

*Full Length Research Paper*

## Early preventive measures are effective against transmission of rotavirus disease from person to person in the hospital environment.

Guillermo Sólomon Santibáñez<sup>1</sup>, Jaime Ramírez Mayans<sup>2</sup>, Napoleón González Saldaña<sup>3</sup>, Hilda Hernández Orozco<sup>3</sup>, José Luis Castañeda Narvaez<sup>3</sup>, Ester Lombardo Aburto<sup>4</sup>, Natividad Navarrete Delgadillo<sup>5</sup>, Wendy Domínguez Viveros<sup>4</sup>, Hugo Juárez Olguín<sup>6</sup>

<sup>1</sup>Dirección General, Instituto Nacional de Pediatría (INP), México

<sup>2</sup>Dirección Médica, Instituto Nacional de Pediatría (INP), México.

<sup>3</sup>Comité de Infecciones, Instituto Nacional de Pediatría (INP), México.

<sup>4</sup>Servicio de Epidemiología, Instituto Nacional de Pediatría (INP), México.

<sup>5</sup>Laboratorio de Virología, Instituto Nacional de Pediatría (INP), México.

<sup>6</sup>Laboratorio de Farmacología, Instituto Nacional de Pediatría (INP), México.

Accepted 13 April, 2012

An observational surveillance study was carried out to describe the outbreak of rotavirus in a pediatric hospital in Mexico City. A total of 13 cases of intra hospital rotavirus infections were identified. None of these cases was vaccinated against rotavirus. The average duration of hospitalization of the patients was 11 days (range 3 to 33 days). Implementation of contact precautionary measures successfully ended the outbreak 21 days after detection. All cases were successfully managed and treated with symptomatic measures. We corroborate the importance of implementation of early preventive measures in intra hospital outbreaks of rotavirus for adequate control.

**Keywords:** Intra hospital, outbreak, rotavirus, prevention.

### INTRODUCTION

Rotavirus accounts for 6% of deaths in children less than 5 years old. Bilcke et al., (2009), reported that 25% of deaths caused by diarrhea in developed countries is due to the same pathogen. Intra hospital gastroenteritis is a frequent problem in the pediatrics units of hospitals, with 20% to 50% of the cases provoked by rotavirus and astrovirus. Other studies have reported incidences of 0.97 to 27.7 per every 100 hospital admissions (Frühwirth et al., 2000). Astrovirus infection has been considered to be of intra hospital origin. Rotavirus infections are seen principally in children between 6 and 23 months old and transmission of the virus could be from person to person and/or by fecal-oral route through water or food.

Gallimore et al. (2006), Gallimore et al. (2008), and Lopman et al. (2006), suggested that this elevated prevalence could be due to environmental pollution, lengthy days of survival of the virus in the environment, high resistance to environmental factors including common disinfectants and the great number of asymptomatic infections with viral replication and elimination (2 to 38%). This was in accordance with the reports of Román et al. (2003); and Lazlo (2009), who coincided that the spread of rotavirus in pediatric units could be due to environmental pollution, the relative resistance of the virus to habitual disinfectants resulting in its persistence in the environment and asymptomatic infections. Rotavirus particles have been shown to persist in the hands of health workers for up to 4 hours and on inanimate objects for several days (López-de-Andrés et al., 2008). In pediatric units, health workers are considered to be the major cause of transmission between patients in the majority of nosocomially acquired

\*Corresponding author e-mail: [juarezol@yahoo.com](mailto:juarezol@yahoo.com); Tel and Fax 5255 1084 3883

**Table 1.** Clinical features of children presenting with intra hospital rotavirus infection

PATIENT	SEX	AGE (MONTH)	HDP-R	DIAHRREA (DAYS)*	SERVICE
1	Male	20	1	7	Infectology
2	Male	2	4	4	Neurology
3	Male	1	1	7	Infectology
4	Male	5	3	1	Infectology
5	Male	1	6	1	Infectology
6	Male	24	18	2	Infectology
7	Female	1	17	2	Internal Medicine
8	Male	1	13	1	Infectology
9	Female	4	15	3	Infectology
10	Male	2	5	1	Infectology
11	Male	6	4	4	Infectology
12	Male	7	33	5	Infectology
13	Female	10	33	13	Surgery

HDP-R: Days of hospitalization before acquiring rotavirus infection (HDP-R)

\*Time patients had diarrhea (days), all the cases came through favorably.

rotavirus cases (Chandran et al., 2006; Ratner et al., 2001).

People infected by rotavirus generally present acute vomitus followed by profuse watery diarrhea without blood stain and with or without fever. The first episode is normally very serious, reason why the clinical signs in children are very severe like in immunocompromised patients and elderly people (Delpiano et al., 2006; Jarvis 2007). The objective of this study was to describe briefly the presentation of intra hospital outbreak of rotavirus at the National Pediatric Institute, Mexico City and to highlight the importance of early preventive measures in the control of such outbreak.

