

PROJECT STUDY ON JAPANESE ENCEPHALITIS VACCINATION AT GOGAMUKH, ASSAM

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ABSTRACT

The aim of the study was to apprise the benefit derived from vaccination against Japanese encephalitis (JE) in Assam. The study was conducted during 1988-1989 with special emphasis on serodiagnosis. Out of total of 22,441 vaccinations, 12,935 belonged to the age group of 5 to 15 years and the rest to 16-25 years. Second and third doses of vaccination were given at 7-14 days and 35-40 days, respectively to 17,336 and 14,605 persons. The protective antibody titre of the blood sample from 5% of the targeted population was assessed. Neutralising antibodies were positive in 245 out of total 261 persons tested before vaccination and was negative in 16. Following vaccination neutralising antibodies were seen in all samples. Even in persons with pre-existing antibodies, a rise in titre was seen after vaccination.

Key words: Japanese encephalitis vaccination.

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Japanese encephalitis (JE) has been ravaging an extensive area of this country since 1952 and has emerged as a serious public health problem in Assam since 1978 with outbreaks resulting high morbidity and mortality. This disease is now spreading slowly and steadily to newer areas. At present there are at least 8 provinces heavily affected by JE infection in India. The locality of the disease and the high proportion of JE in Assam suggest that a control strategy using vaccination against JE should be applied and evaluated with first priority as has been done in many other countries.

The present study was aimed to apprise the beneficial outcome of vaccination under field conditions and to assess the acceptance of vaccination by the public.

Material and Methods

On the basis of high endemicity, a project of vaccination trial under field conditions was undertaken in Gogamukh PHC area in Lakhimpur district of Assam. Gogamukh is a place where high incidence of morbidity and death took place from JE in 1986. The area stretches beside the hilly Arunachal border (Fig.) and is inhabited by people of the same ethnic Hindu community consisting of 65% tribal people. Most of them were illiterate or had elementary education and belonged to low socio-economic strata thriving mainly on agriculture. During monsoon, the villages get flooded with water, especially ponds, tank and shallow ditches. The average humidity of the locality is 28% and rainfall 141 cm. The maximum and minimum temperature are 35.85°C and 7.42°C, respectively. Pigs, poultry, ducks, buffaloes, cows and horses are the livestock reared by the tribal community kept in close proximity of their

dwelling houses. Most of the non-tribals do not rear pigs. Beside the domestic birds, the surrounding is full of herons and egrets. Mosquito nets are not used by 60% tribals and 40% non-tribals at night. Insecticidal spraying of the residential houses, cattle-shed, pigsties and poultries in the affected area was infrequent.

In accordance with the protocol, persons between 5 to 25 years age were selected for vaccination. Out of 22,441 vaccines, 12,935 belonged to the age group 5 to 15 years. A team consisting of doctors, 18 supervisors, 10 health educators and 90 vaccinators were deputed from the existing health staff of the district and health staff of Gogamukh PHC for this study. The state health authority appointed an officer as incharge of the pilot study project. Transport facilities and equipments were provided by the state health service.

Several pre-vaccination demonstration-cum-training programmes were launched at the district headquarters and in the field areas for the field staff. These included the mode of preventive vaccination against JE, use of sterilised syringes and needles, adequate cold chain maintenance and site of vaccination to vaccines. First dose of vaccination in the field was given on day one followed by second between 7-14 days and in a third (booster) between 35-40 days. Health educators were asked to survey in their respective areas 2 months prior to the vaccination and educate the community about the preventive aspects of JE vaccination. They also in groups imparted health education to village headmen, school teachers, members from panchayat and mahila mandal in order to enlist their co-operation for the success of vaccination. They enumerated the targeted population (5 to 25 years) and evaluated the use of mosquito net and knowledge and belief

regarding JE through headman of the family.

