

Brief Original Article

Epidemiology and economic losses of rotavirus infection associated with hospitalization of Armenian children

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Abstract

Introduction: Rotavirus (RV) is the leading cause of severe diarrhea-associated morbidity and mortality among children worldwide. Limited data exist on the epidemiology and burden of rotavirus gastroenteritis in Armenia. The purpose of this study is to estimate the economic losses and describe the epidemiological characteristics of rotavirus infections in hospitalized children in Armenia.

Methodology: A retrospective chart review was performed of all children (aged < 5 years) with Rotavirus infection admitted to the “Nork” Republican Infection Clinical Hospital in Yerevan, the capital of Armenia, between January and July 2014. Criteria of inclusion were age under 5 years old and presence of RV antigen in stool by enzyme linked immunosorbent assay.

Results: The total number of patients was 126; average age was 28.7 ± 13.3 months; 54.8% were male. The highest number of cases (31.8%) was observed in April. Most of the patients (71.4%) were hospitalized in the first three days, demonstrating an acute onset of the disease. In total 19% of the patients had received RV vaccine and, despite this, were infected with RV. Based on bacteriological examination of stool, 18.3% of patients had RV infection combined with pathogenic or conditional pathogenic microflora. All patients spent 817 days in total in the hospital. Economic losses associated with hospitalization were 16340000 AMD (\approx 33346 USD).

Conclusion: Rotavirus carries significant morbidity and economic losses. Comprehensive estimates of the disease characteristics and introduction of a national immunization program against RV initiated in 2012 may decrease this burden. Further studies to evaluate the feasibility and cost-effectiveness of such a program are warranted.

Key words: rotavirus; epidemiology; Armenia.

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Introduction

Viruses are the predominant cause of acute diarrhea in both industrialized and developing countries. Rotavirus (RV) is the leading cause of severe diarrhea and diarrhea-associated morbidity and mortality in children worldwide [1-4]. Each year RV causes an estimated 111 million episodes of diarrhea requiring only home-care, 25 million clinic visits, 2 million hospitalizations, and 352,000–592,000 deaths (median 440,000 deaths) in children < 5 years of age [5].

RV infection cases are registered in all countries, but the complications and deaths from it are mainly registered in low-income countries. In developing countries, where 20 to 70% of hospitalization and 800000 to 3 million deaths per year are associated with RV, economic impact reaches extreme numbers [6-9].

The prevalence of RV infection in the Republic of Armenia generally coincides with the international

statistical indices [10]. RV is documented to cause 38% of acute gastroenteritis hospitalizations among children aged < 5 years [11]. The Republic of Armenia was one of the two earliest countries in the Newly Independent States to introduce rotavirus vaccine into its national immunization program. In November 2012, RV1 (Rotarix) was introduced for Armenian infants of ages 6 and 12 weeks [11,12]. Despite this fact, the hospitalization associated with RV gastroenteritis remains significant. Limited data exist on the epidemiology and economic losses of rotavirus gastroenteritis among hospitalized children in Armenia.

Thus, the aim of this study is the estimation of the epidemiological characteristics and economic losses of rotavirus infection associated with hospitalization of Armenian children.

Methodology

This study was conducted in “Nork” Republican Clinical Hospital. It has been Armenia’s main medical institution specializing in the diagnosis and treatment of infectious diseases since 1956. A total of 126 children aged ≤ 5 years with the confirmed diagnosis of RV infection were included in the research during the period of January–July 2014. Inclusion criteria were the presence of RV antigen in the stool of the child hospitalized with symptoms of enteric infection and the duration of hospitalization for at least 24 hours. Clinical, epidemiological and laboratory examinations were performed, and all the patients were discharged with clinical improvement.

The antigen of RV was detected in the stool of patients using RIDA®Quick Rotavirus (R-Biopharm AG, Darmstadt, Germany) diagnostic test-systems. Within the framework of the Rotavirus Epidemiological Surveillance Program of the Republic of Armenia, all positive samples were sent to the National Center for Disease Control and Prevention of the Republic of Armenia for the confirmation of the diagnosis using Enzyme Linked Immunosorbent Assay (Oxoid Test Systems, Hampshire, UK).

A standardized questionnaire was developed, and patients’ information on demographics, hospitalization, vaccination, clinical signs and symptoms, physical exams, treatment, and laboratory tests results were collected. Hospital costs were calculated based on the daily cost for the management of the patient with RV infection (20000 AMD) and duration of hospitalization.