## METHODS

A double perspective, transversal and observational study was carried out at National Pediatric Institute, a third level hospital in Mexico City. Patients with clinical sign of diarrhea 3 days after their admission to the hospital and who also tested positive for rotavirus by enzyme-linked immunosorbent assay (ELISA) were selected for study. Samples were taken by the personnel of the Committee of nosocomial infections. This description is defined as the cases of intra hospital gastroenteritis by rotavirus. Follow up of the cases was done with an inclusive objective of determining the extent of implementation of preventive and control measures against the outbreak of the disease. The findings showed that the situation was managed by contact precautions such as strict hand hygiene, the use of white robes and gloves with isolation of all the cases in one area.

A case of gastroenteritis by intra hospital rotavirus is defined as a patient hospitalized with clinical signs of diarrhea 72 hours after admission with monoclonal antibodies positive in ELISA test (Rotatest, Abbott Laboratories, Abbott Park, Ill.). On the other hand, a case of community gastroenteritis is defined as a patient who presented the same signs with positive monoclonal antibodies in ELISA test 72 hours before admission.

Demographic data including sex, age, date of admission to the hospital, length of hospitalization, reason for admission and the starting date of diarrhea symptoms was compiled (Table 1). Follow up of the cases was done and preventive measures including strict hand hygiene, the use of white robes and gloves with the isolation of all rotavirus cases in one area, were implemented.

The incidence in the cases of nosocomial gastroenteritis was expressed over total exposed patients that were less than 5 years old who were admitted in the hospital during the period of the outbreak. In addition, for statistical analysis, frequency and central tendency measures were calculated.

## RESULTS

Between the 7<sup>th</sup> and 28<sup>th</sup> February 2007, an intra hospital rotavirus outbreak was identified in the pediatric unit of the National Pediatric Institute, Mexico City. Two cases of community acquired rotavirus were introduced into the unit on 7<sup>th</sup> and 8<sup>th</sup> February 2007. These community cases resulted in additional 11 cases of rotavirus. The intra hospital outbreak was corroborated by reviewing the virology laboratory reports for 2006 in which only 6 cases of rotavirus were reported.

In this study, the first community acquired case admitted in the ward was on 7<sup>th</sup> February, 2007. The Intra Hospital Infection Committee and the Epidemiology Service were alerted and standard measures of infection control were strengthened with enforcement of hand hygiene and isolation of the patients. These measures aided in controlling the intra hospital outbreak with the last case being registered on 28<sup>th</sup> February, 2007.

In the course of the outbreak, 6 other community cases of gastroenteritis by rotavirus were admitted which probably acted as further source of disease transmission among the hospitalized patients in the Institute. None of

the cases had a record of vaccination against rotavirus. The incidence rate for gastroenteritis by rotavirus was 7 cases of intra hospital infections per 100 discharged patients. The specific rate in children less than 1 year old was 10.7 per 100 of discharged children, while the specific rate for those between 1 and 4 years old was 4 for every 100 of discharged children. The mean age of children was 6 months with a range of 1 to 24 months. 69.2% of the cases were males and 30.8% females. The community rotavirus cases that were admitted during this period had an average age of 14 months, ranging from 2 to 34 months. The average hospital stay of the cases from the beginning of the diarrhea was 11 days, ranging from 3 to 33 days. The patients presenting symptoms suggestive of rotavirus infection for more than 11 or 14 days, were negative to the rotavirus test (Rotatest).

In this study, rotavirus infection was reduced by 86.9% through hand washing measures implemented using soap and water while the infection was reduced by 99.9% by the application of antiseptic solutions containing alcohol jelly at 70%. This was determined by comparing the infection cases within the survey, considering if the program against intra hospital infections was implemented or not.

Investigation of new cases of rotavirus continued in the pediatric ward during March 2007 and while new cases of community acquired rotavirus were seen, infection control measures ensured that no additional intra hospital infections were acquired by children in the ward. These observations were based on the absence of any epidemiological relationship and the incubation period of the virus. Transmission of intra hospital rotavirus infections was probably from the hands of the physicians and other health workers. Recovery of all the patients was satisfactory.

## DISCUSSION

The outbreak occurred in children less than 2 years old with a predomination in the group less than 1 year old. This was less than what was reported in community cases where the infection was considered in children aged between 3 months and 3 years.

Study conducted by Velázquez et al (1996) in Mexico, showed that children of two years of age had already had up to 3 episodes of rotavirus infections, although subsequent infections were found to be less severe. Seasonal profile of the sickness with the presence of community cases of rotavirus is in line with the appearance of intra hospital outbreaks. This is due to the fact that the circulation of the virus is kept on like in this case with the transmission of community cases from visitors to workers being constant during this season when adequate preventive measures are not taken.

