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POLIOMYELITIS

PREVENTIVE IMMUNIZATION AGAINST POLIOMYELITIS IN THE MIDDLE EAST AND ITS PROBLEMS

by

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Althcugh paralytic poliomyelitis is world-wide in distribution and widespread epidemics have occurred during the last fifty years mainly in western and northern countries of Europe and in the western hemisphere, there are several features of poliomyelitis that are specific for this part of the world. These features are not characteristic solely for middle-eastern countries but for sub-tropical and tropical areas alike. As the main characteristics which make the poliomyelitis problem differ in the Middle East from that in northern and western areas, one should consider the following:

1. The age incidence of the paralytic disease
2. The endemic occurrence of all three serotypes of poliovirus and other enteric viruses, and possibly
3. Different modes of transmission of the infection

We would like to consider each one of these points separately since they have an important bearing on the choice of preventive immunization measures:

1. The infantile type of paralysis has been an outstanding feature of the epidemiology of poliomyelitis in this part of the world. Statistical evidence for this is contained in the data available on the age incidence of paralytic poliomyelitis from Egypt, Lebanon, Iraq, Turkey, Eritrea, Sudan and Israel. In all these countries, the majority of cases occur in infants and young children, six months to three years old, and the highest incidence is between six and eighteen months of age[1-4]. Antibody studies and clinical surveys carried out during recent years in several middle-eastern countries, mainly by Paul, have definitely confirmed the limited age incidence of polio-

myelitis and stressed the progressive increase in the incidence of the paralytic disease. This has also become evident to the medical profession of the countries involved as pointed out in the reports of the Official Delegates to the Fourth International Poliomyelitis Conference held in Geneva in the summer of 1957.

2. Numerous virus isolation studies carried out in the Middle East, and especially in Egypt and Israel, point to the widespread endemic occurrence and distribution of the three serotypes and numerous other representatives of the enterovirus family. As pointed out by Dr. M. Diwany of Egypt(2), and shown by investigations carried out in Egypt by Paul, Horstmann and Melnick, practically all enterovirus strains are endemic and highly abundant in infants and children. Type two poliovirus isolations from paralytic cases are even more frequent than the other poliovirus types, a finding which may be of importance in considerations for preventive immunization.

3. Our views on the epidemiology of poliomyelitis, and especially on its mode of transmission, have undergone repeated changes during the last two decades. The fecal-to-oral mode of infection has held strong for a number of years, but recently(5) a revision of this point of view is taking place. It seems possible that in certain areas, oro-pharyngeal secretions may be of no lesser importance in the spread of poliomyelitis than fecal contamination. Whether this oro-pharyngeal mode of transmission is prevalent in this part of the world is hard to assess without further study. It would be rather reasonable to expect from the epidemiology of the disease and infection in middle-eastern countries that fecal contamination plays the major rôle in the spread of infection. In western and northern areas, of cooler climatic conditions, the oro-pharyngeal route of infection may be of greater importance.

Owing to the above-mentioned differences, the problems of prevention of paralytic poliomyelitis by means of active immunization, have special specific aspects. We have now on hand two main means for active immunization against poliomyelitis:

1) Killed virus vaccines, mainly formalinized of the Salk type, with which we have had vast experience during the past five years.
and 2) Live attenuated vaccines of the Sabin and Lederle types with which wider and wider experience is being accumulated at present.

When considering the relative value of each one of these two vaccines and the preference in their use for preventive immunization, one should take into account the specific points mentioned above and how they may influence the decision as to what kind of immunization to choose. In addition to these, of course, general considerations like the relative safety of the vaccine used

should not be forgotten. We would like to analyze these two means of immunization according to the following criteria:

1. Safety of these vaccines
2. Problems of production and administration
3. Their effectiveness in infants, and
4. Their influence on virus circulation in a milieu abundant in polioviruses and other enteroviruses.

SALK VACCINE

1. Safety: During the past five years there was a single "accident" in the use of Salk vaccine, and this was in the first year of mass-immunization. From the end of 1955 and until now nothing similar to the "Cutter incident" has ever been documented. It is general belief and experience at present that owing to the stringent safety testing methods incorporated in the process of production of Salk vaccine, the possibility of residual live virus remaining in the final released product is almost out of question. Thus, the safety of Salk vaccine is warranted.

2. Problems of production and administration: Some of these have been outlined in reports published on this country[6,7]. Production of Salk vaccine requires highly trained personnel, skilled virologists, rather elaborate equipment and a steady supply of chemicals and glassware. Each country intending to produce its own Salk vaccine should take these needs into consideration before a decision is made. Administration of Salk vaccine according to a defined schedule is also very elaborate and requires organized and adequately functioning medical and public health services.

