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Rotavirus G and P types from 716 children with acute diarrhea in Dijon from 1995 to 1998 and throughout France during the winter of 1997-1998 were analyzed by reverse transcription-PCR. P[8],G1 predominated, followed by P[8],G4, which emerged during the last winter. G9 and P[6] strains were detected at low frequencies.

Group A rotavirus is the major etiologic agent of acute gastroenteritis in children worldwide. The two outer capsid proteins define two different serotype specificities: G types are determined by VP7 (gene 9), and P types are determined by VP4 (gene 4) (6). Genotyping methods are sensitive for strain typing, notably for P typing (11), and epidemiological studies conducted worldwide have shown that the majority of strains were P[8],G1; P[4],G2; P[8],G3; and P[8],G4 (9). However, other G serotypes have now been found to be common in several regions of the world, notably, serotypes G5, G8, and G10 in Brazil (18; V. Gouvea and N. Santos, Letter, Vaccine 17:1291–1292, 1999); G8 in Malawi (4); and G9 in India (16) and in the United States (17). Since the role of heterotypic protection is not yet clear, strain typing is important from the perspective of introducing polyvalent vaccines.

In France, there is no national strain surveillance system, and few data are available concerning rotavirus type circulation. A recent study conducted in one hospital in Paris (7) during a 1-year survey (1997-1998) reported that 98% of 170 rotavirus isolates were G1 to G4, with type G4 predominating (60%). Here, we report strain typing results obtained in one city (Dijon) over a 3-year period (1995 to 1998) and in 15 other cities distributed throughout France during the 1997-1998 rotavirus season. We showed that the P[8],G1 type was predominant and that the P[8],G4 type has emerged during this period to become very common during the winter of 1997-1998. Furthermore, unusual strains such as G9 and P[6] could be detected at low frequencies.

Rotavirus isolates recovered from 218 children with acute gastroenteritis in a previous study in Dijon from December 1995 to February 1998 (3) were first analyzed. In addition, 498 stool specimens, selected randomly among 645 specimens provided by 15 hospital-based laboratories from November 1997 to May 1998, were further typed. These laboratories, recruited for their geographic representativeness, were distributed in five regions: northeastern (three hospitals), northwestern (four), southeastern (three), southwestern-central (three), and Paris (two). To these 498 specimens were added, for analysis of the 1997-1998 rotavirus season, 55 isolates previously typed in Dijon (northeastern region); thus, a total of 553 specimens were included. The goal of the selection was to type about 120 isolates from each region and 60 from Paris. All the samples were from children with community-acquired gastroenteritis, and when hospitalization was required, stool specimens were collected within 48 h to exclude nosocomial infections. Fecal specimens were shipped to our laboratory in dry ice and were stored at −40°C until they were analyzed. Rotavirus RNA was extracted from 10 to 20% fecal suspensions in phosphate-buffered saline using the QIAamp viral RNA kit (Qiagen, Hilden, Germany) according to the manufacturer’s protocol. G types were identified by multiplex reverse transcription-PCR (RT-PCR) assay using primers Beg9 and End9 and, for typing, RVG9 and the G1(aBT1), G2(aCT2), G3(aET3), and G4(aDT4) primers (10). Specimens that could not be typed were further assayed with primers G8(ATA8) and G9(aFT9) (10) or G9(9T-9B) (5). P types were identified by multiplex RT-PCR assay using primers con3 and con2 and, for typing, RVG9 and the G1(aBT1), G2(aCT2), G3(aET3), and G4(aDT4) primers (10). The amplified products were detected by electrophoresis on a 2% agarose gel containing 0.5 μg of ethidium bromide per ml. For specimens not amplified by RT-PCR, a confirmatory immunnoassay (EIA) was done as previously described (15). RNAs extracted from some specimens were resolved on a 10% polyacrylamide discontinuous gel and stained with ethidium bromide. Nucleotide sequencing of gene 9, for some PCR products, was carried out with the ABI Prism BigDye Terminator Cycle Sequencing Ready Reaction kit on an automated sequencer (model 373A; Perkin-Elmer). Statistical analysis was performed with EPI-INFO version 6.02 software (Centers for Disease Control and Prevention, Atlanta, Ga., and World Health Organization, Geneva, Switzerland, 1994). Distributions of rotavirus types by geographic area were compared by chi-square test. All tests were two-tailed, and P values of <0.05 were considered significant.

The mean and median ages of the 218 children with acute...
The mean and median ages of the 553 children with acute gastroenteritis in Dijon from December 1995 to February 1998 were 10.2 and 7.5 months, respectively (range, 0.2 to 107.7 months; standard deviation, 12.8). The P[8],G1 strain was predominant (169 of 218 [77.5%]). Among the P[8],G1 isolates, three samples which could not be G typed by RT-PCR were found to be G1 type by gene 9 sequencing (unpublished data). The next most common strain was P[8],G4 (30 of 218 [13.8%]); strains P[8],G3 and P[4],G2 were less common (7 and 3 of 218, respectively [3.2 and 1.4%, respectively]). Dual infections with P[8],G1 and P[8],G4 were found in two specimens (0.9%). Seven isolates (3.2%) were nontypeable; all were antigen positive by EIA, but one could not be amplified and six could not be G typed. The temporal distribution of rotavirus types in Dijon during the 3-year period is represented in Fig. 1. The results show the emergence of the G4 type during the last period of the study (32.1% for the period from December 1997 to February 1998 compared to 3.1 and 3.3% for the same periods in the two preceding years) and the disappearance of the P[8],G3 type since 1996.

The predominance of type G4 has been reported in France in several other countries in Europe: the United Kingdom (13), Finland (20), Italy (2), and, more recently, Ireland (14), where an increase in the prevalence of G4 isolates was observed during the winter of 1997-1998. The two other conventional strains, P[8],G3 and P[4],G2, were uncommon, and it is notable that P[8],G1 was not detected after 1996. We also identified (at low frequencies) unusual strains, among them the P[8],G9 type detected in two samples from the same city and the P[6] type in seven samples from three different cities, associated with G1 or G2 types. Such strains have now been reported for children with diarrhea in several studies in industrialized countries (1, 12, 17, 19). To our knowledge, G9 strains have not been previously described in Europe, whereas P[6] strains have been reported recently for the first time in Italy (1).

Finally, in addition to the results of strain typing, this study has allowed us to test a national strain surveillance system of collaborating laboratories.

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