Analyses were carried out using SPSS Statistics for Windows, version 20.0. Reported p values were two-sided, and p values less than 0.05 were considered statistically significant.

The study was approved by the Ethics Committee of the Yerevan State Medical University. Informed consent of the parents of the patients was received.

Results

Among the observed patients 54.8% were males. The average age of children was 28.7 ± 13.3 months, the youngest was 4 months, and the eldest was 60 months. The age distribution of RV positive children (Figure 1) showed that most of the RV infection cases (72%) were observed by 3 years of age. There was no significant difference in the mean age of RV infected boys and girls (p = 0.22).

More than half of the children were residents of Yerevan (58.7%), the capital city of Armenia, others were from regions. Most of the children (71.4%) had been hospitalized within the first three days of the

disease. The patients admitted on the 4th, 5th and 6th days were 15.1%, 10.3%, and 2%, respectively.

The age and sex of the patients did not impact on the dates of hospitalization (p = 0.81 and p = 0.43 respectively), whereas the place of residence had a certain role: Yerevan residents were hospitalized in much earlier period of the disease (2.3 ± 1.2 days) than the residents of the regions (3.2 ± 1.7 days), p = 0.006.

The distribution of RV positive cases by months showed that the highest number of cases (31.8%) was observed in April, then 30.2% in May, 22.2% in March, 7.9% in February, and 7.9% in June.

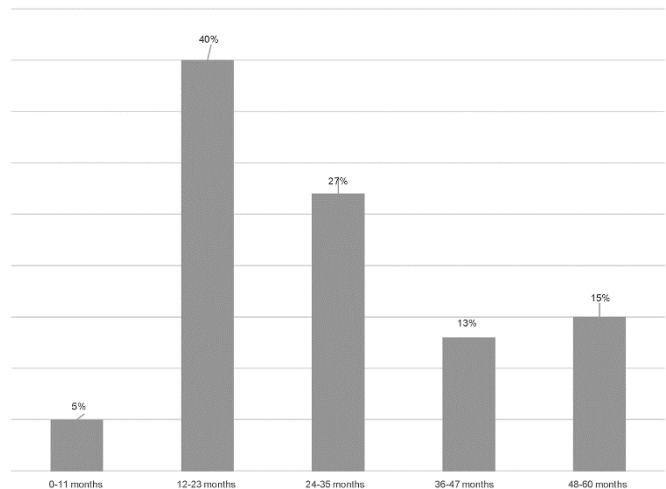
Household contacts were mentioned in 19.8% of cases (mostly family members with similar clinical symptoms). The analysis of the fact of RV vaccination of patients revealed that 81% of RV positive children had not received a vaccine for RV, as they were born before the implementation of the vaccine. However, 19% of hospitalized children had received RV vaccine within the national immunization program, and, despite that fact, were infected with RV.

The median duration of hospitalization was 6.5 ± 2.5 days. In total 126 patients had spent 817 days in hospital. The cost for daily management of the patient in hospital is 20000 AMD, so the government spent 16340000 AMD (≈ 33346 USD) for the hospital care of these patients.

Due to severe illness, 8.7% of the patients were admitted to the Intensive Care Unit. There was no statistically significant difference in the age between the patients admitted to intensive care unit (27.6 ± 12.8 months) and patients admitted to general divisions (28.8 ± 21.3 months).

The main symptoms of the patients at the time of hospital admission were diarrhea (93.7%), vomiting

Figure 1. Age distribution of Rotavirus positive patients.



(92.1%), fever (80.2%), fatigue (70.6%), abdominal pain (30.2%), absence of appetite (42.9%), cough (18.3%), and catarrhal symptoms (7.1%), see Figure 2.

Typical gastroenteritic variant of the disease was observed in most of the examined patients (87.3%), however gastritic (2.4%), enteritic (3.9%), gastroenterocolitic (3.9%) and enterocolitic (2.4%) variants were also observed.

All patients had bacteriological examination of stool in parallel with the detection of specific antigen of RV. Most of the patients (81.7%) had mono- RV infection. In 18.3% RV was detected in combination with pathogenic or facultative pathogenic microflora: *Staphylococcus aureus* predominated among 56.5% of patients with mixed RV infection, followed by *Salmonella* in 21.7%, *Morganella* in 8.7%, *Proteus* in 8.7%, and *Shigella* in 4.3% of cases (Figure 3).

