National Rotavirus Surveillance Program annual report, 2005–06

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Abstract

The National Rotavirus Reference Centre together with collaborating laboratories Australia-wide has conducted rotavirus surveillance since June 1999. This report describes the serotypes of rotavirus strains responsible for the hospitalisation of children with acute gastroenteritis during the period 1 July 2005 to 30 June 2006. Eight hundred and forty-eight faecal samples from across Australia were examined using monoclonal antibody immunoassays, reverse transcription-polymerase chain reaction and polyacrylamide gel analysis. Serotype G1 was the dominant serotype nationally, representing 40.2 per cent of all strains, followed by serotype G4 (22.6%), serotype G9 (15.1%) and serotype G3 (14.7%). Genotype G12 strains were identified for the first time in Australia. As in previous years, there was substantial geographic variation in the prevalence of rotavirus serotypes. *Commun Dis Intell* 2006;30:434–438.

Keywords: disease surveillance; rotavirus

Introduction

Group A rotaviruses are the single most important cause of severe gastroenteritis in young children worldwide. An estimated 500,000 children die annually of severe diarrhoea, however few of these deaths occur in developed countries.[1] Rotavirus induced disease accounts for up to 50 per cent of childhood hospitalisations for diarrhoea, with 10,000 Australian children hospitalised each year,[2] costing an estimated $26 million in direct costs. Clinical trials of two live oral rotavirus vaccines, Rotarix® (GlaxoSmithKline) and RotaTeq® (Merck) conducted in over 60,000 children worldwide have shown that both vaccines are highly efficacious in prevention of severe diarrhoea and hospitalisation due to rotavirus infections.[3,4] As a result, these vaccines have been licensed in Australia and many other countries throughout the world during 2006.

National epidemiological surveillance of rotavirus strains remains an important component in rotavirus vaccine evaluation and implementation programs. During the past five years, the national surveillance program has reported the emergence of serotype G9 strains as the dominant serotype nationally, and reported the re-emergence by serotype G1 as the dominant type since the 2003–2004 rotavirus season.[5,6] The changing pattern of dominant serotypes, together with the multiple types identified in the Australian population each year, highlights the diversity of rotavirus strains capable of causing disease in children.

The surveillance and characterisation of rotavirus strains causing annual epidemics of severe diarrhoea in young children in Australia continues to be undertaken by the National Rotavirus Reference Centre in Melbourne, together with nine collaborating laboratories. In this report we describe the

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results for the period 1 July 2005 to 30 June 2006, and identify the geographic distribution of the predominant rotavirus serotypes.

Methods

Rotavirus positive specimens detected by enzyme immunoassay (EIA) or latex agglutination in collaborating laboratories were collected, stored frozen and forwarded to Melbourne, together with relevant age and sex details. Specimens were then serotyped using an in-house monoclonal antibody (MAb) based serotyping EIA. The EIA employed a panel of MAbs specific for the major glycoprotein VP7 of the outer capsid of the five major group A human rotavirus serotypes (G1, G2, G3, G4 and G9).[7] Strains which could not be assigned a G serotype were genotyped by reverse transcription/polymerase chain reaction, using serotype specific oligonucleotide primers.[8] Polyacrylamide gel electrophoresis (PAGE) was used to classify rotavirus strains genetically into electropherotypes, and to examine the extent of sharing of the same electropherotype between collaborating centres.

Results

Number of isolates

A total of 1,011 specimens were received for analysis from Melbourne and the collaborating centres in New South Wales, the Northern Territory, South Australia, and Western Australia. Eight hundred and forty-eight specimens were confirmed as rotavirus positive using our in-house EIA assay. Specimens containing insufficient specimen for testing, or specimens that were not confirmed to be positive for rotavirus (n=163) were not analysed further.

Age distribution

The overall age distribution of children with acute rotavirus gastroenteritis is depicted in the Figure. In the reporting period, 43.7 per cent of cases were from infants 12 months of age or less, 30.6 per cent were from patients 13–24 months of age, and 10.7 per cent were from patients 25–36 months of age. Overall, 85 per cent of samples were from children aged three years or less, and 92.9 per cent were from children aged five years or less. The male to female ratio was 1:1.

