

Impact of Rotavirus Vaccination on Viral Gastroenteritis Diseases

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Background: Rotavirus infection causes a significant burden of diarrheal diseases in infants and young children leading to hospitalization and death. Rotavirus was a leading cause of viral gastroenteritis hospitalization among children less than the age of 5 years in Bahrain before rotavirus vaccine introduction in 2008.

Objective: To evaluate the impact of rotavirus vaccination program in the viral gastroenteritis admission among patients less than 5 years of age and to evaluate the incidence of intussusception.

Design: A Retrospective Data Analysis.

Setting: Salmaniya Medical Complex, Bahrain.

Method: Children aged less than five years hospitalized with acute gastroenteritis and intussusception based on international classification of diseases, tenth revision code, were included in the study. The patients were divided into two groups: viral gastroenteritis and intussusception; both groups were admitted to pediatric wards and reviewed from 1 January 2008 to 31 December 2012. The characteristics of patients with intussusception only were reviewed and analyzed according to age, sex, nationality and vaccination status. Patients less than five years of age with bacterial gastroenteritis were excluded.

Result: One thousand nine hundred fifty-five children under five years of age were hospitalized from 1 January 2008 to 31 December 2012. The first group consisted of one thousand nine hundred one patients, admitted with viral gastroenteritis. The second group consisted of fifty-four patients who were admitted with the diagnosis of intussusception. Thirty-seven (1.9%) were males, forty-three (2.2%) were Bahrainis and 11 (0.6%) were non-Bahrainis. No intussusception cases occurred within 31 days of Rotavirus vaccination.

Conclusion: The study revealed that children less than 5 years of age who were hospitalized for viral gastroenteritis have declined following Rota virus vaccine introduction and no reported intussusception with 31 days of vaccination.

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Rotavirus infection is the most common cause of severe gastroenteritis in infants and children¹⁻³. According to the World Health Organization (WHO), 2.4 million hospital admissions and 527,000 deaths annually are attributed to rotavirus infection and the estimated rotavirus related global death during 2008 was 453,000 (420,000 – 494,000) child deaths^{1,4}. Because of the worldwide burden of rotavirus infection, the introduction of vaccination to prevent and minimize rotavirus associated morbidity and mortality has been a public health priority to several countries¹.

According to the last census conducted in 2010, Bahrainis were approximately 568,399 (46%) and 666,172 (54%) of the populations were non-Bahraini, which include many workers

and their families⁵. The total number of children under 5 years of age was 89,020, whereas the birth cohort was less than 20,000⁶.

Rotavirus infection has been a major cause of admission due to viral gastroenteritis among infant and young children in Bahrain. In a study between April 2006 to March 2007, it was found that approximately 45% of moderate to severe viral gastroenteritis among hospitalized under 5 years attributed to rotavirus infection; the rotavirus vaccine was introduced to the immunization schedule since October 2008⁷.

Safety of rotavirus vaccine in particular was a concern particularly after the withdrawal of the first licensed rotavirus vaccine in 1999 due to the association with intussusceptions⁸.

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The pre-licensure studies of the new generation rotavirus vaccine did not show evidence of increased risk for intussusceptions; however, post licensure studies in Mexico and Brazil have demonstrated a low-level increased risk of intussusception associated with rotavirus vaccination⁹.

No published database was found in Bahrain since the introduction of the vaccine to routine schedule to evaluate its impact on hospitalization of viral gastroenteritis.

The aim of this study is to evaluate the impact of rotavirus vaccination program in viral gastroenteritis admission among patients aged less than 5 years of age and to evaluate the intussusception incidence in relation to vaccine introduction.

METHOD

Children aged less than 5 years and hospitalized with acute gastroenteritis and intussusception based on international classification of diseases tenth revision code were included in the study.

Children less than five years of age were divided into two groups: viral gastroenteritis and intussusception; both groups were admitted to pediatric wards and reviewed from 1 January 2008 to 31 December 2012. The characteristics of patients with intussusception only were reviewed and analyzed according to age, sex, nationality and vaccination status. Children less than 5 years with bacterial gastroenteritis were excluded.

A monovalent oral Rotavirus vaccine (Rotarix) was introduced in October 2008 to routine childhood immunization schedule as two doses. The first dose is administered concomitantly with the hexavalent vaccine (DTaP,HB,Hib+IPV) and the thirteen valent pneumococcal conjugate vaccine at age of two months, while the second dose was administered at age of four months with the pentavalent vaccine (DTwP,HB+Hib), second dose of thirteen valent pneumococcal conjugate vaccine and oral polio vaccine.

On 22 March 2010, the FDA temporarily suspended Rotarix vaccine due to presence of PCV1 DNA fragments in two batches of Rotarix vaccine in USA. Bahrain decided to temporarily suspend the vaccine from March 2010 to June 2010 as precautionary measure and resumed its use after completion of safety studies.

