

Effects of Rota Vaccine on Severity and Duration of Rotavirus Infection among Children Less Than 5 Years Old at Al Kadhimiya Pediatrics Hospital

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Abstract: *Rotavirus infection is the leading cause of severe acute gastroenteritis in young children worldwide. Rotavirus diarrheal disease is more severe than diarrhea caused by other enteric pathogens with symptoms including an average of 6 stools per day, severe dehydration, which is 14 times more frequent than in children without rotavirus diarrhea, vomiting and fever. Rotavirus is the single most important cause of severe gastroenteritis in young children throughout the world. Globally, an estimated 700,000 children die each year due to rotavirus diarrhea. Rotavirus transmission, in most cases, occurs through contact with contaminated stool. The usual way of transmission involves ingesting food or water contaminated with the virus. The incubation period for a rotavirus lasts approximately two days. This study was carried out to assess the effectiveness of Rota vaccine on the severity and duration of rotavirus infection admitted to Al Kadhimiyah Pediatrics hospital. The results show that rotavirus vaccine is effective in reducing the severity and duration of infection.*

Methods: *Over a period of one year, from the 1st of January 2016 to the 1st of January 2017. 715 patients admitted with gastroenteritis, detailed vaccination history was taken and stool sample was send for lab investigation of rotavirus using commercial Kits (Biotec® UK). A special questionnaire was designed by researchers for the purpose of data collection. Ages of the patients range were from 2 months-5 years, alfa level was set at 0.05. Statistical analysis was done using SPSS 20.*

Results: *Out of 715 stool samples, rotavirus was detected in 375 (52.4%). The majorities 78 % (292) of cases were reported in first two year of age. mean age in months was 8 ± 3 months. 64% (240) were males. mean weight in Kg was 11.6 ± 5 kg, mean height in cm was 82.4 ± 10 .*

21% (78) of the sample were with no history of rota vaccine. 4.5% (17) of the sample were wasted nutritionally. 86.8% (317) of the samples were on complementary feeding, mean vesikari score was 9.3 ± 2.9 .

(58.9 %) 221 of the sample were moderate veskari score .mean duration of admission in days was 5 ± 2 . 63% (236) of the sample were from urban places. only (1.8%) 7 patients outcome was death during the study period.

Conclusion: Rota virus vaccine is effective in reducing the severity and duration of infection. Rota virus is an important cause of diarrheal disease in children less than 5 years old.

Recommendation: Encouragement of full vaccination against rotavirus as a preventive measure against rotavirus infection.

Keywords: rotavirus, Children, Rota vaccine.

تأثير لقاح الفايروس العجلي على شدة و مدة الاصابة بمرض الفايروس العجلي عند الاطفال بعمر اقل من خمس سنوات في مستشفى اطفال الكاظمية

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المستخلص

مقدمة: عدوى فيروس الروتا هي السبب الرئيسي لالتهاب المعدة والأمعاء الحاد الشديدة في الأطفال الصغار في جميع أنحاء العالم. مرض الإسهال الفيروسي الدوار أكثر شدة من الإسهال الناجم عن مسببات الأمراض المعوية الأخرى التي تحتوي على أعراض بما في ذلك متوسط 6 مرات تبرز يوميا، والجفاف الشديد، وهو أكثر تكرارا بـ 14 مرة من الأطفال الذين لا يعانون من الإسهال بسبب الفيروس الدوار. الفيروس الدوار هو أهم سبب لالتهاب المعدة والأمعاء الحاد في الأطفال الصغار في جميع أنحاء العالم. على الصعيد العالمي، يموت ما يقدر بنحو 700000 طفل كل عام بسبب الإسهال بالفيروس الدوار. في معظم الحالات، يحدث انتقال الفيروس عن طريق الاتصال مع البراز الملوث. الطريقة المعتادة للانتقال تتضمن تناول الطعام أو الماء الملوث بالفيروس. تستمر فترة الحضانه للفيروس الدوار ما يقرب من يومين. أجريت هذه الدراسة لتقييم فعالية لقاح الفيروس الدوار على شدة ومدة العدوى بالفيروسات الدوارة التي تم إدخالها إلى مستشفى الكاظمية للأطفال.