In order to measure the level of antibody titre before and after vaccination, collection of blood samples from 5% of registered vaccines were undertaken. The blood specimens were stored and later on transported in cold storage to CRI, Kasauli by air for seroanalysis. The vaccine was prepared at CRI, Kasauli by injecting Nakayama strain of virus into the mouse brain and then inactivating it with formalin.

In order to test potency of the vaccines, National Malaria Eradication Programme, New Delhi collected 100 samples of blood sera from the vaccinated and unvaccinated population of Gogamukh pilot project area in December, 1990 and the results are awaited.

Results

Table I shows that the highest number of cases was registered in the year 1986 with 13 deaths resulting in a case fatality rate (CFR) of 25% in Gogamukh project area. Men were twice more affected than women and the majority were below 15 years (72/116-62%). During this year CFR for Gogamukh, Lakhimpur district, Assam state and India were recorded as 25, 25.56, 35.27 and 35.07% respectively.

Out of the targetted 26,000 population, 22,441 were given the first dose of vaccination. The second and third doses of vaccine were given to 17,336 and 14,605 persons, respectively resulting in a drop out rate of 22.7 and 35.4% for the second and third dose, respectively. This high dropout was due to flood, difficulty in communication, fear of giving blood samples and superstitious beliefs. Even though the sera collection target was 2,500, only 1,216 samples could be collected. Out of these sera

TABLE I—Incidence of Cases of JE in Gogamukh Pilot Study Area

Year	Case	Death	Sex		Age (in years)					
			M	F	0-5	5-10	10-15	15-20	20-25	≥25
1978	6	6	3	3	—	2	1	1	—	1
1979	—	—	—	—	—	—	—	—	—	—
1980	5	4	3	2	—	1	—	—	1	2
1981	1	1	1	—	—	—	—	—	—	—
1982	2	1	1	1	—	1	1	1	—	—
1983	3	—	1	2	—	1	—	2	—	—
1984	7	5	5	2	1	2	1	1	1	—
1985	3	3	2	1	2	1	1	—	—	—
1986	52	13	38	14	3	16	15	13	5	—
1987	21	11	12	9	2	6	5	6	2	—
1988	26	10	14	12	3	5	2	3	1	—
Total	116	55	80	46	11	36	25	28	11	3

samples only 522 samples of paired sera were found suitable for analysis by CRI, Kasauli. This was because of the loss of sera from the vials during transportation. Out of these, 4 pairs belonged to single dose vaccination group, 12 pairs belonged to those with 2 doses of vaccine and 245 with 3 doses of vaccine. All of these sera were positive for NT antibodies with increasing titre following vaccination (Table II).

Discussion

JE is a zoonotic disease causing tremendous concern to the community and medical scientists. According to the Communicable Disease Bulletin, epidemics of JE occurred in Assam during July-September in 1986(1). A total of 9 districts out of 17 were affected with 846 cases resulting in 302 deaths. The prevalence of JE in India is known since 1952. A major epidemic occurred in West Bengal in 1973 followed by

UP in 1978 and later in Gorakhpur in 1988 with heavy toll of lives. In Assam, the first outbreak was in Lakhimpur district in 1978. Since then major outbreaks occurred in 1985-88. These outbreaks were confirmed by sero-analysis at Pune and Kasauli(2). In the year 1986, there was insufficient monsoon and rain in Lakhimpur district. The temperature remained between 25-35°C from April to September. Waterweeds, algae and water hyacinth remained stagnant and could not be washed away for want of rain. This resulted in increased mosquito density leading to JE epidemics. Basumatari found a similar epidemiological ecology causing JE epidemic in Lakhimpur district in the year 1986(3). The suitable ecological environment leading to development of JE in epidemic proportions in Lakhimpur district especially in Gogamukh with heavy toll of humanity led the scientist to undertake a pilot project study on JE vaccination at Gogamukh in 1987.