In the cases studied, the transmission was probably

from health workers who did not adequately observe the technique of hand washing with soap. The most effective method of tackling intra hospital outbreak of rotavirus infection is isolation of the patients and application of strict contact measures, above all, the use of alcohol jelly in asepsis of the hand. Delpiano et al (2006) reported that only 86.9% of the virus sticking to our hands can be reduced by hand washing with soap while the use of antiseptic solutions with 70% alcohol jelly reduces 99.9% of the virus, showing the effectiveness of alcohol jelly when compared with hand washing with soap. In addition, isolation of patients infected by rotavirus may also limit the spread to susceptible infants and young children.

## CONCLUSION

On confirmation of a rotavirus infected patient in a pediatric ward, it is recommended to rapidly implement infection control measures including isolation of infected patients and re-enforcement of hand sanitation with soap and water or jelly-based alcohol disinfectants. In addition, continued education of the personnel within the ward would aid in reminding the staff of the importance of following standard and specific infection control precautions to prevent new outbreaks.

## ACKNOWLEDGMENTS

The authors are very grateful to Leticia Téllez and Concepción Santiago for their collaboration in recollection and transcription of information for the investigation.

## REFERENCES

- Bilcke J, Van Damme P, Van Ranst M, Hens N, Aerts M, Beutels P (2009) Estimating the Incidence of Symptomatic Rotavirus Infections: A Systematic Review and Meta-Analysis. *PLoS One*. 4(6): e6060.
- Chandran A, Henzen HR, Santosaham M, Siberry KG (2006) Nosocomial rotavirus infections: a systemic review. *J. Pediatr*. 194: 441-447.
- Delpiano ML, Riquelme RJ, Casado FM, Álvarez HZ (2006) Comportamiento clínico y costos de la gastroenteritis por rotavirus en lactantes: Adquisición comunitaria versus nosocomial. *Rev. Child. Infectol*. 23: 45-52.
- Frühwirth M, Brösl S, Ellemunter H, Moll-Schüler I, Rohwedder A, Mutz I (2000). Distribution of rotavirus VP4 genotypes and VP7 serotypes among nonhospitalized and hospitalized patients with gastroenteritis and patients with nosocomially acquired gastroenteritis in Austria. *J. Clin. Microbiol*. 38:1804-1806.
- Gallimore CI, Taylor C, Gennery AR, Cant AJ, Galloway A, Iturriza-Gomara M, Gray JJ (2006). Environmental monitoring for gastroenteric viruses in a pediatric primary immunodeficiency unit. *J. Clin. Microbiol*. 44: 395-399.
- Gallimore CI, Taylor C, Gennery AR, Cant AJ, Galloway A, Xerry J, Adigwe J, Gray JJ (2008). Contamination of the hospital environment with gastroenteric viruses: comparison of two pediatric wards over a winter season. *J. Clin. Microbiol*. 46: 3112-3115.

- Jarvis RW (2007). Endemic and epidemic hospital infections. In: Bennett & Brachman editor Hospital Infections 5ed. Philadelphia. Wolters Kluwer Lippincott Williams & Wilkins. pp. 566-569.
- László B, Nyúl Z, Kisfali P, Deák J, Kovács J, Kónya J, Mészner Z, Molnár P, Pátri L, Schneider F, Tóth A, Melegh B, Iturriza-Gomara M, Gray J, Martella V, Szucs G, Bányai K (2009) First detection of P[6],G9 rotaviruses in Hungary--an imported strain from India? *J. Travel. Med.* 16:141-143.
- López-de-Andrés A, Jiménez-García R, Carrasco-Garrido P, Alvaro-Meca A, Graciela Galarza P, Gil de Miguel A (2008). Hospitalizations associated with rotavirus gastroenteritis in Spain, 2001–2005. *BMC Public Health* 8:109.
- Lopman BA, Gallimore C, Gray JJ, Vipond IB, Andrews N, Sarangi J, Reacher MH, Brown DW (2006). Linking healthcare associated norovirus outbreaks: a molecular epidemiologic method for investigating transmission. *BMC Infect. Dis.* 6:108.
- Ratner JA, Neu N, Jacob K, Grumet S, Adachi N (2001) Nosocomial rotavirus in a pediatric hospital. *Infect. Control Hosp. Epidemiol.* 22:299-301.
- Román RE, Wilhelmi De GML, Cileruelo P, Calvo RC, García GML (2003) Gastroenteritis aguda nosocomial e infección asintomática por rotavirus y astrovirus en niños hospitalizados. *An. Pediatr. (Barc)* 60: 337-343.
- Velázquez FN, Matson DO, Calva JJ (1996) Rotavirus infection in infants as protection against subsequent infection. *New Eng. J. Med.* 335: 1022-1028.