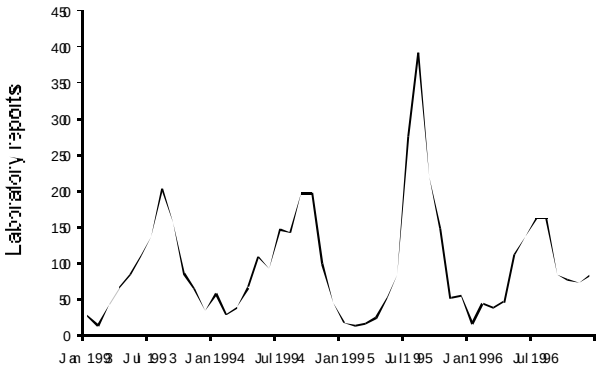
Rotavirus diversity: what surveillance will tell us

Paul J Masendycz, Enzo A Palombo, Graeme L Barnes, Ruth F Bishop,
National Rotavirus Reference Centre, Department of Gastroenterology and Clinical Nutrition,
Royal Children's Hospital, Flemington Road, Parkville Victoria 3052,
email: masenyp@cryptic.rch.unimelb.edu.au

Rotaviruses are the major cause of severe acute diarrhoea in infants and young children throughout the world.[1,2] In Australia, the pathogen is believed to be responsible for the annual admission of up to 12,000 children to hospitals nationwide.[3] Rotavirus infection is the cause of approximately 50% of the admissions to hospital with acute gastroenteritis of children under 5 years of age.[3] The rates of hospitalisation between the States can vary markedly, with New South Wales, Queensland and South Australia having almost twice the rate of hospitalisation as Victoria.[3]

Rotavirus incidence generally follows a typical seasonal pattern in temperate regions of the country, with peaks in mid to late winter[2] (Figure 1) (personal communication, Professor Ruth Bishop, Department of Gastroenterology, Royal Children's Hospital, Parkville Victoria).

Figure 1. Laboratory reports of rotavirus, Australia 1993-1996, by month of specimen collection



Source of data: Four year Australia-wide rotavirus surveillance study, 1993-1996 (personal communication, Professor Ruth Bishop, Department of Gastroenterology, Royal Children's Hospital. Parkville Victoria).

Previous studies in the laboratories at the Royal Children's Hospital have shown the prevalence of the four major serotypes G1,G2,G3 and G4 differs from centre to centre and from year to year, with serotype G1 strains the most prevalent.[4] Larger population centres generally experience greater serotype diversity within any one year. Analysis of the strains by gel electrophoresis has shown up to 10 different electropherotypes can exist within a serotype within one year and are often replaced by new electropherotypes every season. The coexistence of similar electrophoretic strains between adjacent centres such as Melbourne and Hobart is not uncommon.

New rotavirus strains are emerging continually. We have identified novel human strains that have been assigned serotype G6and G8.[5,6] These serotypes are rare in humans and are normally associated with disease in cattle. The strains are believed to be derived from reassortment between human and bovine viruses. These reassortant strains are new to Australia and their novel genetic make-up gives us an indication of how rotaviruses evolve and diversify. Our genetic analysis of the strains generated from rotavirus surveillance provides information about the existence of distinct genetic lineages of rotaviruses within serotypes and the temporal changes occurring in these.

Rotavirus strains with unusual genetic and antigenic properties were discovered in children in Alice Springs and Darwin between December 1993 and August 1994.[7] The strains were responsible for outbreaks resulting in the hospitalisation of approximately 140 children. DNA analysis of the strains causing the outbreak found them to be reassortants between the two major defined genogroups of human rotaviruses. Information about the diversity of rotaviruses enables us to assess the efficacy of rotavirus vaccines.

A candidate rhesus tetravalent rotavirus vaccine should be available in Australia soon. It uses a genetically modified rhesus rotavirus strain carrying genes expressing the major human G serotype specificities. Prior to the vaccine's release, accurate baseline data of rotavirus infections and the degree of antigenic and genetic variation in strains causing disease in humans, needs to be established. A comprehensive rotavirus surveillance study should address some of these issues. Such a study is currently being undertaken by the newly formed National Rotavirus Reference Centre (NRRC).The NRRC was established with the aims of conducting rotavirus surveillance, determining rotavirus prevalence, monitoring epidemics and characterising representative specimens by rotavirus serotype.