Data was entered and analyzed using SPSS 16 statistical package. The data was analyzed to calculate the viral gastroenteritis incidence rate for children under 5 years and the incidence rate of intussusception.

RESULT

One thousand nine hundred fifty-five patients under five years of age were hospitalized from 1 January 2008 to 31 December 2012.

One thousand nine hundred one patients were admitted with viral gastroenteritis (first group). Six hundred sixty-three (34.9%) patients were admitted with viral gastroenteritis in 2008; two hundred fifty-three (13.3%) patients were admitted

with gastroenteritis in 2012. During 2010 and 2011, there was a plateau of viral gastroenteritis coinciding with the period of the temporary suspension. Children who received two doses of the rotavirus vaccine rose from 49% to 96% during 2008 to 2012, see table 1.

Table 1: Rotavirus Vaccination

Year	Coverage with First Rotavirus Vaccine Dose	Coverage with Second Rotavirus Vaccine Dose
2008	71%	49%
2009	87%	81%
2010	71%	59%
2011	97%	96%
2012	98%	96%

*Reduction in the coverage during 2010 following temporary suspension of the vaccine

Fifty-four patients with intussusception (second group) were hospitalized from 2008 to 2012; thirty-seven (68.5%) were males, forty-three (79.6%) were Bahrainis and eleven (20.4%) were non-Bahrainis. Thirty-nine (72.2%) were infants. Eleven (20.4%) were between 1-2 years of age, three cases (5.6%) were aged 2-3 years and only one (1.8%) at age of 4 years. Since vaccine introduction, none of the cases developed intussusception within 31 days from vaccination. One intussusception case was seen in 2009 after 35 days of second dose of rotavirus vaccine and one case developed intussusception after 32 days of the first dose in 2010, see table 2.

Table 2: Intussusception and Vaccine

Year	Received Rota Vaccine	Time of Onset in Relation to Rota Vaccine Administration	Number of Intussusception Cases
2008	No	Not applicable	9
	Yes	Within 31 days of vaccine	0
		>31 days of vaccine	0
2009	No	Not applicable	3
	Yes	Within 31 days of vaccine	0
		>31 days of vaccine	5
2010	No	Not applicable	4
	Yes	Within 31 days of vaccine	0
		>31 days of vaccine	15
2011	No	Not applicable	3
	Yes	Within 31 days of vaccine	0
		>31 days of vaccine	5
2012	No	Not applicable	1
	Yes	Within 31 days of vaccine	0
		>31 days of vaccine	9

Nine cases of intussusception under 5 years of age were admitted in 2008 and 10 cases were admitted in 2012, see figure 1.

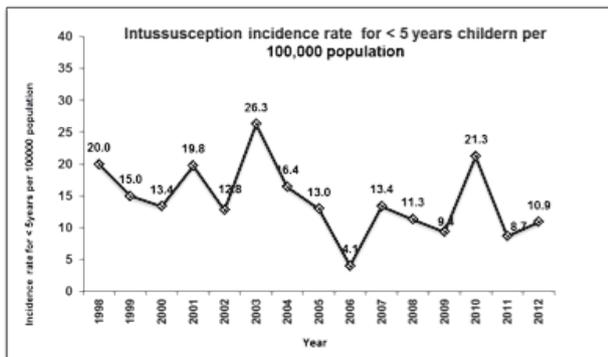


Figure 1: Intussusception Incidence

The estimated rotavirus vaccination coverage percentage for the first and second dose was 71% and 49% respectively during 2008. The coverage percentage reached 98% for the first dose of rotavirus vaccine and 96% for second dose in 2012.

DISCUSSION

In our study, the number of cases was fluctuating prior to vaccine introduction with maximum number of admission related to viral gastroenteritis in the year 2006 and lowest in 2001; in addition, the hospitalization rate for children under 5 years of age in the 4 years prior to vaccine introduction was 0.85% compared to 0.34% in the 4 years following vaccine introduction. The reduction over 4 years among children under 5 years of age hospitalized with acute gastroenteritis was 50%.

Studies showed that increased rotavirus vaccine coverage resulted in rapid reduction of viral gastroenteritis hospitalization among children less than 5 years¹³.

In our study, reduction in viral gastroenteritis hospitalization was found after vaccine introduction and this is supported by similar finding in other studies performed in different countries¹⁴.

The incidence of intussusception has been previously studied in Bahrain prior to vaccine introduction to determine the incidence; the rate was 17.8 per 100,000 per year in children less than five years and 72.4 per 100,000 per year in infants. In our study, the incidence rate was relatively lower following vaccine introduction¹⁵. This might be explained by the variation in the risk of intussusception over time in any country and might be related to variation in reporting. The male predominance is consistent with a previous study conducted in Bahrain¹⁵.

