrics and Surgery Training and Research Hospital (Protocol no: 689, Decision no: 2022/07-02).

Informed Consent: Patient consent was obtained.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept- İD, EB, SNB; Design- İD, SNB; Supervision- İD, SNB; Resource- YO, AAK; Data Collection and/or Processing- KP, YO, YS, AO; Analysis and/or Interpretation- EB, ŞŞ, EK, AAK; Literature Search - EB, EK; Writing- EB, İD; Critical Review- İD, SNB.

Conflict of Interest: All authors declare that they have no conflicts of interest or funding to disclose.

Financial Disclosure: The authors declared that this study has received no financial support.

References

1. World Health Organization. Rotavirus. Available from: <https://www.who.int/teams/health-product-policy-and-standards/standards-and-specifications/vaccines-quality/rotavirus> (Accessed date: 30.09.2021).
2. Committee on Infectious Diseases, American Academy of Pediatrics. Rotavirus Infections. In: Kimberlin DW, Barnett ED, Lynfield R, Sawyer MH (eds). Red Book: 2021-2024 Report of the Committee on Infectious Diseases. 32nd ed. Itasca, IL: American Academy of Pediatrics, 2021:644-48.
3. Dennehy P, Peter G. Risk factors associated with nosocomial rotavirus infection. *Am J Dis Child* 1985;139:935-9. <https://doi.org/10.1001/archpedi.1985.02140110089037>
4. Raad II, Sheretz RJ, Russell BA, Reuman PD. Uncontrolled nosocomial rotavirus transmission during a community outbreak. *AJIC Am J Infect Control* 1990;18:24-8. [https://doi.org/10.1016/0196-6553\(90\)90207-9](https://doi.org/10.1016/0196-6553(90)90207-9)
5. Gervasi G, Capanna A, Mita V, Zaratti L, Franco E. Nosocomial rotavirus infection: An up to date evaluation of European studies. *Hum Vaccin Immunother* 2016;12(9):2413-18. <https://doi.org/10.1080/21645515.2016.1183858>
6. Gundeslioglu ÖÖ, Tekin R, Cevik S, Palanci Y, Yazicioglu A. The effects of nosocomial rotavirus gastroenteritis on the length of hospital stay and cost. *J Infect Dev Ctries* 2016;10(2):163-7. <https://doi.org/10.3855/jidc.5591>
7. Ianaro G, Delogu R, Fiore L, Monini M, Ruggeri FM, RotaNet-Italy Study Group. Group A rotavirus genotypes in hospital-acquired gastroenteritis in Italy, 2012-14. *J Hosp Infect* 2017;96 (3):262-7. <https://doi.org/10.1016/j.jhin.2017.04.004>

8. Gleizes O, Desselberger U, Tatochenko V, Rodrigo C, Salman N, Mezner Z, et al. Nosocomial rotavirus infection in European countries: A review of the epidemiology, severity and economic burden of hospital-acquired rotavirus disease. *Pediatr Infect Dis J* 2006;25:S12-21. <https://doi.org/10.1097/01.inf.0000197563.03895.91>
9. Rutala WA, Weber DJ, and the Healthcare Infection Control Practices Advisory Committee (HICPAC). Guideline for Disinfection and Sterilization in Healthcare Facilities, 2008 Update: May 2019. Available from: <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/> (Accessed date: 30.09.2021).
10. Ford-Jones EL, Wang E, Petric M, Corey P, Moineddin R, Fearon M. Rotavirus-associated diarrhea in outpatient settings and child care centers. The Greater Toronto Area/Peel Region PRESI Study Group. *Pediatric rotavirus epidemiology study for immunization. Arch Pediatr Adolesc Med* 2000;154(6):586-93. <https://doi.org/10.1001/archpedi.154.6.586>
11. Ratner AJ, Neu N, Jakob K, Grumet S, Adachi N, Della-Latta P, et al. Nosocomial rotavirus in a pediatric hospital. *Infect Control Hosp Epidemiol* 2001;22(5):299-301. <https://doi.org/10.1086/501904>
12. Bruijning-Verhagen P, Quach C, Bonten M. Nosocomial rotavirus infections: A meta-analysis. *Pediatrics* 2012;129:e1011-1019. <https://doi.org/10.1542/peds.2011-2779>
13. Nagayoshi S, Yamaguchi H, Ichikawa T, Miyazu M, Morishima T, Ozaki T, et al. Changes of the rotavirus concentration in faeces during the course of acute gastroenteritis as determined by the immune adherence hemagglutination test. *Eur J Pediatr* 1980;134:99-102. <https://doi.org/10.1007/BF01846024>
14. Vesikari T, Sarkkinen HK, Maki M. Quantitative aspects of rotavirus excretion in childhood diarrhoea. *Acta Paediatr Scand* 1981;70:717-21. <https://doi.org/10.1111/j.1651-2227.1981.tb05774.x>
15. Richardson S, Grimwood K, Gorrell R, Palombo E, Barnes G, Bishop R. Extended excretion of rotavirus after severe diarrhoea in young children. *Lancet* 1998;351:1844-8. [https://doi.org/10.1016/S0140-6736\(97\)11257-0](https://doi.org/10.1016/S0140-6736(97)11257-0)
16. Mukhopadhyaya I, Sarkar R, Menon VK, Babji S, Paul A, Rajendran P, et al. Rotavirus shedding in symptomatic and asymptomatic children using reverse transcription-quantitative PCR. *J Med Virol* 2013;85(9):1661-8. <https://doi.org/10.1002/jmv.23641>
17. Springthorpe VS, Grenier JL, Lloyd-Evans N, Sattar SA. Chemical disinfection of human rotaviruses: Efficacy of commercially-available products in suspension tests. *J Hyg (Lond)* 1986;97:139-61. <https://doi.org/10.1017/S0022172400064433>
18. Sattar SA, Springthorpe VS, Adegkunrin O, Zafer AA, Busa M. A disc-based quantitative carrier test method to assess the virucidal activity of chemical germicides. *J Virol Methods* 2003;112(1-2):3-12. [https://doi.org/10.1016/S0166-0934\(03\)00192-7](https://doi.org/10.1016/S0166-0934(03)00192-7)
19. Borg MA, Abela R. Prevention of Healthcare-associated Gastrointestinal Infections. *IFIC Basic Concepts of Infection Control*, 3rd edition. Portadown: International Federation of Infection Control; 2016:e1-5.
20. Pillet S, Berthelot P, Gagneux-Brunon A, Mory O, Gay C, Viallon A, et al. Contamination of healthcare workers' mobile phones by epidemic viruses [published correction appears in *Clin Microbiol Infect* 2016;22(9):e21]. *Clin Microbiol Infect* 2016;22(5):456.e1-456.e4566. <https://doi.org/10.1016/j.cmi.2015.12.008>
21. Deshpande A, Dunn AN, Fox J, Cadnum JL, Mana TSC, Jencson A, et al. Monitoring the effectiveness of daily cleaning practices in an intensive care unit (ICU) setting using an adenosine triphosphate (ATP) bioluminescence assay. *Am J Infect Control* 2020;48(7):757-60. <https://doi.org/10.1016/j.ajic.2019.11.031>
22. Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect* 2009;73(4):305-15. <https://doi.org/10.1016/j.jhin.2009.04.019>
23. World Health Organization 2009. WHO guidelines for hand hygiene in health care. Available from: <https://www.who.int/publications/i/item/9789241597906> (Access date: 30.09.2021).