3. Effectiveness in infants: This point deserves special analysis. Contrasting results on the antibody response of young infants to Salk vaccine have appeared in the literature[8-12]. Since this point has been of special concern in the immunization programme carried out in Israel during the last three years, we have investigated it rather extensively[13], and the following is a short summary of our results:

"The antibody response to Salk vaccine has been studied in a large number of young infants. The effect of primary as well as booster inoculations was investigated. Primary immunization consisted of two or three inoculations of one ml vaccine each, followed by a one ml booster inoculation six months later.

The infants were divided into three "age groups" according to their age at primary immunization: group A - infants one and two months old, group B - infants three and four months old, and group C - infants five and six months of age. To facilitate interpretation of results, post primary bleedings

in group A and B were made when these infants reached six months of age, when maternal antibody is absent in almost ninety per cent of the infants. Development of antibody after primary immunization was pronounced in all three age groups for all three poliovirus types. However, there was marked variation in antibody response according to age at primary immunization, type of poliovirus, and presence or absence of maternal antibody. Infants of group C responded to a higher percentage than those of group B, and these in turn better than those of group A. The best response was to type two poliovirus, next to type one and worst to type three. Presence of maternal antibody interfered with active production of antibody. The effect of the schedule for primary immunization was marked in infants of group C. Post primary conversion rates in these infants were seventy-one, ninety-eight and fifty-three per cent respectively for types one, two and three poliovirus after a course of two one ml inoculations, and ninety, one hundred and eighty-five per cent after three one ml inoculations of vaccine. The booster response was excellent in all infants who had not shown demonstrable antibody after primary immunization. The booster response was independent from age at primary immunization and from presence or absence of maternal antibody at the time when primary immunization was administered."

The possibility of immunization at birth, starting with the first inoculation of Salk vaccine at one to five days of age, the second inoculation one month later and followed by a third at six months of age, is at present under investigation by us on circa 300 infants and the results will be available towards this winter. If this schedule turns out to be effective in producing both, a high percentage of immunes and adequate antibody titres at the age of six months, then prevention of poliomyelitis in the young infant would be much simplified.

4. The influence of Salk vaccine on poliovirus circulation in the community has been discussed and tested quite extensively. Although several investigators have shown that immunization with Salk vaccine does not influence appreciably poliovirus circulation in those vaccinated and in their immediate contacts[14,15], Salk has recently questioned these findings in the light of the experience in the USA which indicates a marked reduction in the paralytic disease in the general (non-vaccinated) population[5]. Salk brings evidence to prove that the use of killed vaccine reduces the amount of virus in the community by cutting down the spread of virus from oro-pharyngeal secretions. Whether this will be true in middle-eastern countries is a matter for debate especially when considering the different epidemiology of poliomyelitis in these areas. It seems that more experience is still needed to prove or disprove these assumptions.

LIVE POLIOVIRUS VACCINES

1. Safety: In spite of the fact that millions of individuals have been fed these vaccines during the past few years, their absolute safety is still being questioned. In addition, the probability of reverse-mutation towards virulence is still under investigation and certain indications of increased virulence during passage of the virus in the community have been reported(16-18). The problem of safety and back-mutation towards virulence are by far of the greatest concern in the widespread use of attenuated poliovirus vaccines while other problems of the kind mentioned in connection with Salk vaccine are of minor importance.

2. Production and administration are simpler and easier than with Salk vaccine and do not pose special problems.

3. Effectiveness in infants: the immunogenic capacity of the attenuated vaccines in infants seems to be well documented(19). Maternal antibody seems to have no effect on the extent of multiplication of the attenuated viruses in the intestinal tract and thus the problem of interference is of no practical importance.

4. Influence on poliovirus circulation and effect of other enteroviruses: These points need further clarification. Experience from various sources indicates that the abundance of enteroviruses other than poliovirus might affect the multiplication of the attenuated strains fed. Since infants' and children's alimentary tracts are "loaded" with these viruses in our area, interference may be a factor of importance and should be studied rather carefully.

Following above analyses it will be seen that both vaccines have their pros and contras as well. Facts concerning their safety and effectiveness should be indicated by laboratory experts and epidemiologists, decision should be left to those responsible for public health. In trying to solve our own problem of poliomyelitis in Israel, starting some three years ago, we have followed a certain pattern. We have chosen to use at first Salk vaccination for two main reasons:

a. It was available at the time and we have had no special problems in preparing our own.

b. We were aiming to cut down in this way the incidence of paralytic poliomyelitis as far as possible.

At the same time we have "kept our eyes open" on further developments in the field of attenuated poliovirus strains and are at present in the midst of careful though limited studies with these strains. When more is known about the doubtful points mentioned above and when we ourselves will have accumulated more experience with these viruses on our own "grounds", it is very probable that we shall endeavour in the future to supplement, if not substitute, Salk vaccination with the attenuated poliovirus vaccines.

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