Established sentinel centres around Australia already collect rotavirus positive specimens for the centre. The NRRC is seeking rotavirus notifications from Australian laboratories that screen for rotavirus and would like to be informed about rotavirus outbreaks or epidemics. It is planned that representative numbers of positive specimens will be serotyped by enzyme immune assay and polymerase chain reaction (PCR). Findings for the first year of operation will be provided to the National Centre for Disease Control. Data will be collated and findings reported in *Communicable Diseases Intelligence* on a regular basis (approximately every 2 months). Assistance with this Australia-wide rotavirus surveillance will enable

the creation of a more comprehensive epidemiological profile of rotavirus infection in Australia.

References

1. Kapikian AZ, Chanock RM. Rotaviruses. In: Fields BN Knipe DM Howley PM, editors. Fields Virology. 3 ed. Philadelphia: Lippincott-Raven, 1996:1657-1708.
2. Bishop RF. Natural history of human rotavirus infections. In: Kapikian AZ (ed). Viral infections of the gastrointestinal tract. 2nd ed. Marcel Dekker, New York, 1994:131-167.
3. Carlin JB, Chondros P, Masendycz P, Bugg H, Bishop RF, Barnes GL. Rotavirus infection and rates of hospitalisation for acute gastroenteritis in young children in Australia, 1993-1996. *Med J Aust.* 1998;169 (5): 252-6.
4. Masendycz PJ, Unicomb LE, Kirkwood CD, Bishop RF. Rotavirus serotypes causing severe acute diarrhoea in young children in six Australian cities, 1989 to 1992. *J Clin Microbiol.* 1994;32:2315-2317.
5. Palombo EA, Bishop RF. Genetic and antigenic characterisation of a serotype G6 human rotavirus isolated in Melbourne, Australia. *J Med Virol.* 1995;47:348-354.
6. Palombo EA, Clark R, Bishop RF. Characterisation of a "European-like" serotype G8 human rotavirus isolated in Australia. *J Med Virol.* 1999;51 (in press).
7. Palombo EA, Bugg HC, Masendycz PJ, Coulson BS, Barnes GL, Bishop RF. Multiple-gene rotavirus reassortants responsible for an outbreak of gastroenteritis in central and northern Australia. *J Gen Virol.* 1996;77:1223-1227.

Enterovirus 71 outbreak in Western Australia associated with acute flaccid paralysis. Preliminary report.

Peter McMinn,[1] Ivan Stratov,[1] Gary Dowse[2]

There have been 6 cases of acute flaccid paralysis (AFP) identified in Perth, Western Australia since March 1999 (2 in March, 2 in April, 1 in May and 1 in June). All cases have been in children under 2 years of age. Four of these cases are associated with enterovirus shedding (throat and stool) and EV71 has been identified by neutralisation in 2 of the cases. Stool specimens from 4 of the cases have been submitted to the Polio Reference Laboratory in Melbourne. Poliovirus infection has been ruled out in the 2 cases with confirmed EV71 infection and is pending in 2 other AFP cases.

Three of the 6 cases have residual weakness 1-2 months after illness onset and 1 case remains in hospital with prolonged flaccid paralysis requiring ventilation.

In addition, 12 cases of aseptic meningitis associated with enterovirus shedding (1 CSF isolate, the other isolates from throat and stool) have been identified. These cases have occurred in association with a large epidemic of hand, foot and mouth disease (HFM) in Perth and in rural areas of Western Australia. One of the AFP cases comes from Kalgoorlie.

An enterovirus has been isolated from skin lesions or throat swabs from 15 uncomplicated HFM cases, and 3 of 4 skin isolates have been confirmed as EV71. The EV71 isolates come from individuals living across the Perth metropolitan area and Mandurah, suggesting that EV71 activity has been widespread in recent months.

The origin of this virus is unknown. Whilst the recent EV71 epidemics in South-East Asia suggest a possible source, the acute myelitis observed in the Perth cases is clearly different from the brainstem encephalitis which characterised the severely affected cases in those epidemics. Molecular epidemiological studies of the Perth EV71 isolates are underway.

Public health measures instituted at this stage have included widespread media coverage to raise public awareness, and information and fact sheets distributed to all general practitioners and acute hospitals. In addition, child-care centres across the State have been given information emphasising the importance of good hygiene, and that children with HFM should be excluded. Paediatric hospitals in other States and Territories have been advised.

1. Corresponding author. Department of Microbiology, Princess Margaret Hospital for Children, Roberts Road, Subiaco WA 6008)
2. Communicable Disease Control Branch, Health Department of Western Australia