Seroprevalence of Antibodies after Vaccination against Poliomyelitis

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After six cases of paralytic disease were reported in the southern region of Saudi Arabia an investigation was conducted to evaluate the role of poliomyelitis in these illnesses. Part of this study was to determine the seroprevalence of antibodies against poliomyelitis in normal vaccinated children. The children studied were selected randomly from the Al Gasem and Najran regions.

The cytopathic effect (CPE) neutralization method was used to determine the antibody levels and 1/8 and/or more was used as a positive titre. The overall seropositive rates in both regions for polio types 1, 2 and 3 were 76.6%, 84.4%, and 71.9% respectively. Although this phenomenon of low seroconversion after oral polio vaccination is known in developing countries, further investigations should be conducted to identify its possible causes.

Poliomyelitis is a highly infectious disease against which vaccination is the only effective method of prevention. Despite a high coverage with the vaccine, some outbreaks have been reported in some developing countries.

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Date submitted: 17.11.90.
Date accepted: 09.05.91.

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Six cases with paralytic disease were reported in Gizen in the southern part of the kingdom of Saudi Arabia. These cases were suspected to be due to poliomyelitis. All patients in the reported cases had been vaccinated. One of the basic steps in investigating such a situation is to conduct a survey to determine the seroprevalence of antibodies against poliomyelitis after vaccination. In view of the results further analytical studies or trials can be conducted to clarify the problem.

Two regions were selected, Najran which has a similar environmental background to Gizen (where the paralytic cases were reported) and Al Gasem in the central region.

No cases of poliomyelitis were reported from these two areas during the year 1989.

Methods
In this preliminary study 72 children were selected from the Najran and Al Gasem areas and 3 ml of blood was
collected in a plain tube at the age of 6-12 months after completing the first three doses of oral poliomyelitis vaccine (OPV) at the ages of 3, 4 and 5 months. The serum was separated and sent to the laboratory where serial doubling dilution were prepared. Three sets of each dilution were prepared and the cytopathic effect (CPE) neutralization method (CDC protocol) was used to evaluate the antibodies against the three types of poliomyelitis virus.1,5

A neutralizing titre was taken as the reciprocal of the dilution at which complete neutralization occurred i.e. complete cell culture with no CPE. Results were considered positive if the antibody titre was equal to 1/8 or more.5,7 A parallel study was done at the CDC Atlanta, Georgia, USA for quality assurance.

Results
Eight samples were excluded from the study for technical reasons, and the remaining 64 samples were evaluated. The seropositivity rates for polio virus types 1, 2 and 3 were 76.6%, 84.4% and 71.9% respectively. Of the 64 children, 41 positive antibodies against the three types of polio, and 4 children did not have antibodies against any type. The geometric mean of the titres were 38.9, 128.8, 19.05 for types 1, 2 and 3, respectively.

No significant differences were found between the results for the two regions.

Discussion
In developed countries with a high standard of hygiene and efficient poliomyelitis vaccination programmes, poliomyelitis has become a rare disease.6 This is far from true in developing countries where outbreaks of poliomyelitis have been reported despite high vaccination coverage e.g. Brazil, Oman and the Gaza Strip.5

Poor seroconversion rates were noticed in these developing countries compared with developed countries like USA which reports a more than 90% response after only two doses of OPV.9 The occurrence of poliomyelitis in spite of adequate vaccination coverage in developing countries was claimed to be due to a lower seroconversion rate. Many factors in these countries with a warm climate were suggested as the cause of poor seroconversion. These factors included the storage of vaccine in the heat, insensitive serological tests, interference by other entroviruses, malnutrition, and prolonged breast feeding.8

In our study, the seroconversion rates were similar to those done in the CDC (unpublished report). The rate of seroconversion as well as the level of antibodies against type 3 poliomyelitis were lower than to the other types. Similar results were demonstrated in other studies and a change in the ratios of the three Sabin strains was tried to overcome this problem.9

To produce enhanced seroconversion, some modifications in the poliomyelitis vaccination programme have been tried. Increasing the number of doses of OPV was suggested and tried in certain parts of India.8 In other countries a combination of live and inactivated polio vaccine was used to decrease the annual incidence of paralytic disease.10 Other workers advised starting vaccination at an earlier age, at which time non-poliomyelitis viruses may not have colonized the infant's intestinal tract.11

Although reported cases of poliomyelitis are becoming very few in Saudi Arabia where the coverage rate of vaccination is high, we still believe that this low seroconversion might explain the failure to eradicate poliomyelitis in this country. For this reason a national study has been started by the Medical Research Department of the Ministry of Health aiming at identifying the cause(s) of the low seroconversion after oral poliomyelitis vaccination.

References