Rotavirus infection in infants and young children with acute gastroenteritis in the Islamic Republic of Iran

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عدوى الفيروسات العُجَيْلية في الرضع وصغار الاطفال المصابين بالتهاب حاد في المعدة والامعاء في إيران

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تمت دراسة معدل العدوى بالفيروسات العُجَيْلية بين ٧٠٤ من الأطفال الذين يقل عمرهم عن خمس سنوات ، ويعانون من التهاب حاد بالمعدة والأمعاء ، فيما بين تموز/ يوليو ١٩٩٣ وحزيران/ يونيو ١٩٩٤ ، في طهران . وتم اكتشاف مستضدات هذه الفيروسات العُجَيْلية في ١٥٫٣٪ من عينات البراز التي فحصت باختبار إليزا ، بينما كانت النسبة المقارنة ١٫١٪ بين مجموعة شاهدة من الأصحاء . ووجد أن تواتر العدوى بالفيروسات العُجَيْلية كان عالياً جداً بين الأطفال الذين يقل عمرهم عن ٢٤ شهراً (١٩٫٧٪) بالمقارنة بمن يبلغون من العمر عامين أو أكثر (٥٫١٪) . وظهر أن للرضاعة الطبيعية تأثيراً واقياً من هذه العدوى ، وأن ذروة انتشار العدوى جاءت في فصل الربيع . لقد كشفت هذه الدراسة عن أن الفيروسات العُجَيْلية من المسببات الهامة للنزلات المَعِدية المعوية الحادة بين الأطفال في طهران .

The incidence of rotavirus infection was studied in 704 children less than five years of age who were suffering from acute gastroenteritis, between July 1993 and June 1994 in Teheran. Rotavirus antigen was detected by ELISA in 15.3% of the stool samples examined, as compared to 1.1% in a group of healthy controls. The frequency of rotavirus infection was significantly higher among patients under 24 months of age (19.7%) than among children two years old or more (5.1%). Breast-feeding had a protective action against rotavirus infection and the peak of incidence was in the spring. This study revealed that rotavirus is an important etiological agent of acute gastroenteritis among children in Teheran.

L'infection à rotavirus chez les nouveau-nés et les jeunes enfants souffrant de gastro-entérite aiguë en République islamique d'Iran

L'incidence de l'infection à rotavirus a été étudiée entre juillet 1993 et juin 1994 à Téhéran chez 704 enfants de moins de cinq ans qui souffraient de gastro-entérite aiguë. L'antigène du rotavirus a été détecté par la méthode ELISA dans 15,3% des prélèvements de selles examinés, comparé à 1,1% dans un groupe de sujets témoins sains. La fréquence de l'infection à rotavirus était considérablement plus élevée chez les enfants malades de moins de 24 mois (19,7%) que chez les enfants de deux ans ou plus (5,1%). L'allaitement maternel a eu un effet protecteur contre l'infection à rotavirus et le niveau maximal de l'incidence se situait au printemps. Cette étude a révélé que le rotavirus est un facteur causatif important de la gastro-entérite chez les enfants à Téhéran.

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Introduction

Rotavirus is the most important etiological agent of serious dehydrating diarrhoea among infants and young children [*1*], causing an estimated nine million cases of severe disease, and more than 800 000 deaths per year worldwide [2]. Rotavirus particles are 65–75 nanometres in diameter, with a double protein shell and II strands of double-stranded RNA. The majority of rotaviruses known to infect humans and animals share a common-group antigen and are termed group A rotaviruses [*1*].

Outbreaks of rotavirus infection are common among infants and young children in hospitals, day-care centres and schools. Such outbreaks result in both clinical and subclinical cases, and premature and underweight babies are most likely to develop serious infections [*3–6*]. The virus is usually shed in the faeces for five to seven days. In severe cases, rapid dehydration can lead to renal shutdown and death [*7,8*].

In developing countries this virus accounts for nearly 6% of all diarrhoeal episodes and for 20% of all diarrhoea-associated deaths of children under five [*9*]. In industrialized countries as well, rotavirus gastroenteritis is a major cause of hospitalization of infants and young children [*10–12*]. In temperate climates, rotavirus is most often detected in the winter and rarely in the summer, whereas in the tropics it is found all year round, with less-defined seasonal variation [*13*]. Rotavirus diarrhoea is most prevalent among children aged 6–24 months; it has been estimated that an effective vaccine could reduce diarrhoeal mortality among this age group [*14,15*].

The purpose of this study was to assess the rate of rotavirus infection among children under five years of age with acute gastroenteritis at three paediatric clinics in Teheran.

Materials and methods

A total of 704 male and female children less than five years of age admitted with acute diarrhoea were studied at three paediatrics clinics associated with Teheran and Shahid Beheshti Universities of Medical Sciences in Teheran between July 1993 and June 1994. A total of 176 nondiarrhoeal healthy children of the same age group were studied as controls at day-care centres in Teheran. Stool samples were obtained within 24 hours of admission and were frozen and stored at –70 °C until processing.

A commercial enzyme linked immunosorbent assay (ELISA) (Behring, Marburg, Germany) was used to test the faeces of patients and control group for the presence of rotavirus antigen, according to the manufacturer's instructions. Readings were made spectrophotometrically at a wavelength of 450 nanometres.

