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Outbreak of acute gastroenteritis caused by adenovirus type 41 in a kindergarten

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SUMMARY

In response to an alert due to epidemic gastroenteritis in children in a kindergarten, an outbreak investigation was carried out in a Portuguese municipality. The objectives were to establish an aetiological diagnosis, assess vaccine efficacy if possible, and to take corrective measures if necessary. The warden at the kindergarten was interviewed, and we visited the premises. The overall attack rate was 11·4% and most cases were mild. Stool samples from three symptomatic children were collected and screened for the presence of noroviruses, rotaviruses and adenoviruses. High vaccination coverage against rotaviruses was recorded in children aged <2 years. We initially thought that noroviruses and rotaviruses were more likely to have been the aetiological cause of the disease, but the outbreak was caused by infection with adenovirus 41. These viruses should not be overlooked in the laboratory protocol in the study of acute gastroenteritis outbreaks.

Key words: Adenoviruses, gastroenteritis, outbreaks.

INTRODUCTION

It has been recognized that much of the gastroenteritis infection in children is caused by rotaviruses, caliciviruses, astroviruses and adenoviruses [1]. In terms of relative frequency, adenoviruses have been described as being in the 'minority', while noroviruses (caliciviruses) and rotaviruses are the most frequently encountered [2, 3]. In the municipality where this gastroenteritis outbreak occurred, and in a neighbouring municipality, noroviruses (caliciviruses) had already been identified as the cause of outbreaks in children in these type of settings [4, 5]. In other published studies, rotaviruses have been identified as major causes of gastroenteritis in Portuguese children [6], namely in a hospital in the same geographic area [7].

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Alert

On 21 October 2008, the local health authority (LHA) was contacted by telephone by the warden of a kindergarten reporting several cases of diarrhoea (with or without vomiting – our case definition). We already knew the institution and the staff members from similar situations and we triggered the usual procedures, including the initial telephone interview and the collection of initial information.

Preliminary assessment

Infants and children at the institution were divided in six groups according to age. Each group was housed in a different room. Twenty-one adults worked at the institution. No serious clinical conditions were identified.

Based on the background and the initial information collected, it was decided to conduct an outbreak investigation with the main objectives of:

- Testing the hypothesis that the acute gastroenteritis episodes were caused by noroviruses or rotaviruses.
- Providing information to the kindergarten community on appropriate control measures.
- Collecting data on vaccination against rotaviruses; although it is not part of the Portuguese National Vaccination Programme, vaccination against rotaviruses is often recommended by paediatricians.
- Estimating rotavirus vaccine efficacy, should it be the aetiological agent.

METHODS

Clinical and epidemiological data

The warden was asked to provide a list with names and birthdates of all members of the kindergarten community (children and staff). Staff members were asked to identify all those with diarrhoea or diarrhoea and vomiting (case definition) during October. Vaccination data from all children and adults were traced in the computerized files at the local health centre. The warden was asked to telephone the LHA to inform on any further developments of the outbreak and to provide all the required information when cases had ceased to occur.

A staff member of the LHA visited the kindergarten on 21 October, to check on site the information given by telephone and instructed the staff and parents on the collection of stool samples, for which specific containers were provided. On this type of occasion, standard oral and written information on prevention and control measures is supplied to parents and institutions. Stool samples from three symptomatic children were collected the following day (22 October). All three children were born in 2007.

Laboratory study

The stool samples were screened for the presence of norovirus, group A rotavirus and adenovirus types 40 and 41. Norovirus was searched for by reverse transcription–PCR using the broadly reactive primers, JV12y/13i that target a partial RNA-dependent RNA-polymerase region of the genome [8]. Rotavirus and adenovirus were screened with a commercial immunochromatographic test (VIKIA Rota-Adeno, bioMérieux, France). Adenovirus-positive samples were confirmed by nested PCR using the primer set, Hex1deg/Hex2deg for the first round of amplification and primers nehex3deg and nehex4deg for the second round [9]. PCR amplification products were directly sequenced with BigDye Terminator v. 1.1 Cycle Sequencing kit (Applied Biosystems, USA).

RESULTS

The outbreak was over before the 30 October. Data on cases were provided but lacked precision concerning date of onset and duration of symptoms. It was reported that most clinical cases were mild, and lasted <48 h. The only severe case was observed in a staff member who had to be hospitalized but returned to work after 3 days. The 21 adult staff members were all women, born between September 1959 and December 1981.