طرائق البحث: على مدى عام واحد، من 1 كانون الثاني 2016 إلى 1 كانون الثاني 2017 تم تضمين 715 مريضا بالتهاب المعدة والأمعاء، وتم أخذ تاريخ تطعيم مفصل وتم إرسال عينة من البراز للمختبر للتحقق من وجود الفيروس الدوار باستخدام معدات تجارية من شركة (Biotec® UK). تم تصميم استبيان خاص من قبل الباحثين لغرض جمع البيانات. كان نطاق اعمار المرضى من شهرين إلى 5 سنوات. تم تحديد مستوى الفا عند 0.05. تم إجراء التحليل الإحصائي باستخدام برنامج SPSS 20.

النتائج: من بين 715 عينة من البراز، تم الكشف عن الفيروس الدوار في 375 (52.4%)، وتم التبليغ عن 292 حالة في العامين الأولين من العمر. كان متوسط العمر بالأشهر 3 ± 8 أشهر، 64% (240) من المرضى كانوا من الذكور. وكان متوسط وزنهم بالكيلوغرام 5 ± 11.6 كغم، اما متوسط الطول بالسنتيمتر فكان 10 ± 82.4 ، 21% (78) من العينة كانوا بدون تاريخ مرضي بسبب الفيروس الدوار، 4.5% (17) منهم يعانون من الهزال من الناحية التغذوية، 86.8% (317) من العينة تعتمد على الغذاء التكميلي، معدل vesikari كان 9.3 ± 2.9 ، 58.9% (221) من العينة كانوا بمعدل vesikari معتدل. معدل فترة الرقود بالأيام كانت 2 ± 5 يوم. (236) او ما نسبته 63% من العينة كانوا من المناطق الحضرية. فقط 7 من المرضى (1.8%) توفوا خلال فترة الدراسة.

الاستنتاج: لقاح الفيروس الدوار فعال في الحد من شدة ومدة الإصابة . الفيروس الدوار هو سبب مهم لمرض الإسهال لدى الأطفال أقل من 5 سنوات من العمر.

التوصية: تشجيع التطعيم الكامل ضد الفيروس الدوار كإجراء وقائي ضد العدوى بالفيروس.

الكلمات المفتاحية: الفيروس الدوار، الأطفال، لقاح الفيروس الدوار.

Introduction

Diarrhea remains the second leading cause of death around the world for children under 5 years of age. Diarrhea can be caused by a variety of microbes, or parasites, but most often it is caused by viruses. Approximately 10% of all cases of childhood diarrhea are caused by a rotavirus; Rotavirus frequently produces more severe diarrhea, than other microbes. It is known that among children with severe diarrhea, rotavirus is found in almost 50% of cases [1]. Rotavirus is an important pathogen in day care-acquired illnesses. The virus can remain infectious on inanimate surfaces, such as toys, for several days, and up to four hours on human hands. Rotavirus infection is the foremost cause of severe gastroenteritis of young children worldwide [2]. Rotaviruses are the most important cause of severe dehydrating diarrhea in young children in both developed and developing countries [3]. Rotavirus transmission, in most cases, occurs through contact with contaminated stool. The usual way of transmission involves ingesting food or water contaminated with the virus. The incubation period for a rotavirus lasts approximately two days [4]. Rotavirus infection is the leading cause of severe acute gastroenteritis in young children worldwide. Rotavirus disease is more severe than diarrhea caused by other enteric pathogens with symptoms including an average of 6 stools per day, severe dehydration, which is 14 times more frequent than in children without rotavirus diarrhea, vomiting and fever [5–7]. Rotavirus gastroenteritis is a mild to severe disease characterized by vomiting, watery diarrhea, and low-grade fever. Once a child is infected by the virus, symptoms often start with vomiting followed by four to eight days of profuse diarrhea. Dehydration is more common in rotavirus infection than in most of those caused by bacterial pathogens, and it is the most common cause of death related to rotavirus infection [8]. Severe dehydration, leading to acute shock with electrolyte imbalance is believed to be the major cause of death in rotavirus gastroenteritis (RVGE) [9-11]. Vaccination is considered one of the most effective public health strategies to prevent rotavirus infection and reduce disease burden [12].

This study was carried out to assess the effectiveness of rotavaccine on the severity and duration of rotavirus infection admitted to Al Kadhimiya Pediatrics hospital.