Discussion

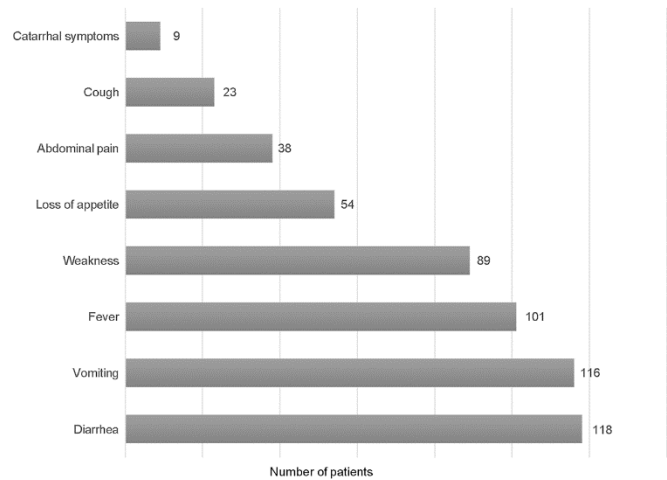
The study results documented that most of the hospitalizations (72%) occurred among children < 3 years of age, which coincided with the international data [13-16]. The fact that no statistically significant differences in age between patients admitted to Intensive Care Unit and patients admitted to general divisions were detected may suggest that there were other factors influencing the severity of the disease. The results demonstrated that the residents of the capital city had better access to hospital care in the early stages of the disease compared with the residents of the regions. Rotavirus infection among 19% of vaccinated children could be associated with non-G1 serotypes of the virus. The longer median duration of hospitalization compared with the reported international data [13,17] could be explained by the absence of a uniform RV case management protocols in the hospital. Along with the detection of RV antigen, stool culture should be performed to gain a better understanding of the (gastroenterocolitic and enterocolitic) clinical variants of the disease.

The primary limitation of this study is the lack of data about RV infected patients in other hospitals of Armenia due to the fact that RV diagnostic tests are not available in regional hospitals. Data were not collected year-round to allow characterization of seasonal fluctuations of RV.

Conclusion

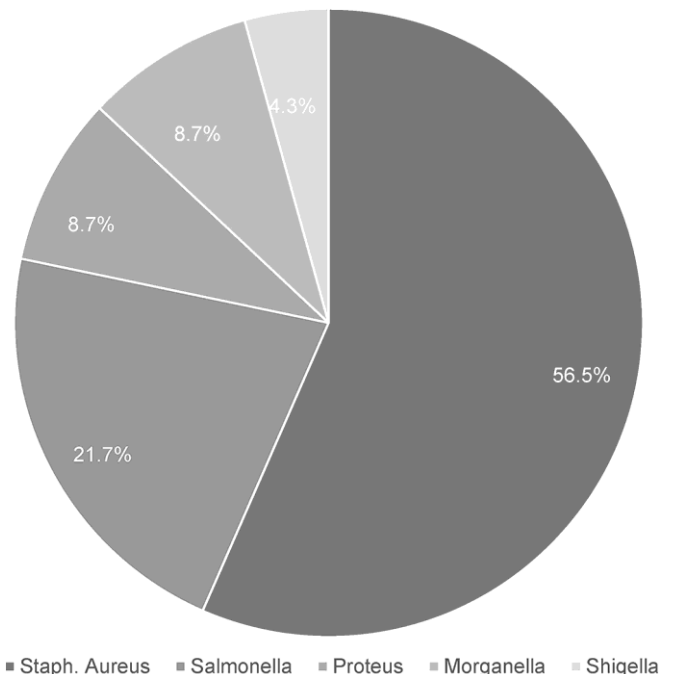
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Figure 2. Clinical symptoms of Rotavirus positive patients.



2012 may decrease this burden. Further studies to evaluate the feasibility and cost-effectiveness of such a program are warranted. The implementation of the available diagnostic tests for RV in all the regions of Armenia is necessary to identify the burden of the disease. Access to needed health services in the regions should be improved to ensure universal health coverage. Development and implementation of case management protocols for RV infected hospitalized patients could improve patients’ care and decrease hospital losses.

Figure 3. Results of the bacteriological examination of stool among patients with mixed Rotavirus infection.



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