

TRANSFER OF ANTIBODIES AGAINST POLIO VIRUSES ACROSS THE PLACENTAL BARRIER

by

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Introduction

Antibodies are transferred from the mother to the foetus by the placenta during pregnancy. This transfer of antibodies is a very important phenomenon as it gives immunological protection to the offspring long before the development of its own immunological mechanism. Not much is known about the transfer of viral antibodies from the mother to the foetus although the level of antibodies against viruses in new born has been widely studied.

Polio virus was recovered from the gut of neonates who were completely free from symptoms. It could be that the viruses could not produce the ill-effects because of the presence of maternal antibodies against the virus in the new born. Frequent attacks of poliomyelitis in pregnant women could also affect the foetuses as has been rather frequently observed in different countries.

We studied the presence of antibodies against the 3 types of polio viruses in the sera of pregnant mothers and the new born children on delivery, and also in the sera of those women undergoing medical

termination of pregnancy and their foetuses obtained by hysterotomy.

Material and Methods

The samples were obtained from the Obstetrics and Gynaecology Department of the Seth Sukhlal Karnani Memorial Hospital of the Institute of Post Graduate Medical Education and Research, Calcutta.

Five ml. of blood was collected from each of 100 mothers just after delivery, an equal amount of cord blood was collected from each of their babies at the same time. The blood was allowed to coagulate and the sera were separated. The paired mother and child sera were stored at -20°C after proper labelling for further use.

One hundred foetuses between 10 to 20 weeks in size were obtained by hysterotomy from patients attending the M.T.P. Clinic. Blood (as much as possible) was collected from them by cardiac puncture. Five ml. of blood was also taken from each of the corresponding mothers undergoing the hysterotomy. The sera were separated and stored in pairs (mother and foetus) as before, at -20°C .

Prototype strains of polio virus type 1, 2 and 3 were obtained from the National Institute of Virology, Pune, and were used for the neutralisation tests to detect the antibody levels in each sample.

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The neutralisation test was carried out on monolayer cultures of Hep-2 cells (a permanent cell line) using Eagle's medium with 5 per cent goat's serum.

The neutralising antigens for each of the 3 types of polio viruses were produced in the Hep-2 cells. One in the dilutions of each of the types of the virus in Hank's Basal Salt Solution was inoculated into the cell cultures. When the cytopathogenic effect was complete, the cultures were frozen to -70°C and then thawed. The fluid was then centrifuged at 2000 r.p.m. at 4°C . The supernatant formed the neutralising antigen. The 100 TCID₅₀ per ml. of the viral antigen was used. This was calculated by the Reed-Muench formula.

Each serum underwent inactivation at 56°C for 30 minutes to make it complement-free; serial two-fold dilutions were made ranging from 1:4 to 1:512.

Serum virus mixtures in equal volumes of one ml each, that is, one ml. of 100 TCID₅₀ virus and one ml. of diluted serum, were incubated at 37°C for 30 minutes for all the serum samples. After incubation 0.2 ml. of the mixture was inoculated into 6 tubes of Hep-2 cell cultures. For each dilution 6 cell culture tubes were taken. The tubes were then observed for the appearance of cytopathogenic effects. The neutralising antibody titre of each serum was calculated by the Reed-Muench method.

The maternal new born and maternal

foetal paired sera were tested side by side.

Results

The presence of antibodies against polio viruses types 1, 2 and 3 in the sera tested are shown in Table I.

All the mothers of the new born and the women attending the M.T.P. Clinic for hysterotomy possessed antibodies against Type 1 polio virus, 90 per cent and 75 per cent of the mothers of the new born had antibodies against Type 2 and Type 3 polio viruses, while 85 per cent and 78 per cent of the patients attending the M.T.P. Clinic had antibodies against Type 2 and Type 3 polio viruses.

Of the one hundred new born children examined, 53 had antibodies against Type 1, 41 against Type 2 and 20 against Type 3 polio viruses respectively.

Out of one hundred foetuses in the study, 42 showed the presence of antibodies against Type 1, 33 against Type 2 and 25 against Type 3 polio viruses respectively.

The presence of antibodies against polioviruses in the sera of foetuses according to their size is shown in Table II.

Foetuses that were less than 12 weeks in size did not show the presence of antibody while those between 13 to 16 weeks in size showed the appearance of antibodies in levels less than their mothers and new borns. Foetuses above 17 weeks

TABLE I
Presence of Antibodies in the Sera

Type of sera	Number of sera	Antibodies against Polioviruses		
		Type 1	Type 2	Type 3
Newborn	100	53	41	20
Mothers of newborn	100	100	90	75
Foetus	100	42	33	25
Mothers of foetuses	100	100	85	78

TABLE II
Presence of Antibodies in Foetuses

Size of Foetus in weeks	Number	Antibodies to Poliovirus		
		Type 1	Type 2	Type 3
10-12	5	0	0	0
13-16	23	20	15	8
17-20	72	42	36	25

size demonstrated similar levels of antibodies against polio viruses as the new borns.

Comments

Studies are available on the transmission of viral antibodies from mothers to neonates and the results obtained by us corroborated with those found elsewhere in this country and abroad. The transfer of antibodies to polio viruses across the placental barrier from the mother to the foetus is not yet very well documented. We observed that from 17 weeks of gestation, antibodies to polioviruses Type 1 and 2 passed easily to the foetus across the placenta. The antibodies to Type 3 poliovirus however did not pass the barrier easily. The Type 3 antibodies were however low in the mothers also. It has already been reported that the frequency of polio virus Type 1 is 47.06% and Type 3 is 19.1% in new borns in West Bengal.

Foetuses below 13 weeks of gestation did not show the presence of any antibody, indicating thereby, that there is no transfer of antibodies from the mother to the foetus at that early stage.

From 13 weeks onwards, there was a gradual increase in the incidence of transfer of antibodies to polioviruses. Neonates showed a very high incidence of the antibodies and the levels were more or less same as the levels detected by other workers in different parts of the

world. This indicates that there is a definite transfer of antibodies against polioviruses across placenta from the mother to the foetus.

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