Materials and methods

The study was conducted at Al Kadhimiya Pediatric hospital, In Iraq , north of Baghdad with a capacity of 120 bed a tertiary pediatric hospital. Patients are admitted from the city and north of Baghdad villages, and referred from The health centers. During a 1-year period from January 2016 through January 2017, children less than 5 years of age who were hospitalized in the ward and diagnosed with acute gastroenteritis (AGE) (>5 loose or watery stools in a 24 h period) were included in the study after verbal consent was obtained. All patients were treated from dehydration until discharge or death. Nutritional status was assessed using WHO criteria; The weight and height/length of the selected child was recorded and converted (weight for length/or height indices of nutritional status) into: either wasted or not according to WHO criterion based on standard deviation (SD) units, children who were more than two SDs below the reference median were considered wasted.

Stool samples were collected within 48 h of admission and tested for rotavirus using commercial kit (Biotec® UK).the Laboratory procedure was done according to instructions of the manufacturer.

Inclusion criteria: parasite – free stool samples at microscopic examination.

Exclusion criteria: were a hemorrhagic fresh stool samples.

Data collection was done using a special questionnaire developed by researchers based on thorough literature review was used to record each case included the followings: Age in months, Sex, Weight in Kg, Length or height in Cm, Vaccination status, weight for length/or height, Type of feeding, Vesikari severity score, duration of illness in days, Address, Outcome. Statistical methods were done using SPSS v.20 software. Percentages, frequencies, mean and standard deviations were computed and the statistical significance of the severity in comparisons to other characteristics tested using the Chi-square test. Alfa level was set at 0.05 and below.

Clinical Severity Scoring System: These parameters took into account each of the symptoms identified as important in the clinical presentation profile including: diarrhea, vomiting, fever, dehydration, and the duration of diarrhea and vomiting. An additional parameter considered is treatment status. Each of the seven parameters is broken into thirds according to an equally divided severity distribution (i.e., bottom third=1, middle third=2, top third=3) as initially identified by Ruuska and Vesikari [10]. The scores for each parameter within the clinical severity scoring system are added allowing for a severity score between 0 and 20 points. The seven parameters and the corresponding scores provided for each categorical level of severity are outlined in Table 1 [13]. Severity scores above 10 points (i.e., ≥ 11 points) are considered severe, scores between 7 and 10 moderate, and scores less than 7 mild.

Table 1: Vesikari Clinical Severity Scoring system parameters and Scores

Parameter	Score		
	1	2	3
Diarrhea			
Maximum number of stools per day	1-3	4-5	≥ 6
Vomiting			
Vomiting	1-4	5	≥ 6
Maximum number of Vomiting episodes per day	1	2-4	≥ 5
Vomiting Duration (days)	1	2	≥ 3
Temperature	37.1-38.4	38.5-38.9	≥ 39.0
Dehydration	N/A	1-5%	$\geq 6\%$
Treatment	Rehydration	Hospitalization	N/A

Results

Out of 715 stool samples, rotavirus was detected in 375 (52.4%). The majorities 78% (292) of cases were reported in first two year of age. Mean age in months was 8 ± 3 months. 64% (240) were males. Mean weight in Kg was 11.6 ± 5 kg. Mean height in cm was 82.4 ± 10 (Table 2). 21% (78) of the sample with no history of Rota vaccine. 4.5 % (17) of the sample were wasted nutritionally. 86.8% (317) of the sample were on complementary feeding. Mean vesikari score was 9.3 ± 2.9 . (58.9 %) 221 of the sample were moderate vesikari score. Mean duration of admission in days was

5 ±2. (63%) 236 of the sample were from urban places. Only (1.8%) 7 patients outcome was death during the study period. Chi square test was run to assess the association between Vaccination status and vesikari score category, the results showed that there was a significant association between Vaccination status and vesikari score category (P value = 0.00000, df=4). Chi square test was run to assess the association between Vaccination status and illness duration category, the results showed that there was a significant association between Vaccination status and illness duration category (P value = 0.00000, df=2).

