JAPANESE ENCEPHALITIS IN KANCHANPUR DISTRICT DURING OUTBREAK SEASON; A HOSPITAL BASED STUDY

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An epidemiological study on Japanese encephalitis based on Mahakali Zonal Hospital of Kanchanpur district of Nepal was carried out from April 2003 to November 2003. The study was based on Mahakali Zonal Hospital of Kanchanpur district. Collection of sera samples from suspected encephalitis cases in the zonal hospital, structured questionnaire survey with laboratory findings were used for the data collection. The overall case incidence was found to be 6.61 per 100,000 populations. Children of age group 0 - 14 years constituted 20% of total cases but all were not vaccinated. The overall case fatality rate was 16%. Of the 25 JE serum samples, 12% of samples were found to be positive for anti - JE IgM antibody. Among all 25 interviewed cases, 48% of cases were aware about mosquito borne mode of the disease. 56% did out-door activity at dawn and dusk, 60% were mosquito-net users, 96% had paddy field around their houses and 8% reared pigs in houses by traditional methods. The recording and reporting system of Japanese encephalitis epidemic was very poor at hospital level. Most of the respondents were unaware about the disease and its preventive measures. Strengthening hospital as well as national level laboratory facilities is necessary for forecasting Japanese encephalitis epidemics.

Key words: Japanese encephalitis, *Flavivirus*, Epidemiology, Kanchanpur district

INTRODUCTION

Japanese encephalitis (JE), caused by *Flavivirus,* is a mosquito borne viral zoonosis. It causes an acute Flaviviral neurological infection of the central nervous system. It is primarily a disease of swine, equine and wading birds. The disease accidentally affects human population and no viraemia in human thus man plays no role in perpetuating the virus (Pavri 1997). It has been one of the most serious public health problems in Nepal since 1978 because of the severity of the disease and high mortality rate.

Though thirty species of mosquitoes belonging to five genera are believed to be responsible for the disease transmission, *Culex tritaeniorhynchus* is the principal vector in Nepal (EDCD 2001, Pradhan *et al.* 1991).

JE is wide spread in temperate and tropical Asian countries (South East Asia), the Indian subcontinent, China, Korea, Japan and parts of Oceania and is thus the most important causes of epidemic encephalitis worldwide. The annual incidence of clinical infection in endemic areas ranges from 10 to 100 per 100,000 populations. Approximately 3 billion people and 60% of the world's population live in endemic regions and about 35,000 to 50,000 cases are notified annually, with 10,000 to 15,000 deaths (Tsai 1998). More than 50% of the affected populations are children of less than 15 years of age. Case fatality rate (CFR %)

range from 0.3 to 80%. There is nearly universal exposure to the virus by adulthood. In developed countries of Asia and in areas where children are protected by immunization, JE occurrence is increased in the elderly, consistent with waning immunity with age.

A survey by EDCD (2001) in Nepal has shown that 24 districts of Terai & inner Terai regions are mostly affected by JE and 12.5 millions people are estimated to be at the risk of the disease. Annually 2,000 to 3,000 total cases and 200 to 400 deaths occur. Total 26,094 cases and 5,334 deaths have been reported with average CFR% of 20.44% in an aggregate since 1978 to 2003 [Epidemiology & Disease Control Division (EDCD), unpublished].

The cases are generally reported in high numbers in every alternate year since 1995 to 2002 in Kanchanpur district as revealed by the data 51, 1, 50, 43, 21, 95, 85, 138, 118, 160 and 34 cases in the year 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001 and 2002 respectively (EDCD, unpublished) on the basis of clinical diagnosis due to lack of laboratory facilities. No study has been done to know the knowledge, attitude and practice (KAP) of people about JE in Kanchanpur district. Thus, one of the most important significance of the study is to shed light in its present case incidence and CFR%, and to correlate KAP of JE cases with its occurrence in the district.

MATERIALS AND METHODS

The study was carried from April 2003 to November 2003 and was based on Mahakali Zonal Hospital of Kanchanpur district. During the study period, a total of 25 human sera samples were collected in the acute phases from the JE suspected cases in the zonal hospital during outbreak season and stored in a deep freezer at 20°c prior to transportation to the reference laboratory. Anti Japanese Encephalitis Immunoglobulin M Capture Enzyme Linked Immunosorbent Assay test was done in the above sera samples at National Public Health Laboratory, Teku for the confirmatory diagnosis. To correlate the KAP of cases about JE with its occurrence, all the 25 JE suspected patients able to respond or the closer guardians of the JE suspected patients at the zonal hospital were interviewed through structured questionnaire. Statistical analysis of the collected data was done by using chi-square test.

RESULTS

The study was carried out in three ways viz. clinical aspects, laboratory diagnosis and questionnaire survey.

Clinical Aspects

During the study period, a total of 25 cases of JE were recorded from the Mahakali Zonal Hospital. Among them, 68% (17case) of cases were recovered, 12% (3 cases) referred, 4 %(1 case) left Against Medical Advice and 16% (4 cases) died. Mixed infection with *Plasmodium falciparum* was also reported in one case and that of *P. vivax* in another one case.