TABLE II—NT Antibody Titre of Paired Sera Before and After JE Vaccination

Group	No. tested	Before vaccination		After vaccination	
		No. of sera +ve	NT antibody titre	No. of sera +ve	NT antibody titre
Single dose	4	4	2'48 ± 0'27	4	3'74
2nd dose	12	12	2'52 ± 0'57	12	3'79 ± 0'49
3rd dose	245	229	2'38 ± 0'48	245	3'91 ± 0'30
Total	261	245	—	261	—

The male: female ratio of 2:1 was seen in earlier reports of JE epidemic too(1-4). The high incidence in males could be attributed to two reasons. Men are supposed to go for fishing and ploughing thus facing the adverse vulnerable environment for JE. Kamala *et al.* observed that the men are more likely to be brought to medical attention than women resulting in a slight preponderance(4).

CFR appeared low in Lakhimpur district and Gogamukh during 1986 even though the disease affected a larger number. According to the Communicable Disease Bulletin, JE epidemic in Lakhimpur district affected all age groups except infants(1). About 70% cases were between 5-29 years and case fatality was 60.9% in 1-4 years age group. Much higher CFR ranging between 26.0-50.64% have been reported in India(1,3-5). Case fatality rate varied from 10% in Vellore to 53% in Manipur(6) and morbidity rate varied from 0.03-0.5 per thousand population. In Japan, CFR between 5-50% have been reported(7). The reason for low morbidity and CFR in the study area inspite of an epidemic could be due to nonreporting of disease and death owing to remoteness of the concerned locality.

There are reports of detection of NT antibodies in birds, ducks, bats and pigs

indicating that they may act as amplifiers in the spread of JE(8,9). In Gogamukh, it is likely that pigs could be the primary amplifier because a large number of pigs died in Kasikata village of Lakhimpur district, prior to the outbreak of JE in humans in the year 1988.

In the present study there was a high dropout rate in JE vaccination due to a variety of reasons. This could be improved by vigorous health education to the community. Health education activities to prevent the occurrence of JE in Assam should be organised throughout the year, as is being done in Goa. These activities should be intensified on a war footing basis during the onset of monsoon. Mass media and other communicable media need to be alerted towards these ideals.

A study of feasibility, acceptability and effectiveness of the JE vaccine when combined with the EPI was done in Chiangmai province of Thailand. The dropout rate of JE vaccination was as less as 0.6%(10). In this study it was feasible to administer JE vaccine simultaneously with DT toxoid to 6-7 years old children. Mass vaccination is probably not the answer to control JE(6). However, the primary approach in the control of JE should be immunization on a mass scale in high risk groups in vulnerable areas.

The confirmation of diagnosis of JE is usually possible by serological studies especially detection of IgM level which is sadly lacking in this part of the country. Many lives are lost for want of early diagnosis and treatment. Our observation shows that out of 12.16 blood sera, only 522 samples of paired sera were suitable for analysis indicating the problems of transport of sera from these areas. Thus there is a felt need to provide serodiagnostic facilities for virological studies for North East region preferably by an apex virology research centre. Serological studies also demonstrated that the lowest titre of antibodies were present in childhood. There is a need to study further very young children, preferably between 6 months to 5 years to ascertain the profile of infection. More than 90% of the vaccines had already high titre before vaccination(11). This signifies the high JE virus activity in this area for the last few years. A level of more than 1 log 10 titre is sufficient enough to give protection against JE. But a rise of protective antibody upto 3.91 after the 3rd dose is an indication of the high effectiveness of vaccine(11). Only 16 sera did not have antibody before vaccination and became positive after vaccination.

On recent follow-up, none of the vaccines had developed delayed reaction or side effects following vaccination in 1988. Similarly it is interesting to note that no JE cases has been so far reported till date from the vaccinated and unvaccinated population of the project area at Gogamukh.

In summary, health education plays an important step in the success of vaccination. In high risk areas it is worth considering inclusion of JE vaccination alongwith other vaccines under EPI. JE should be declared as a notifiable disease and labora-

tory facilities to confirm the outbreak of an epidemic locally in the high risk areas should be provided.

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