Table (2): Distribution of rotavirus infection according to the study population

	Frequency	Percentages		Frequency	Percentages	Frequency
Age groups (Months)			Nutritional status	Wasted	17	4.5
=< 6	58	15.4%		Not wasted	358	95.5%
7-12	139	37%		Total	375	100 %
13-24	95	25.3%		Types of feeding		
25-36	60	16%				
37-60	23	6 %		Breast feeding	21	5.6 %
Total	375	100 %		Bottle feeding	14	3.7 %
				Mixed feeding	23	6.1 %
Sex			Complementary food	317	86.8 %	
Males	240	64 %	Total	375	100 %	
Females	135	36 %				
Total	375	100 %	Severity score category			
			Mild <7	126	33.6 %	
Vaccination history			Moderate 7-10	201	53.6 %	
No vaccine	72	19.2 %	Severe => 11	48	12.8 %	
Partial	187	49.8 %	Total	375	100 %	
3 doses vaccine	116	30.9 %				
Total	375	100 %	Illness duration category			
			< 5 days	227	60%	
Address			=>5 days duration	148	39%	
Urban	236	63 %				
Rural	138	37 %				
Total	375	100 %				
Outcome						
Death	7	1.8 %				
Recovery	368	98.13 %				
Total	375	100 %				

Discussion

Concerns that the performance of orally administered rotavirus vaccines may be diminished in developing countries of Africa and Asia due to possible interference by concurrent enteric infections, greater levels of maternal antibodies, and higher rates of malnutrition and comorbidities, WHO recommended further efficacy testing in these settings prior to issuing a global

recommendation for vaccine use [14]. Our study had shown that (52.4%) of the sample were infected with rotavirus, a study from Ghana had shown that (32%, N=1021) of the sample were infected with Rota virus. Another study from Rwanda had shown that (24%, N=48) of the sample were tested positive for Rota virus infection [15,16]. The same study from Rwanda had concluded that Rotavirus vaccine is effective in preventing rotavirus disease in Rwandan children who began their rotavirus vaccine series from 7 to 18 weeks of age [16].

A study from Baghdad that was carried out in 2013, the detection rate of Rota virus (N=465), was 22.8%. The same study detected (61.7%) of the total stool samples from the studied diarrheal cases have showed positive results for one or more viruses. Rotavirus antigen was the most frequently detected agent in children as 64.1% in (0-12) months group, 30.2% in (13-24) months group and 5.7% detected in children with the age of >24 months group [17].

The prevalence rate of Rota virus infection in this study was 375 (52.4%). Another study that was carried in Baghdad in 2013 had concluded that Rotavirus-positive stool specimens was detected in 325 (40.3%), (N=807) among acute diarrheal children aged less than five years [18]. Another study from Erbil had shown that the prevalence of Rota virus infection was 96 (37%) (N=260) [19]. A study from Kirkuk (N=177) the prevalence of Rota virus infection was 30 (16.9%) of the total cases studied [20]. A study from Baghdad in 2013 (N=150) showed that the prevalence of Rota virus infection was 23.33 % (N=105) among children less than 4 years old with diarrhea [21]. A study from Babylon from October 2012-May 2013 (N=103) of children less than 12 years old showed that 50.5% of the sample were positive for Rotavirus infection [22]. Another study from Babylon October 2011 to March 2012 (N=236) showed that the prevalence of Rotavirus infection was (45.76 %)[23]. A study from Basrah (N=79) that took place from October 2014 to February 2015; the prevalence of Rotavirus infection was 12.7 % [24]. A study from western Iraq in Al Ramadi that took place from 1st of January 2009 to the 1st of January 2010 (N=420), Rotavirus was detected in 165 (39.26%) and the majority of cases were reported in first year of age [25]. Only 5.6 % (21) of the sample who were breast fed were infected with Rota virus; this may be due to the fact that Breast milk contain immunoglobulin A (IgA) and trypsin inhibitors which limits the acquisition of rotavirus infection [25].

Mean age in this study was 8±3 months. Another study from Baghdad had shown that the mean age in the infected children with Rota virus was 10.5±8.4 months [18]. It was found in a study that covered by EMRO for the WHO Eastern Mediterranean region as a whole, including the countries of Egypt, Iran, Iraq, Jordan, Libya, Morocco, Oman, Syria, Tunisia, and Yemen as well as Afghanistan and Sudan that the overall annual prevalence of RVGE among the gastroenteritis in children under five years of age was 42% [26]. Our study clearly showed that rotavirus vaccine is effective against the severity of the disease, in agreement with a study that was carried out in Ghana in 2013 which suggested a substantial reduction of pediatric diarrheal disease as a result of vaccination [15].

A systematic review of data from 8 countries reported a 49%–89% decline in laboratory-confirmed rotavirus hospitalizations and 17%–55% decline in all-cause gastroenteritis hospitalizations among children aged <5 years within 2 years of vaccine introduction [27]

Limitations of the study: source of drinking water were not included in the research questionnaire. Seasonality of infection was also not recorded in the research questionnaire.

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