Age-group wise JE case distribution:

Of the total cases, 20 % (5 cases) of cases belonged to age group 0 - 14 years, 64 % (16 cases) to 15 - 44 years, and 16% (4 cases) to 45 and above years (Table no. 1). Statistically, the difference was found to be significant ($\chi^2 = 10.64$, $p < 0.05$).

Table no. 1: JE cases: Age-groupwise, 2003 (Kanchanpur)

Age groups (yrs.)	Cases	Percentage (%)
0-14	5	20
15 - 44	16	64
45 and above	4	16
Total	25	100

Sex-wise JE case distribution

Of the total cases, 64% (16 cases) of cases were males and 36% (9 cases) females (Table no. 2). Statistically, the difference was not found to be significant ($\chi^2 = 1.96$, $p > 0.05$).

Table no. 2: JE cases: Sex wise, 2003 (Kanchanpur)

Sex	Cases	Percentage (%)
Male	16	64
Female	9	36
Total	25	100

Caste/ethnic wise JE case distribution

Among the total cases, 44% (11 cases) of cases were chhetri, 24% (6 cases) tharu, 24% (6 cases) lower castes (sunar/sarki/okheda/oad/nepali) and 8% (2 cases) brahmin. But, there was no significant statistical difference ($\chi^2 = 6.52$, $p > 0.05$).

Monthwise JE case distribution

Regarding months, 52% (13 cases) of cases were recorded in the month of September, 40% (10 cases) in August, 4% (1 case) in July and 4% (1 case) in October (Table no. 3). Statistically, the difference was also found to be significant ($\chi^2 = 18.36$, $p < 0.05$).

Table no. 3. JE cases: Month wise, 2003 (Kanchanpur)

Months	Cases	Percentages (%)
July	1	4
August	10	40
September	13	52
October	1	4
Total	25	100

Table no. 4: JE case incidence: Age group wise, 2003 (Kanchanpur)

Age groups (Yrs)	Total population	Cases	CI/10^5
0- 14	158,017	5	3.16
15 - 44	167,527	16	9.55
45 and above	52, 355	4	7.64
Total	377,899	25	6.61

Table no. 5: JE case incidence: Sex wise, 2003 (Kanchanpur)

Sex	Total Population	Cases	CI/10^5
Male	191,910	16	8.33
Female	185,989	9	4.83
Total	377,899	25	6.61

JE Case Fatality Rate (CFR %)

The study showed that the CFR% was 16%. Regarding age groups, the CFR% were 40%, 0% and 50% in the 0 - 14 years, 15 - 44 years, and 45 and above years respectively (Table no. 6). The CFR% was 18.75% in males and 11.11% in females (Table no. 7)

Table no. 6: JE CFR%: Age group wise, 2003 (Kanchanpur).

Age groups(yrs)	Total cases	Deaths	CFR%
0-14	5	2	40
15 -44	16	0	0
45 and above	4	2	50
Total	25	4	16

Table no. 7: JE CFR%: Sex wise, 2003 (Kanchanpur)

Sex	Total cases	Deaths	CFR°/o
Male	16	3	18.75
Female	9	1	11.11
Total	25	4	16

Post JE Sequelae

Among the 17 recovered cases of 25, post JE sequelae was developed in 24% (4 people). Among them, JE chorea was persisted in 50% (2 peoples) of the post sequelae developed people, followed by deafness in 25% (1) people and left side hemplegia in 25 %(1) people.

Laboratory Results

Among 25 sera samples collected, 12% (3) of samples were found to be positive for anti-JE IgM antibody and these belonged to age group 15 - 44 years (Table no. 8). Of the 3 positive samples, one sample belonged to male sex and two to female (Table no. 9).

Table no. 8: Laboratory Findings: Age group wise, 2003 (Kanchanpur).

Age groups(yrs)	Total no. of Samples tested	No. of positive samples	Percentage (%)
0-14	5 (20%)	0	0
15-44	16(64%)	3	18.75
45 and above	4(160%)	0	0
Total	25	3	12

Table no. 9: Laboratory Findings: Sex wise, 2003 (Kanchanpur)

Sex	Total no. of samples tested	No. of positive samples	Percentage (%)
Male	16(64%)	1	6.25
Female	9 (36%)	2	22.22
Total	25	3	12

Regarding castes/ethnic groups, 2 samples were found to be positive in Chhetri and 1 in lower caste group. Month wise analysis showed 2 samples to be positive in September and 1 in August (Table no. 10).

Table no. 10: Laboratory findings: Month wise, 2003 (Kanchanpur)

Months tested	**Total no. of samples**	**No. of the positive samples**	**Percentage (%)**
July	1 (4%)	0	0
August	10(40%)	1	10
September	13(52%)	2	15
October	1(4%)	0	0
Total	25	3	12

Questionnaire Survey

Correlation of JE with KAP of Interviewed Respondents

The study showed that of the 25 interviewed respondents (cases) 48% (12) of cases were aware about mosquito vector and 52% (13 cases) were unaware about the vector. *56% (14)* of cases did outdoor activity at dawn and dusk and 44% (11 cases) indoor activity at dawn and dusk. 60% (15 cases) of cases were mosquito-net users and 40% (10 cases) non-users. 96% (24 cases) of cases had paddy cultivation around houses during rainy season and 4% (1 case) did not have. 8% (2 cases) of cases had reared pigs in open coop by traditional method and 92% (23 cases) did not have pigs in their houses (Table no. 11).

