Oral Polio Immunisation and Breastfeeding

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During the latter part of the Ming Dynasty (1368-1644) a system of inoculation was introduced in China whereby pulverised crusts from smallpox pustules were blown through a silver tube into the nostril, the left in males, and the right in females. Even before the rapid spread of vaccination which started in England in 1799 through the efforts of Jenner, inoculation or "variolation" against smallpox had already been extensively practised in Turkey throughout the previous century.

Due to its dramatic impact on the disease, smallpox vaccination became compulsory in England during the early 19th century; and it was towards the end of the latter era that the immunological basis of infectious disease and their prevention had been established. The early 1900's saw the development of vaccines against diphtheria, tetanus and typhoid, and later cholera. Viruses, being intra-cellular parasites, proved difficult to culture and virus vaccines appeared much later. It was in 1949 that Dr John Enders of Harvard discovered the possibility that poliovirus could be grown in tissues culture; the development of polio and other vaccines rapidly followed.

Initial successes were marred by sporadic disasters. In the Lubeck disaster of 1936, 251 children contracted severe tuberculosis because of contaminated B.C.G. vaccine. Another major disaster in the United States was the Cutter incident of 1955 when live polio virus had been incorporated with the inactivated vaccine resulting in 298 cases of paralysis and 170 deaths. Henceforth safety precautions and procedures assumed top priority.

Jonas Salk developed the first effective formalin-inactivated poliovirus vaccine which still bears his name; this vaccine was in world-wide use in 1954. It was introduced in the United Kingdom in 1957 after a decade of serious polio outbreaks of up to 8000 cases per year, with a fatality rate of 10%.

The late 1950's saw the mass use of the newer live attenuated Sabin vaccine which did not require parenteral administration; small doses were required and it carried an extra dividend in that it spread to non-immunised contacts conferring herd immunity - at the time it was confirmed that no harmful effects ensued thereby. (Sabin, JAMA 194:872; 1965) In the spring of 1960 the Sabin vaccine was in world-wide use and had superseded the Salk. It was, however, capable of causing paralysis on rare occasions - 1/6 million with Type 1, 1/5 million with Type II and 1/2.5 million with Type III. Seven cases of paralytic poliomyelitis were reported in the U.K. in 1978, 5 of which were attributable to Sabin OPV. Small doses of penicillin are also contained in the oral vaccine, and this raised some problems with its use in allergic subjects.

The relative efficacy of the two types of vaccine can be gauged from the following figures relating to annual polio cases in the United States: (Grislain

pre-1954	40,000 cases per year
1960	3,190 (after Salk programme)
1966	44 (after Sabin programme).

In Italy the Salk vaccine produced no marked improvement after its introduction in 1958 (Giovanardi, 1969); there still was an annual indicence of about 3,000. With the introduction of the Sabin vaccine in 1964, however, a marked reduction in cases followed, with a reported incidence of 87 in 1968.

Repeated and continued immunisation of newborn infants is essential if no new epidemics are to take place. In Argentina the annul rate was 6,000 in 1956; it dropped to less than a 1,000 after the introduction of Salk vaccine in 1957, and still further with the Sabin vaccine in 1963. After a 2-year period of non-immunisation an epidemic occurred during 1965/66. (Sujoy, 1969).

Sweden, Finland and the Netherlands, however, have eliminated the disease by utilising Salk vaccine alone. (Barnett Christies, 1981; Fagraens (1980); Sweden reported 18 cases in 1960, and nil in 1967. (Grislain, 1969).

As early as 1950, Sabin himself described an antipoliomyelitic substance in the milk of human being and certain cows. (Am J. Dis, Child, 1950). This finding has been confirmed by a host of other workers. (Vahlquist, 1958; Harfouche 1970; Lepow 1961; Sabin, 1963, Hodes 1962; Michaels 1965; Athreya 1964; Sabin 1962; Pinter 1953; Sabin 1962; Adcock 1971, Hodes 1964; Mata 1971; Kenny 1967; Hodes 1964; Goldman 1973). Antibody activity against poliovirus has been shown to lie in the secretory IgA fraction of human milk. (Hodes 1964). Although colostrum contains 1970; Mouton, 1970). Although colostrum contains between 20-40 mg. of IgA per ml, (Amman & Stiehm, 1966; Hanson, 1971) there is a drastic decrease to about 1mg/ml on the fourth day of life; the large increase in milk production thereafter, however, is sufficient to compensate for this reduced IgA concentration, sufficient amount being present to permit detection in the stools. (Kenny, 1967; Michael 1971; Gindrat, 1972).