Data on cases of acute gastroenteritis of the 122 children and staff members are summarized in Table 1. Fourteen people met the case definition criteria accounting for a global attack rate of 11·4%. The highest attack rate was observed in children born in 2007. No cases were reported in children aged <1 year or in those born in 2004 and 2005.

Detailed computerized vaccination data were available for 107 of the 122 members of the kindergarten community (Table 1). High vaccination coverage against rotavirus was recorded in the younger age groups (born in 2007/2008), low coverage was observed in children born in 2005 and 2006, while children born in 2003/2004 and staff members had never received a single dose of vaccine.

Laboratory study

All three stool samples were negative for noroviruses and rotaviruses but were positive for adenoviruses by the commercial immunochromatographic test. The presence of adenoviruses was confirmed by PCR. Nucleotide sequencing of the PCR products demonstrated that the isolates were identical and were adenovirus 41.

Table 1. *Cases of acute gastroenteritis and rotavirus vaccination status, by group, in the kindergarten*

Group	Males	Females	Total	No. of cases (attack rate %)	Vaccinated (%) against rotavirus *
Born in 2008	4	1	5	0 (0·0%)	3/5 (60·0%)
Born in 2007	10	6	16	8 (50·0%)	8/13 (61·5%)
Born in 2006	10	9	19	2 (10·5%)	2/17 (11·8%)
Born in 2005	9	11	20	0 (0·0%)	1/17 (05·9%)
Born in 2004	12	7	19	0 (0·0%)	0/18 (0·0%)
Born in 2003	6	16	22	1 (4·5%)	0/18 (0·0%)
Staff members	0	21	21	3 (14·3%)	0/19 (0·0%)
Total	51	71	122	14 (11·4%)	14/107 (13·1%)

* No vaccination data were available for 15 children/staff members.

Control and prevention measures

The premises were inspected and the procedures were verified; they complied with Portuguese legal requirements. As stated previously, the LHA has annual planned activities including routine visits and supplying advice to staff in elementary schools and kindergartens in the municipality. Therefore, the oral and written information provided in the visit was already well known to this kindergarten community. Nevertheless, we believe that 'recall' may be useful on these highly emotive occasions, when an outbreak occurs.

DISCUSSION AND CONCLUSION

The described outbreak of acute gastroenteritis was due to adenovirus 41 and not to norovirus or rotaviruses as initially hypothesized. To our knowledge this is the first study to identify adenovirus as a causative agent of an outbreak of gastroenteritis in a Portuguese kindergarten.

Our initial hypothesis that this was a norovirus outbreak was influenced by the clinical and epidemiological features of the outbreak, which were similar to other outbreaks occurring around that time in the same geographical area and in similar settings [4, 5]. The alternative hypothesis that the outbreak was due to rotavirus was simultaneously raised because this aetiology has been recently described by other Portuguese authors [6, 7]. Because laboratory results rejected these two viruses we had to consider a less frequent viral aetiology of acute gastroenteritis outbreaks, i.e. adenovirus.

Because viral aetiology was suspected from the outset, given the clinical and epidemiological features of the outbreak, bacteria and protozoa were not searched for.

Rotavirus vaccine efficacy assessment was not possible since the outbreak was not due to rotavirus. However, vaccination data collected for that purpose allowed us to conclude that, in children aged <2 years, the coverage is higher than could be expected with a vaccine that is not part of the National Vaccination Programme, and has to be paid for by the families. This high coverage in an institution diminished the likelihood of rotavirus being responsible for this outbreak and is consistent with published statements on the possible influence of anti-rotavirus vaccination on the shift in virus causing diarrhoea outbreaks [2, 10].

We now know that this particular outbreak was due to adenovirus, an *a priori* less likely viral agent, but we cannot extrapolate for the situation in the municipality, let alone to the epidemiology of such events in Portugal as a whole. We simply flagged this event and agree with the authors that argue in favour of the need for epidemiological and laboratory surveillance [2, 6]. Moreover, in the UK, some authors have reported adenoviruses 40 and 41 as the cause of sporadic cases of gastroenteritis in children within the same age group [11]. We thus recommend that adenovirus should not be overlooked in the laboratory protocol in the study of acute gastroenteritis outbreaks. This is particularly relevant in countries like Portugal, where rotavirus vaccine is in use and there is a risk that some outbreaks or cases of gastroenteritis could be perceived as vaccine failures.

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DECLARATION OF INTEREST

None.

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