Table no. 11: KAP of interviewed respondents (cases) & occurrence of JE.

Characteristics	Cases	
	Numbers	Percentage (%)
Vector awareness		
Yes	12	48
No	13	52
Total	25	100
Outdoor activity at dawn and dusk		
Yes	14	56
No	11	44
Total	25	100
Use of mosquito net		
Yes	15	60
No	10	40
Total	25	100
Paddy cultivation around house		
Yes	24	96
No	1	4
Total	25	100
House hold pigs		
Yes	2	8
No	23	92
Total	25	100

DISCUSSION

Clinical Aspects

The present study conducted at Mahakali Zonal Hospital showed a total of 25 JE suspected cases which stands 2.89% of national figure and is lower than the previous year (2002) which was 4.03% (EDCD, unpublished). Low morbidity rate in the district may be due to little awareness about the disease and its control measures leading to low attendance of patients to the hospital. More believes of villagers on Dhami/Cruruwa and foreign (Indian) hospitals than national hospital may also support low morbidity. Moreover, low population of amplifying hosts (pigs, 2.21% and 1.57% of national figure in the year 2000 and 2001 respectively) and mass vaccination of less than 10 years in the district may be other factors of low morbidity (EDCD 2001). The development of JE sequelae in 24% cases of total recovered cases (17) may be due to delay in seeking professional care at first level.

Parajuli *et al.* (1992) reported all ages and both sexes to be affected by JE. However, males were affected more than females. In the present study all the age groups were found to be affected by JE, but the percent was high in 15-44 years age group. This may be because 15-44 years age group is an economically active age group and hence spend most of their time in outdoor activities and have higher chance of being bitten by mosquitoes.

The proportion of male to female cases was 1.8:1. The CI was found higher in males (8.33 cases per 100,000) than in females (4.83 cases per 100,000). This may reflect to more out-door activities of males leading to more chances of mosquito bites. Moreover, females have less approach to health care facilities in comparison to males. Similar type of result was also reported in other study by Chattopadhay (2001).

The overall low CI (6.61 cases per 100,000 population, which stand 0.21% of national figure), than the previous year, 2002 (8.98 cases per 100,000 population) may reflect to mass vaccination in the district.

The variation of cases in the caste/ethnic groups may be due to the number of cases visiting to the hospital.

The significant case burden difference in the respective months may be related to environmental factors i.e. rainfall, temperature, paddy cultivation and, consequently JE vector density.

The CFR% (16%), which stands 0.47% of national figure, was somewhat higher than previous year, 2002 (14.70%) and may be consistent with hospitalization time of cases. Akiba *et al.* (2001) reported the CFR 13.2% in the South-western part of Nepal in 1997.

Laboratory Results

Of the total 25 serum samples, only 12% (3 cases) of the cases were found to be serologically positive for anti-JE IgM antibody. All belonged to age group 25-44 years and had no CFR % among them for which it could not be explained and this needs to be investigated further with large sample sizes. Of the three seropositive cases, mixed infection with P. *falciparum* was reported in a 17 years old female and left side hemiplegia in 38 years old male who was admitted to the hospital in unconscious state from the India - Nepal border area after 3 days. This study was different from the study of Akiba *et al.* (2001) due to sampling differences.

Questionnaire Survey

The outdoor activity of JE case at dawn and dusk (56%) was somewhat higher than the study of Gurung *et al.*(2003).The use of mosquito-net (60%) was consistent with the study of Lowery *et al.* and did not agree with the study of Gurung *et al.* (2003). In studies conducted in Central China, bed netting without chemical impregnation did not protect children against JE but pyrethroid treatment of bed nets in late May or June conferred protective efficacious of 28-48%(Dapeng *et al.*1994 a,b). It has become well established that mosquito vector of JE, *Culex tritaeniorhynchus*, tends to bite much more frequently out-doors than indoor, which would explain why such household protection measures as bed netting, windows covering or DDT residual indoors spraying are likely to have only limited impact.

In the present study, the proportion of JE cases having paddy cultivation and no paddy cultivation around house during summer- rainy season was 24:1, which revealed that paddy cultivation increase the risk of JE by favoring vector breeding. Sherer *et al.* (1959) and Paul *et al.* (1993) did not identify paddy cultivation as specific risk factor. JE cases having house-hold pigs were-lower (8%) than in the study of Gurung *et al.* (2003).

CONCLUSION AND RECOMMENDATION

JE problem in Nepal will progressively worse if effective intervention strategies are not implemented. Thus, use of insecticide impregnated mosquito nets, upgrading of laboratory facilities at hospital as well as national level, decentralized health education campaigns, environmental and entomological studies in relation to JE are strongly recommended.

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