Interference with oral poliomyelitis vaccination by breast-feeding was a problem. (Warren, 1964; Holquin 1962; Sabin 1963). These reports by far outweigh the occasional observation that OPV is not influenced at all by breastmilk (Deforest 1973;), Prof. J. Pattison of King's College Medical School, London remarks further that: "the transplacental passive transfer of IgG from the mother to the infant will protect the latter for 6 to 12 months after birth. Because of their protective umbrella, there is no point in administrating live vaccines before 6 months of age. (Pattison, 1981.) Before this age antibody response may also be reduced because of the infant's immature antibody forming mechanisms. (Neonatal Medicine 1974) Besides, maternal antibodies depress the response to killed vaccines as well, and these too should not be administered to infants before the age of 6 months (Beale, 1969).

Although the literature dealing with polio vaccination and the breastmilk effect is large and controversial, there are certain points of agreement. An antipoliomyelitis factor exists in colostrum and breast milk, and this interferes with polio vaccination in the first few weeks of life, on the assumption that the mother herself has antipolio antibodies in her serum. It appears that the human mammary gland is able to concentrate these antibodies and secrete them in the milk. These are resistant to denaturation in the intestine, and to a greater extent than are, say, the anti-E. Coli antibodies. (Kenny, 1967). Polio vaccine is destroyed at a low pH; gastric pH in the neonate is very low indeed. (ibid.).

The main controversy which exists concerns the age at which these antibodies cease to possess an inhibiting effect on OPV and whether breastfeeding should be postponed for a period around the time of vaccination or not. Whilst some workers maintain that this inhibitory effect of human milk lasts only a few weeks, (Adcock, 1971 "Break milk inhibition is *probably* of no clinical significance in older infants receiving routine primary OPV"), several others have shown that it extends to much later in the first year of life, including the period during which infants are normally immunised. (Sabin 1950;) "53% to 73% of the regular milk obtained from one to twelve months after delivery neutralised the virus".

A satisfactory schedule of polio immunisation is required for breastfed infants. The advantages of oral Sabin vaccine include ease of administration, low dosage, gut colonisation and low cost of production. Its spread to non-immunised contacts may not be entirely beneficial, as it rarely causes paralysis; contacts to be avoided include pregnant women, patients with immunological abnormalities, patients on steroids or immunosuppressants or receiving irradiation, and patients with tumours of the reticuloendothelial system especially Hodgkin's disease. Seroconversion is poor in some tropical countries. Although the Salk vaccine is expensive and is unable to displace wild virus from the community, it posseses the advantage of not multiplying in the host and an inability to revert to virulence. Its role in antibody formation is not affected by: social conditions, climate or the presence of other viral infections. It can be administered to the immunodeficient. It will *not* be affected by secretory IgA antibodies in breast milk, so that it would be the ideal choice in breastfed infants over the age of six months. With the oral Sabin vaccine, an alternative schedule which has recently been suggested is an increase in the number of doses, from the usually recommended three to five, that is not including booster doses. (Barnett Christie, 1981: Fulginiti, 1982).

With regard to the necessity of withholding breastfeeding around the time of vaccination, there are some who advocate it and have taken it for granted in their studies (Adcock, 1971), whilst others

recommend that breastfeeding is far more important and should not be interrupted (Barnes, 1977). The American Academy of Paediatrics recommends it. (Redbook, 1982).

In the Maltese Islands, poliomyelitis became notifiable in 1921, but only 61 cases were reported until the first major epidemic of 1942, which incidently started off in the British adult population here and spread rapidly thereafter, affecting mainly children under the age of four years. Another two outbreaks followed in 1947 and 1950 respectively, but it was not until November 1956 that immunisation with Salk vaccine was started in children between the ages of one and ten years. 41 cases had been notified that year. By July 1959, a total of 34,800 children had been vaccinated against poliomyelitis. (Cassar, 65). The last sporadic case occured in 1964, two years after immunisation with the Sabin type of vaccine had been introduced in the Maltese Islands. The last small epidemic was in 1962 when 48 cases were notified, and it has been estimated that a total of a thousand cases of poliomyelitis were recorded between 1930 and 1964. (Wyatt)

Immunisation against poliomyelitis, tetanus and diphtheria is obligatory in Malta, and the Department of Health offers the Sabin vaccine which is usually started at age 3 months and is followed by another two doses at six to twelve week intervals during the first year of life; they are usually given at the same time as diphtheria and tetanus, with or without pertussis, by injection. Poliomyelitis vaccine is not given to children in contact with pregnant mothers in the first four months of pregnancy. The Salk vaccine predominates in the private sector, where it is combined with diphtheria, tetanus and pertussis in a single dose injection.

Although remaining subject to individual preference, it is clear that poliomyelitis immunisation cannot be taken lightly particularly in breastfed infants, and at a time when WHO is conducting such a world-wide campaign to promote breastfeeding.

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