Despite the slight increase in the incidence rate of intussusception found within 31 days of rotavirus vaccination in other countries, a similar finding was not observed since the introduction of the rotavirus vaccine in our study⁹. However, this needs to be interpreted cautiously due to small population, short duration of vaccine introduction and low coverage in the year 2008 and in the year 2010. In addition, some of the intussusception cases might not have been reported to health facilities or resolved spontaneously¹⁵.

The study gives an overall insight of the impact of newly introduced vaccine and evaluates its continuity.

Several countries in the region estimated rotavirus disease burden; however, the vaccine was not incorporated in their schedule. This study proves that the vaccine has a positive impact on reducing viral gastroenteritis hospitalization.

This study provides baseline information that might be utilized by a decision maker to measure the impact of vaccines on decreasing morbidity related to diseases targeted by vaccination.

The study had several limitations: it was conducted in one center rather than multicenter, the overall effect of rotavirus vaccine was studied and only admitted cases were considered.

CONCLUSION

The study revealed reduction of hospitalization due to viral gastroenteritis following Rota virus vaccine introduction and no reported intussusception within 31 days of vaccination. It is advised to conduct a multicentric study to evaluate the incidence of viral gastroenteritis and intussusception following vaccine introduction.

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REFERENCES

1. Parashar UD, Hummelman EG, Bresee JS, et al. Global Illness and Deaths Caused by Rotavirus Disease in Children. *Emerg Infect Dis* 2003; 9(5):565-72.
2. Kane EM, Turcios RM, Arvay ML, et al. The Epidemiology of Rotavirus Diarrhea in Latin America. Anticipating Rotavirus Vaccines. *Rev Panam Salud Publica* 2004; 16(6):371-7.
3. Cunliffe NA, Kilgore PE, Bresee JS, et al. Epidemiology of Rotavirus Diarrhoea in Africa: A Review to Assess the Need for Rotavirus Immunization. *Bull World Health Organ* 1998; 76(5):525-37.
4. World Health Organization (WHO). Global and National Estimates of Deaths Under Age Five Attributable to Rotavirus Infection: 2004 (as of 31 March 2006). http://www.who.int/immunization_monitoring/burden/rotavirus_estimates/en/ Accessed on 17 February 2013.

5. Central Informatics Organization. Census Summary Result: 2010. http://www.cio.gov.bh/cio_ara/English/Publications/Census/Population/1.pdf Accessed 14 February 2013.
6. Central informatics Organization. Census Summary Result: 2010. http://www.cio.gov.bh/cio_ara/English/Publications/Statistical%20Abstract/ABS2009/Ch3/1.pdf Accessed 14 February 2013.
7. Al Musawi M, Zainaldeen H, Shafi F, et al. Burden of Rotavirus Gastroenteritis in Children Aged <5 Years in the Kingdom of Bahrain: A Hospital-Based Prospective Surveillance (2006-2007). *International Journal of Infectious Diseases* 2012; 16:e196.
8. Kombo LA, Gerber MA, Pickering LK, et al. Intussusception, Infection, and Immunization: Summary of a Workshop on Rotavirus. *Pediatrics* 2001; 108(2):E37.
9. Patel MM, López-Collada VR, Bulhões MM, et al. Intussusception Risk and Health Benefits of Rotavirus Vaccination in Mexico and Brazil. *N Engl J Med* 2011; 364(24):2283-92.
10. Immunization Unit, Disease Control Unit, Public Health Directorate, Ministry of Health, Kingdom of Bahrain. Immunization Annual Report 2010. Manama, Bahrain: Ministry of Health, 2010.
11. Bahrain Health Statistics 2010. <http://intranet.health.gov.bh/Docs/Statistics/Health> Accessed on 19 December 2012.
12. FDA News Release: Components of Extraneous Virus Detected in Rotarix Vaccine; No Known Safety Risk FDA Recommends Clinicians Temporarily Suspend Use of Vaccine as Agency Learns More. <http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm205625.htm> Accessed on 18 February 2013.
13. Patel MM, Parashar UD. Assessing the Effectiveness and Public Health Impact of Rotavirus Vaccines after Introduction in Immunization Programs. *J Infect Dis* 2009; 200 Suppl 1:S291-9.
14. World Health Organization (WHO). Weekly Epidemiological Record No. 5 2013; 88:49–64. <http://www.who.int/wer/2013/wer8805.pdf> Accessed on 7 April 2013.
15. Al Musawi M, Al Hindi S, Abu-Elyazeed R, et al. Incidence of Intussusception, Five-Year Hospital-Based Retrospective Review. *Bah Med Bull* 2010; 32(2): 61-4.