Results

The frequency of detection of rotavirus in faeces among children less than five years of age with acute diarrhoea is shown in Table 1. A total of 108 (15.3%) episodes of acute gastroenteritis were associated with rotavirus antigen detection, whereas two (1.1%) of the control group were positive ($p < 0.001$).

The majority of rotavirus infection cases (97 cases or 89.8%) occurred in children under 24 months of age. The highest incidence of diarrhoea caused by rotavirus (25.1%) was in children between 6 and 12 months of age, decreasing to 5.2% in patients two years of age and older. The overall mean age was 12.2 months. There was a significant difference between the rate of infection in children under 24 months of age with children older ($p < 0.001$). The

Table 1 Detection by ELISA of rotavirus in the stools of 704 children with acute gastroenteritis in Teheran, by age of child

Age group (months)	Patients: Number	No. with rotavirus diarrhoea	Positive rate (%)
0– 5	167	27	16.2
6–11	183	46	25.1
12–17	73	15	20.5
18–23	68	9	13.2
24–29	43	3	7.0
30–35	56	5	8.9
36–41	23	0	0
42–47	42	1	2.4
48–53	13	1	7.7
54–59	36	1	2.8
TOTAL	704	108	15.3

$p < 0.001$

Table 2 Monthly incidence of rotavirus in the stools of patients with acute gastroenteritis in the period July 1993–June 1994

Month	Patients: No. tested	positive: No.	(%)
July	169	20	11.8
August	117	14	11.9
September	13	2	15.4
October	10	1	10.0
November	14	2	14.3
December	14	2	14.3
January	12	3	25.0
February	81	12	14.8
March	39	4	10.3
April	28	4	14.3
May	95	25	26.3
June	112	19	17.0
TOTAL	704	108	15.3

$p = 0.004$

rotavirus diarrhoea in females under five years old (18.0%) was higher than that in males (13.7%) of the same age.

From the questionnaire data, it was estimated that rotavirus gastroenteritis cases in outpatients and inpatients stood at 12.1% and 21.9% respectively, and there was a significant increase of infection in hospitalized children ($p < 0.001$).

A possible relationship between the occurrence of rotavirus infection and seasons was investigated (Table 2). The rates of rotavirus infection were 20.4% in the spring (April–June), 12.0%, in summer, 13.2% in autumn and 14.4% in winter, with a significant difference between infection rates in the spring and other seasons ($p = 0.004$).

The rotavirus-related episodes of diarrhoea in children according to clinical features and type of feeding are shown in Table 3. In infants up to nine months of age who were breast-fed there was an infection rate of 19%, significantly lower than that in the bottle-fed group (48%) ($p = 0.0035$). The study of clinical manifestations in rotavirus gastroenteritis cases showed that most children with infection had fever (89.4%), vomiting (86.7%) and dehydration (87.8%).

Table 3 Clinical characteristics of children with rotavirus diarrhoea

Characteristic	No. of patients	Episodes of diarrhoea: No.	%
Fever	47	42	89.4
Vomiting	45	39	86.7
Dehydration	41	36	87.8
Breast-fed	47	9	19.1
Bottle-fed	33	16	48.5

$p = 0.0035$

Discussion

Rotavirus has been shown to be a major enteropathogen throughout the world, affecting mainly children less than five years of age in both industrialized and developing countries [*16,17*].

Rotavirus was detected in 11–71% of children with diarrhoea; the median rate of detection (33%) was independent of the level of economic development or geographical region of the study area [*13*]. The present study shows that the overall rate of rotavirus infection was 15.3% in children with diarrhoea, and 1.1% in the control group. There are similar studies by others in this country [*13,18*]. These results agree with those obtained by other workers in developing countries (China, India, Mexico, Myanmar and Pakistan), which record a prevalence of 16% in infection cases and 2% in control groups [*19*].

As documented by other studies, most of the cases of rotaviral diarrhoea occur in children less than two years of age [*20,21*]. However, the highest incidence of rotavirus diarrhoea in this study occurred in children aged 6 to 12 months. This is similar to the incidence in other developing countries where rotavirus is a significant pathogen among infants aged less than 12 months [*19*]. In most parts of the world, the rotavirus is present throughout the year, which suggests that low-level transmission could maintain the chain of infection [*13*]. The virus is spread by the faecal–oral route, but airborne or droplet transmission has also been postulated.

During the period of the present study rotavirus infections occurred throughout the year, but the greatest number of rotavirus cases was identified between April and June. While rotavirus infections have been called a winter disease in the temperate zones, we found that their incidence peaked in the spring months. The frequency of rotavirus cases among breast-fed and bottle-fed children in Teheran was 19.1% and 48.5% respectively for infants up to nine months of age. This result may indicate that breast-fed infants, besides acquiring a passive immunity from the mothers, may also acquire resistance to infection with rotavirus as is implied here by the low frequency of breast-fed infants among patients. During this study, watery stools, vomiting, fever and dehydration were prominent symptoms in children suffering from rotavirus-associated gastroenteritis. The results of this study indicate that rotavirus is a major etiological agent of acute diarrhoea in infants and young children in Teheran.

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