Figure. Cases of rotavirus, Australia, 1 July 2005 to 30 June 2006, by age group

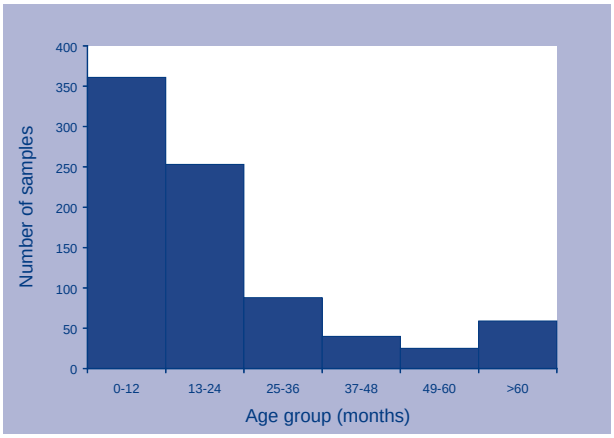

Table. Rotavirus G serotypes, Australia, 1 July 2005 to 30 June 2006

Centre	Total number	Serotype													
		G1		G2		G3		G4		G9		mix		NR	
		%	n	%	n	%	n	%	n	%	n	%	n	%	n
Melbourne	132	79.5	105	2.3	3	5.3	7	0.8	1	8.3	11	0.8	1	3.0	4
Sydney (POW)	52	58	29	3.8	2	0	0	5.8	3	34.6	18	0	0	0	0
Sydney (Westmead)	80	61.3	49	5.0	4	3.7	3	2.5	2	7.5	6	0	0	20	
Perth	76	40.8	31	0	0	2.6	2	54.2	41	1.3	1	0	0	1.3	1
PathWest WA	171	32.2	55	1.2	2	2.3	4	49.7	85	6.4	11	0.6	1	7.6	13
Alice Springs	133	3.0	4	0	0	69.2	92	23.3	31	2.3	3	1.5	2	0.7	1
Darwin	41	19.5	8		0	12.2	5	2.4	1	63.4	26	0	0	2.4	1
Darwin (Western Pathology)	70	0	0	0	0	17.1	12	0	0	71.4	50	2.9	2	8.6	6
Adelaide	93	64.5	60	0	0	0	0	30.1	28	2.2	2	0	0	3.2	3
Total	848	40.2	341	1.3	11	14.7	125	22.6	192	15.1	128	0.7	6	5.3	45

An additional 163 specimens were omitted from analysis due to insufficient sample, or specimen was not confirmed to be rotavirus positive.

* Eleven samples were identified as genotype G12.

Serotype distribution

The rotavirus serotypes identified in Australia from 1 July 2005 to 30 June 2006 are shown in the Table. Serotype G1 was the most common, representing 40.2 per cent of all specimens. It was the dominant strain in the 3 southern state capital cities of Melbourne, Sydney, and Adelaide, and was the second most common type in Western Australia. Serotype G4 was the second most common serotype nationally, and represented 22.6 per cent of specimens. It was identified in eight of the nine collaborating centres but was the dominant type only in Western Australia. Nationally, serotype G9 and G3 represented 15.1 per cent and 14.7 per cent of all specimens, respectively. Serotype G9 strains were found in all centres, and were the dominant type in Darwin. Similarly, serotype G3 strains were found in seven of the nine centres, and were dominant in Alice Springs. Only nine serotype G2 strains were each identified in three centres during the study, and represented less 1.3 per cent of the total strains identified. Interestingly, 11 samples from The Children's Hospital at Westmead in Sydney were found to be genotype G12.

Less than one per cent of the rotavirus samples contained multiple serotypes, and in 4.0 per cent of the samples a serotype was not identified. The latter could be samples with virus numbers below the detection limits of our assays, or could have contained inhibitors present in extracted RNA which prevent the function of the enzymes used in RT and/or PCR steps. It is unlikely that these represent unusual serotypes not identified using standard methods, since none of the non-typeable isolates exhibited unusual PAGE patterns. Future studies will include further characterisation of the genes encoding the outer capsid proteins of these strains.

Discussion

National rotavirus surveillance from 1 July 2005 to 30 June 2006 found that serotype G1 was the dominant serotype nationally, comprising 40.2 per cent of all strains. It was identified in all centres, and continues to be the dominant type along the Eastern seaboard, in Melbourne and Sydney and Adelaide. Serotype G1 has been the dominant type nationally for all except two years since 1999.[9–10] It was only the emergence of serotype G9 during 2001–03, which replaced G1 as the dominant serotype in Australia. Serotype G1 continues to be reported as the dominant type in epidemiological studies conducted throughout the world.[11,12]

The survey highlights the diversity of serotypes that cause disease in Australian children. Serotype G4, G9 and G3 strains were each the dominant serotype in one location (Western Australia, Darwin and Alice Springs), and comprised 22.6 per cent, 15.1 per cent and 14.7 per cent of all strains nationally.

Of significance was the emergence of serotype G4 strains as the dominant type in Western Australia, and second most predominant serotype in two centres (Adelaide and Alice springs). The emergence of serotype G4 strains follows three previous annual reports which showed that G4 strains represented only a minor type nationally (<2% overall). The last time serotype G4 strains represented an important serotype in Australia was 2001, when it was identified in 9.7 per cent of strains nationally.[13]

While serotype G3 remained a significant cause of acute gastroenteritis in Alice Springs in this survey, its prevalence throughout Australia has declined rapidly, from a prevalence of 36.6 per cent in 2004–05 to 14.7 per cent nationally this year. The predicted eastward spread of G3 strains to Adelaide, Sydney and Melbourne did not occur during the 2005–06 reporting period and this may explain the decline in G3 predominance.

The prevalence of serotype G9 has slightly increased during the current survey, being present in all collaborating centres for the first time since the 2003–04 report, and represented 15.1 per cent of all strains nationally. This is an increase from the previous survey, however, whether serotype G9 will become the dominant type nationally as it was in 2001–03 remains to be determined.

The identification of genotype G12 strains represents the first report of strains belonging to this type in Australia. Genotype G12 strains were first identified in the Philippines in 1990, and have subsequently been identified in a variety of countries such as Japan, Malaysia, Italy, the United States of America and India as a single isolate or minor proportion.[14–16] Whether this genotype continues to emerge is unclear. In Australia, it is likely that genotype G12 will be similar to genotype G6 and G8 which represent rare strains, identified as single infections or small outbreaks. However, continued surveillance for these rare genotypes is important to understand whether they emerge as important types.

The rotavirus serotyping results from this survey, together with those of previous years, highlights the changes in the prevalence of rotavirus strains across Australia. In addition, the identification of genotype G12 further highlights the diversity of strains capable of causing severe disease in Australian children. Therefore, given the recent licensure of two rotavirus vaccines in Australia, understanding the fluctuations in rotavirus serotypes using multi-centre national surveillance will provide valuable insight into vaccine efficacy.

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